BOOK 5R

Notes:
Blank pages: inside front cover sheets
1, 2, 3, 7, 8, 9, 10, 36, 60, 66, 72, 76, 77, 81, 112, 114-116, 118, 126, 136, 138, 140, 148, 156, 160, 162, 166, 167, 178, 184, 194, 212, 246-255, 257-300
back inside cover sheets

-pages 5/6 ripped out
-page 64 has picture taped to it
-2-sided piece of paper between page 132 & 133
-1 graph sheet between page 150 & 151
-1 sheet between page 216 & 217

had to cut & paste a dark printing of words with lighter printing of picture (pg 64).

Scanned by:
Sheila Finch
RSICC /Oak Ridge National Lab.
March 24, 1999

BOOKS

233U

TINKERTOY

U^{233}

1st Shipment from Hanford

Material received in 3-liter containers - transferred to 15-liter bottles

Bottle #	BHW #	Element wt	wt % isotope	Isotope wt.	Net wt kg
1	6-28-141	915	98.301	899	4.012
	6-29-148	926	98.294	910	4.114
2	6-29-149	934	98.294	918	4.117
	6-31-156	950	98.092	932	4.251
3	6-28-142	890	98.301	875	3.944
	6-29-147	924	98.294	908	4.119
4	6-31-158	948	98.092	930	4.270
	6-29-146	849	98.294	835	3.783
5	6-28-144	886	98.301	871	3.871
	6-28-159	971	98.092	952	4.266
6	6-28-143	912	98.301	897	3.887
	6-31-155	932	98.248	915	4.155
7	6-29-145	907	98.294	892	4.060
	6-31-157	912	98.092	895	4.022
8	6-28-140	916	98.301	900	4.001
	Total	13.772 kg		13.529 kg	

15-liter capacity bottles

~~64.9~~

U^{233}

15-liter Containers

8-3-66 Expt 1. Exp. Plan W-6

Experiment conducted in 6 ft-square experimental tank. Purpose: to verify that 12 liters of U(233) nitrate solution in 15-liter polyethylene bottle is subcritical when ~~flooded~~ submerged.

The number 7 bottle centered in the tank. Solution height 47.6 cm. Bottle located on ½" thick plate. Zero on scale in control room corresponds to 3.4.3 cm.

12:15 K << 1 water height reached as 47.8 ⇒ 72.1 cm. water level ~15-cm above solution.

Have added 3 liters of solution from bottle #3 to #7. Solution lvl in #7 now reads 71.2 cm.

K<<1 water height reads as 62.15 cm ⇒ 86.4 cm ~15 cm above solution. There is no evidence of an exponential rise on the linear instruments. Multiplication is nil.

2:45 Have added remaining 3 liters of bottle 3 to #7. solution height now ~ 92.4 cm.

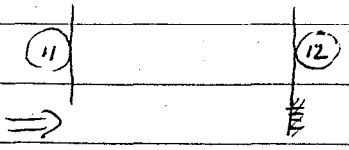
K<<1 water height reads as 83.4 cm ~15 cm above sol'n. There is an observable curvature on these linear instruments → indication of some multiplication – probably much less than 5.

12

11- liter containers

9-7-66

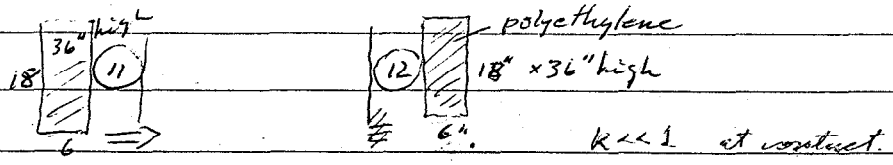
Expt. 2



$k \ll 1$ at contact.

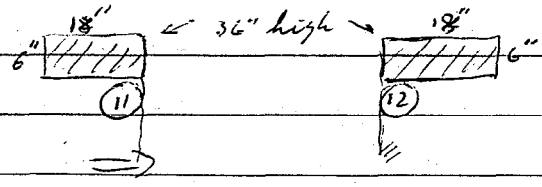
k_{gu}	2.598	2.852
$k_{gu^{233}}$	2.533	2.740

Expt. 3



$k \ll 1$ at contact.

Expt 4



$k \ll 1$ at contact.

Expt. 2 U^{233} solution

JTT

Instrument Check on 9-7-66 Source 10 mc

C.C.

PM-1	Low Trip	✓	Alarm Trip ✓
PM-2			Alarm Trip out
IC-1	> 3×10^{-11}	Meter Calib ✓	Alarm Trip ✓
IC-2	> 3×10^{-11}	✓	Powered ✓
IC-3	Responds	✓	Alarms ✓
IC-4	Responds	✓	Diff. Pwr. .05"
CRM		Meter Trip	

Purpose: determine if two bottles are critical at any separation distance.

Bottle #12 is on fixed table and #11 on movable table.

10^{AH} $k << 1$ no observable multiplication when bottles are in contact.

Expt. 3 same as Expt 2 but with stack of polyethylene blocks behind each bottle.

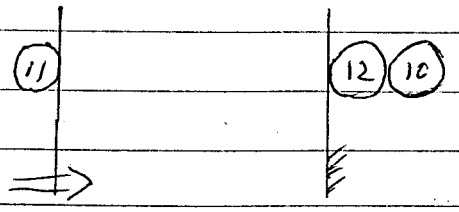
$10^{1/2}$ AH $k < 1$ no observable multiplication at contact.

Expt. 4 same as Expt 3 but with rearrangement of polyethylene reflector.

10^{25} AH $k << 1$ no observable multiplication at contact.

9-7-66

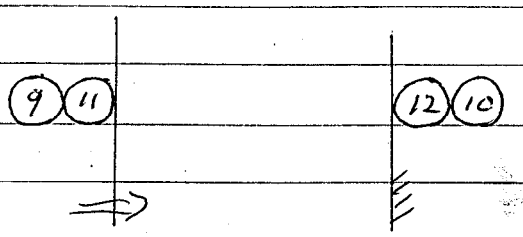
Expt 5.



$k<<1$ at contact.

K_g U	2.598	2.852 2.462
$K_g U^{233}$	2.533	2.740 2.402

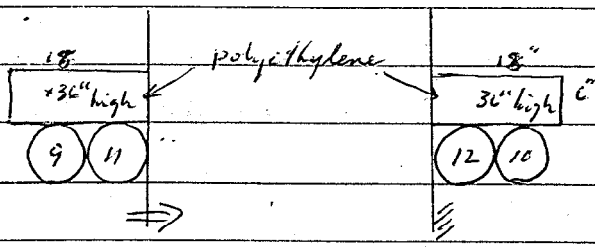
Expt 6.



$k<<1$ at contact.

K_g U	3.176
$K_g U^{233}$	3.090

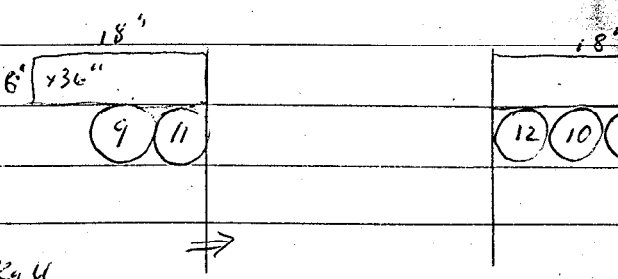
Expt 7



$k<<1$ at contact

$M \sim 2$

Expt 8



$k<1$ $9<11<10$

K_g U	3.111
$K_g U^{233}$	3.028

Expt. 5 Determine if 3 containers in contact are critical as a linear unreflected array.

10:55 AM k<<1 no observable multiplication at contact

Expt. 6 Determine if 4 containers in a linear unreflected array are critical; zero separation.

11 AM k<<1 no observable multiplication at contact.

Expt. 7 Determine if 4 containers in a linear array reflected on one side by 6-in-thick polyethylene reflector is critical; zero separation.

11:30 AM k<<1 multiplication of about 2 (from linear instruments.)

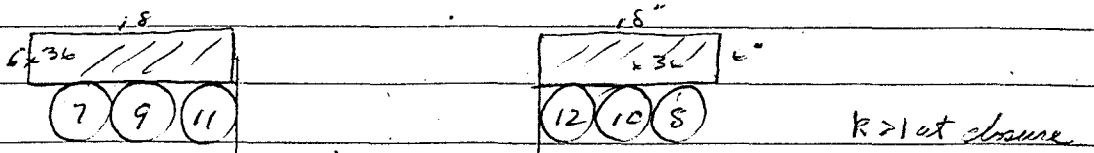
Expt. 8 Same description as Expt 7 but have now added bottle #8 to the fixed table - 5 containers against polyethylene reflector; zero separation

2 PM k<1 Multiplication between 9 & 10.

16

9-7-66

Exp. 9



K > 1 at closure

						Total
K_{gu}	2.399	3.176	2.598	2.852	2.462	3.111	16.598
K_{gu}^{233}	2.339	3.090	2.533	2.740	2.402	3.028	16.132

9-7-66

Expt 9 Same as Expt 3 with addition of Bottle #7 to movable table. 6 containers in line against polyethylene reflector; 3cc separation

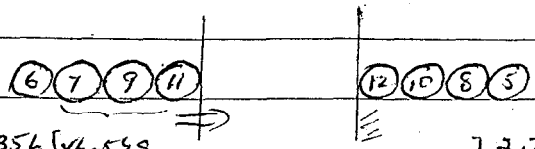
3:20 PM k>1 tables separated 5.55 revs ⇔ 0.299"

positive period 143 sec ⇒ 7.49 ⇒ 4.93 $/in

k=1 tables separated 5.78 revs ⇔ 0.314"

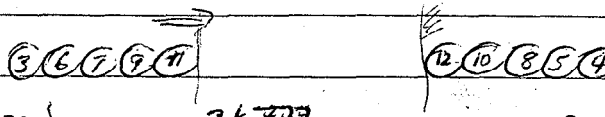
9-8-66

Expt 10



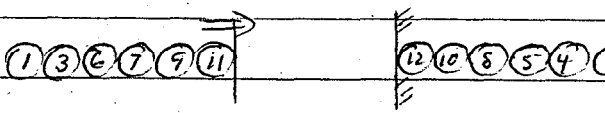
kg U	2.356	26.598	2.773	
kg U^{233}	2.294	16.132	2.700	k << 1 at contact

Expt 11



kg U	2.970	24.722	2.825
kg U^{233}	2.890	24.126	2.751

Expt. 12



				Total
kg U	2.619	27.517	2.895	33.031
kg U^{233}	2.552	26.767	2.816	32.135

9-8-66

C.C.

JN

Instrument Check on 7-8-66 Source 10 mc Be

PM-1 Low Rate ✓ Alarm ✓

PM-2 ✓

IC-1 $> 3 \times 10^{-11}$ Meter Rate ✓ ✓

IC-2 $> 3 \times 10^{-4}$ ✓ Alarm ✓

IC-3 Responds Calibration JN Alarm ✓

IC-4 Responds Calibration JN Alarm ✓

CRM Meter Read

Expt. 10 Purpose: Examine linear unreflected array of 8 cylinders in contact.

10^{15}/pm $k << 1$ no observable multiplication when tables are closed.

Expt. 11 Purpose: Examine linear unreflected array of 10 cylinders in contact.

10^{48}/pm $k << 1$ no observable multiplication when tables are closed.

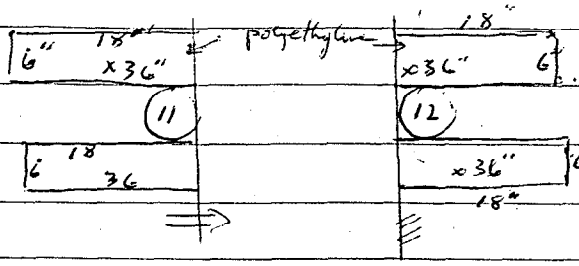
$(1.8/1.5 = M)$

Expt. 12 Purpose: Examine linear unreflected array of 12 cylinders in contact.

$k << 1$ no observable multiplication in contact.

$(M \sim 2/1.8)$

Expt 13

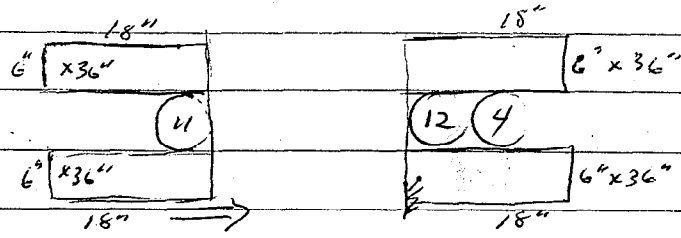


k 2<1

M-L 2

Rg 4^2.33 2.533 2.740

Expt. 14

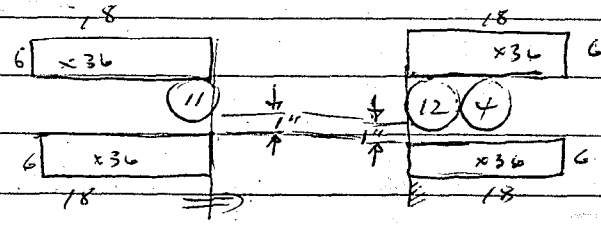


R=1

~3.5"

Rg 4^2.33 2.533 3.140 2.751

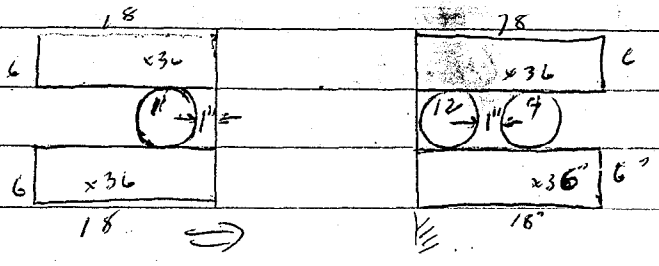
Expt. 15



R=1

~1.5"

Expt 16



R=1

~

9-8-66

Expt. 13

Purpose: Examine criticality of two containers, in contact, and reflected on two sides by 6-in-thick polyethylene

$k << 1$ multiplication ~2 from Lu N and IC-2.

Expt 14

Purpose: Examine criticality of three containers in contact and reflected on two sides by 6"-thick polyethylene.

1 3/5 PM $k = 1$ 32.0 Revs. (~3.5") table separation

Expt 15

Purpose: Same as 14, except have moved one side reflector 1" from bottles

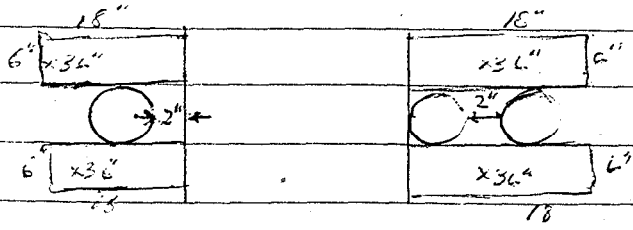
$k = 1$ 18.4 revs. (~1.5") table separation.

Expt. 16

Purpose: Examine criticality of linear array of three containers separated by 1" and reflected on two sides of 6"-thick polyethylene reflector.

$k = 1$ 15.78 with ~1.2" table separation.

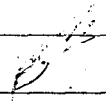
Exp. 17



Expt 17

Purpose: Same as Expt 16 separation now ~2" = 1/16

K << 1 M ~ 2 on LuN & IC2



Solution transfers covered under NSR 183
8/23/66

U^{233} Inventory

Rec'd	Bottle No.	Net kg	U kg	^{233}U kg
8/22/66	1	11.201	2.619	2.552
	2	11.835	2.895	2.816
	3	12.261	2.970	2.890
	4	11.821	2.825	2.751
	5	11.743	2.773	2.700
	6	10.318	2.356	2.294
	Totals	69.179	16.438	16.003
8/26/66	7	10.134	2.399	2.339
	8	12.930	3.111	3.028
	9	13.183	3.174	3.090
	10	11.008	2.462	2.402
	11	11.125	2.598	2.533
	12	11.934	2.852	2.740
	Totals	70.314	16.598	16.132
9/23/66	13	12.238	2.804	2.688
	14	12.143	2.760	2.691
	15	11.389	2.634	2.566
	16	11.920	2.669	2.605
	17	10.944	2.558	2.490
	18	12.321	3.041	2.867
	19	12.522	2.844	2.776
	20	12.607	2.828	2.760
	Totals	96.084	22.138	21.443

Rec'd	Bottle #	Net, kg	U, kg	^{233}U, kg
11/22/66	• 21	12.461	2.770	2.706
	• 22	11.873	2.723	2.659
	23	12.283	2.818	2.750
	• 24	11.885	2.727	2.663
	25	12.702	2.845	2.774
	Totals	61.204	13.883	13.552
12/20/66	• 26	12.464	2.892	2.826
	• 27	12.281	2.830	2.764
	Totals	24.745	5.722	5.590
	Grand totals	321.526	74.779	72.720

Total wt of solution 321.526 kg

total wt of uranium 74.779 kg

$UO_2(NO_3)_2$ has salt factor of 1.66952

∴ there are 124.84504 kg of salt.

321.526 − 124.84504 = 196.68096 kg of H_2O

$$\therefore \frac{H}{U} \sim \frac{1}{9}\,\frac{196.68096}{74.779} \times 233 = 68.1$$

estimate conc. 330–350 g/l.

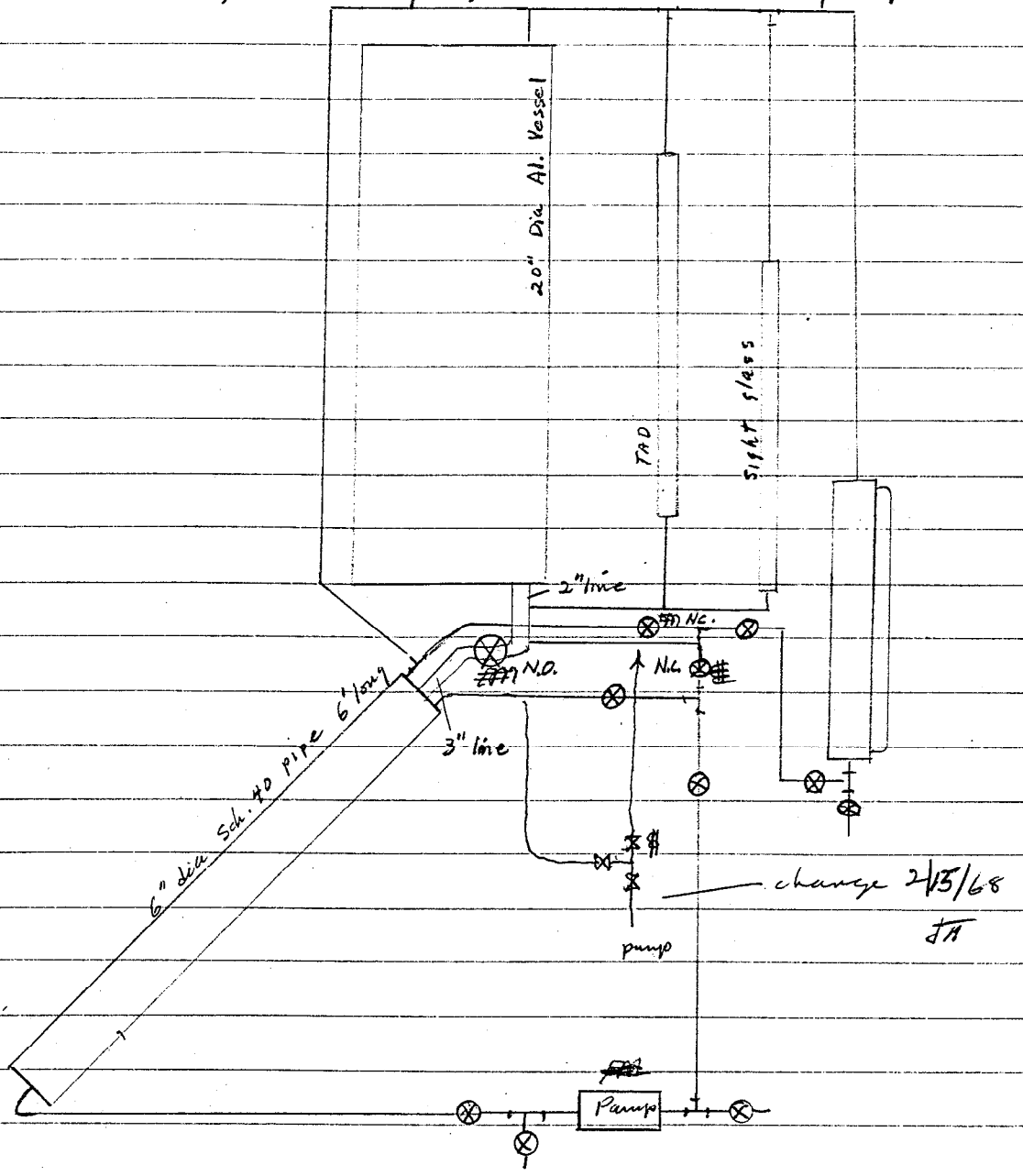
Volume calibration of transfer system

ht.	ΔV	V	ht	ΔV	V	ht	ΔV	V
93.48	.4975	.498	87.75	.980	.980	76.50	2.0	2.0
87.60	.495	.993	77.00	.980	1.960	55.80	2.0	4.0
82.00	.500	1.493	66.70	.970	2.930	35.81	2.0	6.0
76.70	.485	1.978	56.66	.980	3.910	16.20	2.0	8.0
71.45	.500	2.478	46.90	.970	4.880	<0	2.0	10.0
66.10	.485	2.963	37.20	.980	5.860	on mark	.025	10.025
61.25	.490	3.453	27.60	.980	6.840			
56.25	.490	3.943	17.96	.980	7.820			
51.30	.490	4.433	8.25	.980	8.800			
46.35	.490	4.923	<0	.980	9.780			
41.45	.490	5.413						
36.64	.490	5.903						
31.76	.490	6.393						
27.03	.480	6.873						
22.20	.490	7.363						
17.40	.480	7.843						
12.60	.485	8.328						
7.80	.485	8.813						
2.90	.490	9.303						
<0	.480	9.783						

Complete drain from ht 37.60 cm is ~4.40 liters.

System complies with TM 349 requirements. JH

Schematic of Plumbing System for U^{233} Ring Expro.



20" dia cyl has 2,027 l/cm.

3/27

Expr. 18

Have added containers 1 and 27 to system

#1 2.619 kg U

27 2.830 kg U ~

total 5.449 kg U

Expr. 19 added containers 3 and 8 to system

#3 2.970 kg U

8 3.111 kg U

total 11.530

3/28

Expr. 20 added containers 7 and 9 to system

Storage cylinder full; solution standing

0.97" in 20" dia. cylinder

#7 2.399 kg U

#9 3.176 kg U

Total 17.105 kg U.

Added 6 boxes of KG 33 rings to 20" dia cylinder

~324 rings/box

ring height in cylinder about 27"

relays Zero is 0.02"

Instrument Check on 3-27-67 Source 10 mc Ra

PM-1		Low Trip	OK	Alarm Trip	OK
PM-2				Alarm Trip	—
IC-1	$> 3\times10^{-11}$	Meter Trip	OK	Fast Trip	OK
IC-2	$> 3\times10^{-11}$	Meter Trip	OK	Personnel	✓
IC-3	Responds	Calibration	OK span out	Alarms	✓
IC-4	Responds	Calibration	OK span out.	Press	.05
CRM		Meter Trip			

Expt. 18 Purpose Check criticality of bare 20" dia Al cyl

$k<1$ tab 37.20 Soln 1.74" (corrected) = 4.42 cm ⇒ 8.958 ℓ.

Expt. 19

$k<1$ tab 25.42 Soln 4.30" (corrected) = 10.922 cm ⇒ 22.137 ℓ.

Instrument Check on _____ Source _____

PM-1		Low Trip	3-28-67	Alarm Trip	—
PM-2				Alarm Trip	
IC-1	$> 3\times10^{-11}$	Meter Trip	OK	Fast Trip	OK
IC-2	$> 3\times10^{-11}$	Meter Trip		Personnel	✓
IC-3	Responds	Calibration	OK span OK	Alarms	✓
IC-4	Responds	Calibration	OK span OK	Press	−0.05"
CRM		Meter Trip			

$94^5/A$ Expt. 20 – Find critical ht in 20" bare cyl.

$k>1$ tab 31.53 Soln 5.285" +ρ T = 155.8 sec ⇒ −8.3¢

$10^{25}/A$ $k=1$ tab 24.10 Soln 5.260

3/29 sample taken from system after expr. 21

U^{233} # 1 Gross wt. 74.218 gm

tare = 20.691

net = 53.527 gm U

X-10 Sample control # SFA 2154

{ 334.1 mg/ml sp. gr. 1.4632
{ 340.2 mg/ml.

Expr. 22 Have added containers 5 & 6 to system

5 2.773 Kg U

6 2.356 Kg U

Total 22.234 Kg U

3/30 Have added containers 4 and 11

4 2.825 Kg U

11 2.598 Kg U

Total 27.657

Added containers 10 and 12.

10 2.462 Kg U

12 2.852 Kg U

Total 32.971

Instrument Check on 3-29-67 Source 10 mc Ra

PM-1 _____ Low Trip OK ~~Alarm Trip~~ _____

PM-2 _____ _____ ~~Alarm Trip~~ _____

IC-1 >3×10⁻¹¹ Meter Trip OK Fast Trip OK

IC-2 >3×10⁻¹¹ Meter Trip OK Alarms OK

IC-3 Responds Calibration OK Personnel OK

IC-4 Responds Calibration OK Press -0.05

CRM _____ Meter Trip _____

Expr. 21 Check Criticality when 20" cyl. contains rings.

9 AM Solution height in vessel at beginning 1.49"

k << 1 tad 39.28 C_{sol} 12.43

Expr. 22 Check Criticality with additional solution

k << 1 tad 38.28 C_{sol} 17.56

Instrument Check on 3-30-67 Source 10 mc Ra

PM-1 _____ Low Trip OK ~~Alarm~~ Trip OK

PM-2 _____ _____ ~~Alarm Trip~~ _____

IC-1 >3×10⁻¹¹ Meter Trip _____ Fast Trip _____

IC-2 >3×10⁻¹¹ Meter Trip OK Personnel OK

IC-3 Responds Meter Trip OK Alarms OK

IC-4 Responds Meter Trip OK Press -0.05

CRM _____ Meter Trip _____ _____

8 58 AM Solution standing 17.56" in Vessel: Prepare add two more containers.

Expr 23 k << 1 tad 39.28 C_{sol} 22.464"

Expr. 24

k << 1 tad 20.10 C_{sol} 24.75

3/30

Added Containers 2 and 21

2 . 2.895 kg U

21 2.770 kg U

Total 38.634

4/3/67 Sight glass tube developed crack - necessary to replace before proceding. Crack noted on Friday 3/31/67 -

Expr. 26 Have added bottle #26 to system

#26 2.892 kg U Total 41.528

Expr. 25 K<<1± Tad 20.12 Soln 30.04

Observed solution to be above ring bed. Drained and observed level when some rings are above solution level. Reading 26.90"

4/3/67 Replaced tube in sight glass. Have pumped all solution into vessel again. Selsyn set to read 30.14 when tad is at 20.12" – this will require checking zero again when solution is drained.

Instrument Check on 4/3/67 **Source** 10 mr/

PM-1		Low Trip	OK	~~Alarm~~ Trip	OK
PM-2				~~Alarm~~ Trip	
IC-1	$> 3 \times 10^{-11}$	Meter Trip	OK	Fast Trip	OK
IC-2	$> 3 \times 10^{-11}$	Meter Trip	OK	Alarms	OK
IC-3	Responds	Calibration	OK	Personnel	OK
IC-4	Responds	Calibration	OK	Psln	– 0.05"
CRM		Meter Trip			

Expr. 26 Attempt criticality with solution above rings.

k > 1 tad 22.68 Soln 30.75²

k = 1 tad 19.68 30.77⁵

3/5/67 $\lambda_{Cl_{Kp}}$ 23.8 c^5

Exp. 26

Background traverses

distance of BF_3 from bottom (in)	c/min C_1	C_2	C_3	Source present
0	970	10270	400	
5	1010	10280	700	
10	1040	10400	400	
15	1000	10280	600	
20	1020	10340	900	
22.5	1060	10150	700	
25	1020	10120	400	
27	1060	10230	100	
	Source out			
0	440	1510	100	
5	390	1470	400	
10	460	1470	480	
15	440	1590	300	
20	440	1490	200	
22.5	480	1550	400	
25	470	1470	400	
27	440	1450	200	

Exponential Measurement.

Instrument Check on 4-5-67 Source Cm-244

PM-1		Low Trip OK	Alarm Trip OK
PM-2			~~Alarm Trip~~
IC-1	$>3\times10^{-11}$	[illegible] OK	Test Trip OK
IC-2	$>3\times10^{-11}$	[illegible] OK	Personnel OK
IC-3	Responds	Calibration OK	Alarms OK
IC-4	Responds	Calibration OK	Press. -0.05"
CRM		Meter Trip	

945 Expr. 27 - Axial traverse with BF_3 counter.

Make backgd traverse ; Tab 20.15" Soln 27.98^5

k>1 Tab 24.78" Soln 30.78

k=1 " 22.15 " 30.77

Traverse IC-2 (3×10^9) 3.6

IC-3 .16

IC-4 2.8

Solution height variable as BF_3 is moved.

1158 Shutdown ; k=1 Tab : 22.72^5 Soln : 30.78^5

Expn. 27 cont'd

Traverse with R=1 Instrument Levels recorded on p 35

BF_3 position from bottom (in)	c/m × 10^{-1} C_1	C_3	C_4	Tab position (in)
0	577835	198651	218	22.15
1	485380	200908	321	22.15
3	49865	205101	839	22.94
5	50761	207367	1151	21.75
7	51249	188747	1881	21.42
9	60878	206835	2620	21.18
11	60192	204809	3198	"
13	60460	205113	5150	"
15	60744	206352	10735	"
17	61312	207113	14541	"
19	61488	216850	22099	"
21	62166	208982	34920	20.96
23	61527	206952	61223	20.96
25	59522	201026	103217	21.03
27	44780	186363	162153	21.80
29	58883	208237	81031	22.39
30	52710	209869	28577	21.80
28	62384	208193	152976	
26	62981	210362	155748	
24	66006	219565	74668	20.55

NORMALIZED TRAVERSE

BF_3 Position from Bottom (in)	Norm. to C_3 @ 25"	Norm to C_1 @ 25"		
0	221	225	.00218	.00108
1	321	394	.00382	.00189
2	563	588	.00570	.00282
3	822	1001	.00970	.00479
4	881	877	.00850	.00420
5	1116	1349	.01307	.00646
6	1061	2109	.01024	.00531
7	2003	2185	.02117	.01046
8	1930	2024	.01961	.00969
9	2546	2562	.02482	.012269
10	3067	3060	.02965	.01465
11	3139	3162	.03063	.01514
12	4142	4128	.03999	.01977
13	5047	5070	.04912	.02428
14	6451	6769	.06558	.03242
15	10458	10519	.10191	.05037
16	10249	10103	.09788	.04838
17	14114	14116	.13676	.06760
18	15966	15697	.15208	.07517
19	20487	21392	.20725	.10244
20	25087	24796	.24093	.11875
21	33591	33434	.32392	.16011
22	47369	46728	.45271	.22378
23	59470	59228	.57382	.28364

Expt. 29 Traverse.

BF_3 position from bottom (in)	C_1	C_3	C_4	Tank (in.)
22	65095	216877	51104	20.55
20	64464	215195	26855	19.60
18	65117	216223	17173	"
16	64661	215265	10975	19.48
14	57202	202699	6505	23.31
12	59390	199914	4119	23.05
10	58831	198217	3024	22.87
8	59037	209099	2008	"
6	59313	209301	1105	"
4	59262	199102	873	22.72
2	58895	207832	582	22.72
0	59387	209458	219	22.72

Norm. traverse Cont'd.

BF_3 Position From Bottom (in)	Norm to C_3 @ 25°	Norm to C_1 at 25°		
24	68364	67333	.65234	.33245
25	103217	103217	1.—	.49480
26	148836	147193	1.42605	.70489
27	174913	215534	2.08816	1.032
28	147710	145957	1.41408	.6990
29	78225	81910	.79357	.3923
30	27373	32270	.31264	.1545
0	210	219	.00212	.00105

BF_3 Position (in)	C_1 (×10⁷)	C_3 (×10⁷)	C_4 (×10⁷)	Norm to C_3	Norm to C_1	Tool position
8	56612	155743	2006	.0204	.0205	21.21
10	57032	156965	3095	.0313	.0314	"
12	56578	155331	4103	.0419	.0420	"
14	56617	155292	6588	.0674	.0673	"
16	55877	152868	9910	.1029	.1026	"
18	56538	154883	15880	.1628	.1625	21.115
20	57081	155215	25059	.2564	.2540	"
22	57960	156624	37854	.3838	.3780	"
24	57436	155566	67977	.6938	.6849	"
25	55130	151265	95265	1.000	1.000	"
23	56417	153524	55937	.57704	.5738	"
21	57989	156981	32624	.3300	.3256	"
19	59771	157554	21081	.2125	.2041	"
17	59621	157660	13690	.1379	.1329	21.095
15	59867	158228	10163	.1020	.098	"
13	60313	159198	5040	.0503	.0484	"
11	60605	159023	3191	.0319	.0305	"
9	61644	150850	2533	.0266	.0238	"

Instrument Check on 3-6-67 Source 10 mr/

PM-1		Low Trip	OK	~~Alarm~~ Trip	OK
PM-2				~~Alarm~~ Trip	
IC-1	$>3\times10^{-11}$	Meter Trip	OK	Part Trip	OK
IC-2	$>3\times10^{-11}$	Meter Trip	OK	Personnel	OK
IC-3	Responds	Calibration	OK	Alarms	OK
IC-4	Responds	Calibration	OK	Pulse	-0.05^{v}
CBM		Meter Trip			

Expt. 28 Repeat #27

$k>1$	rad	21.69[5]	solution 30.78[5]
$k=1$		21.11	30.78[2]

10 ~~PM~~ AM Shut Down K=1 rad 21.095 Soln Ht 30.78[2]

Least square fit of data to $e^{-\gamma d}$

Expt. 27 $\gamma = 0.2397 \pm .0025$

28 $\gamma = 0.2337 \pm .0022$

4-10-67

Begin filling tin Cans.

	Cylinder No.	Tare wt. kg	Gross kg	Net kg solution	rollsyn 23.96⁵
4/10	1	.324	6.644	6.320	
4/10	2	.323	6.643	6.320	21.115
4/12	3	.324	6.644	6.320	
4/12	4	.323⁵	6.643⁵	6.320	18.325
4/12	5	.324	6.644	6.320	
4/12	6	.325	6.645	6.320	15.50⁵
4/13	7	.325	6.645	6.320	26.64 ##
4/13	8	.323	6.643	6.320	23.80
4/13	9	.323	6.643	6.320	22.5¢ 0-22.20
4/14	10	.324	6.644	6.320	
4/14	11	.325	6.645	6.320	1945
4/14	12	.324	6.644	6.320	
4/14	13	.325	6.645	6.320	16.66
4/28	14	.325	6.644	6.319	~~15.645~~
"	15	323	6.644	6.321	
"	16	324	6.644	6.320	
"	17	324	6.644	6.320	
"	18	324	6.644	6.320	10.068
"	19	324	6.644	6.320	
"	20	326	6.646	6.320	
"	21	327	6.647	6.320	
"	22	324	6.644	6.320	

Cyl. No.	Tare wt. kg	Gross wt kg	net wt. kg Soln.	Selsyn	
5-1-67 23	.326	6.644	6.318	8.545	3.281
24	.323	6.643	6.320		
25	.324	6.644	6.320		
26	.322	6.642	6.320		
27	.323	6.643	6.320		3.162

Determination of Volume occupied by glass

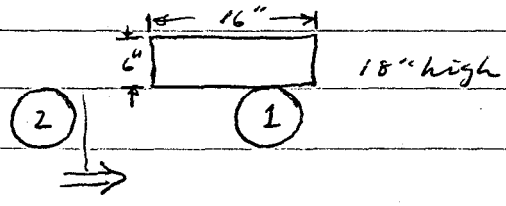
Vol drained	Δht (in)	Δht (cm)	cyl. ΔVol (l)	% Glass $\frac{\Delta Vol - Vol\ drained}{\Delta V} \times 100$	
>8.8	2.85	7.239	14.673	40.027	wt
8.8	2.79	7.087	14.365	38.738	2
8.8	2.82	7.163	14.519	39.389	2
8.8	2.74	6.960	14.107	37.620	2
4.4	1.39	3.531	7.157	38.517	1
8.8	2.75	6.985	14.159	37.846	2
8.8	2.79	7.087	14.365	38.738	2
17.6	5.577	14.166	28.714	38.705	4
22.0	6.787	17.239	34.943	37.041	5
17.6	5.433	13.800	27.972	37.080	4

weighted Ave 37.980

Ave 38.186

In filling cans 1 and 2 setups changed from
23.865" to 21.125 ⇒ 7.214 cm ⇒ 14.622 liters

Expt. 30



Instrument Check on 4-10-67 Source 10 mc Ra

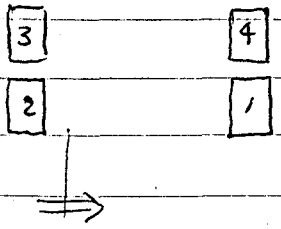
PM-1		Low Trip	OK	~~Alarm~~ Trip	OK
PM-2				~~Alarm~~ Trip	
IC-1	$>3\times10^{-7}$	Meter Trip	OK	Fast Trip	OK
IC-2	$>3\times10^{-11}$	Meter Trip	OK	Personnel	OK
IC-3	Responds	Calibration	OK	Alarms	OK
IC-4	Responds	Calibration	OK	Press.	-0.05"
CRM		Meter Trip			

Expt. 28 Explore safety of handling 2 units
Unit 1 on fixed table #2 one moveable Table.
$k << 1$ at contact (units) no apparent instrument level change.

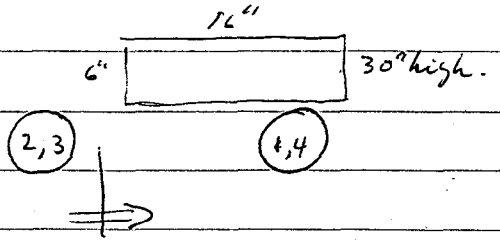
Expt. 30 Same as 28 but with a reflector wall.
$k << 1$ at unit contact – same result as 28

III 4-12-67
Flooded unit in the west end as. area
estimated multiplication 2 or 3. JT

Expm. 31



Expm. 32



Instrument Check on 4-12-67 Source 10 mc Ra

PM-1		Low Trip	OK	~~Alarm~~ Trip	OK
PM-2				Alarm Trip	
IC-1	$>3\times10^{-11}$	Meter Trip	OK	Test Trip	OK
IC-2	$>3\times10^{-11}$	Meter Trip	OK	Personnel	✓
IC-3	Responds	Calibration	OK	Alarms	✓
IC-4	Responds	Calibration	OK	Press	-0.05"
CRM		Meter Trip			

Expt. 31 Examine condition with 4 cans, 2 on each stringer; 7" spacer between Al. support plates. Units in a plane with zero separation at table closure.

$k<<1$ Very little multiplication ~1.05

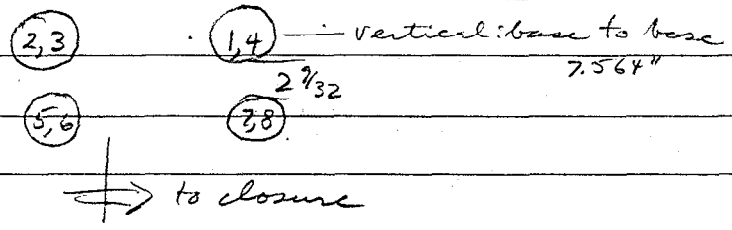
Expt. 32 Add reflector to east face. 16×30×6"

$k<<1$ Slightly greater multiplication than Expt. 31 M ~ 1.12

Cell vol. = (7.22 + 2.282)(7.22+0)(7.564) × 16.387 = 8.50 liters

mass u = ~340 g/ℓ × 4.4 ℓ. = 1.495 kg u

$\bar{\rho}$ = 0.176 g/cc



Instrument Check on 4-13-67 Source 10 mc #

PM-1		Low Trip	OK	~~Alarm~~ Trip	OK
PM-2				~~Alarm Trip~~	
IC-1	$>3\times10^{-4}$	Meter Trip	OK	Fast Trip	OK
IC-2	$>3\times10^{-4}$	Meter Trip	OK	Personnel	✓
IC-3	Responds	Calibration	~~FH~~	Alarms	✓
IC-4	Responds	Calibration	~~FH~~	Pres.	−0.05"
CRM		Meter Trip			

Expr. 33 Eight units - unreflected - spaced .564" vertically between bases, 2.9/32" E-W and variable to contact N.S.

$k<<1$ at table closure $M=2$.

Instrument Check on 4-17-67 Source 10 mc #

PM-1		Low Trip	OK	~~Alarm~~ Trip	OK
PM-2				~~Alarm Trip~~	
IC-1	$>3\times10^{-11}$	Meter Trip	OK	Fast Trip	OK
IC-2	$>3\times10^{-11}$	Meter Trip	OK	Personnel	✓
IC-3	Responds	Calibration	~~FH~~	Alarms	* ✓
IC-4	Responds	Calibration	~~FH~~	Press	−0.05
CRM		Meter Trip			

* No trip on 8 but responds.

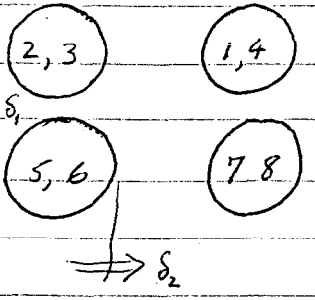
Expr. 34 same as 33 but spacing now

N S - $1\frac{27}{64}$ E W $1\frac{23}{64}$ Vertical 7.31"

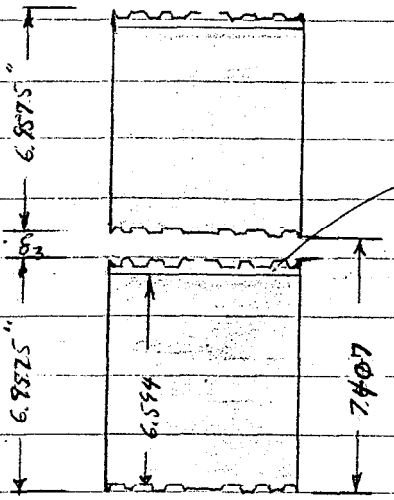
$k<1$ at table closure $M<2$

Expts. 35–37

Unit Arrangement ~~& Spacing~~:



δ_3 = vertical sep. between containers ~~solution~~ surfaces



solution is ≈0.156" lower
+.09375
.24975

#36, 37

$\delta_3 = 7.407 - 6.9575 = .4495$

Summary of Spacings for k = 1

Expr.	δ_1	δ_2	δ_3	δ_3 (solution)
35	0.75	1.222	0.3555	0.60525
36	0.8125	0.9925	0.4495	0.6990
37	0.9375	0.9925	0.4495	0.6990

To find vertical separation equal to horizontal

take $\delta_3 + .24975 = \delta_1$ or δ_2

Instrument Check on 4/18/62 Source 10 mc Ra

PM-1		Low Trip	OK	~~Alarm~~ Trip	OK
PM-2				~~Alarm~~ Trip	
IC-1	$>3\times10^{-11}$	Meter Trip	OK	Fast Trip	OK
IC-2	$>3\times10^{-11}$	Meter Trip	OK	Personnel	~
IC-3	Responds	Calibration	OK	Alarm	OK
IC-4	Responds	Calibration	OK	Press	−0.05"
CRM		Meter Trip			

Expr 35. Eight, unreflected, array spacing:

n S = E W. = 3/4"

Vertical Separation of Bases 7 1/4" + .063"

K = 1 at 7.95 revs. (0.472")

Expr. 36 Same unit arrangement – unreflected

n.S = E W = 13/16"

Vertical separation of bases 7.407"

K = 1 @ 5.42 revs (0.290")

Expr. 37 Same

n. S variable with table closure + 13/16"

E.W = 15/16"

Vertical base separation 7.407"

K = 1 @ 3.70 revs. (0.180")

Spacing δ_1 = East West Horizontal Surface sep.

δ_2 = North South " Surface Sep

δ_3 = Vertical Surface Sep.

$6.958'' + \delta_3$ = base separation

Instrument Check on 4-19-67 Source 10 mc Ra

PM-1	Low Trip OK	~~Alarm~~ Trip	OK
PM-2		~~Alarm~~ Trip	
IC-1	$>3\times10^{-11}$	Meter Trip OK	Test Trip OK
IC-2	$>3\times10^{-4}$	OK	Personnel
IC-3	Responds	Calibration OK	Alarms
IC-4	Responds	Calibration OK	Press −0.05"
CRM		Meter Trip	

Exp. 38 Eight unreflected Units

Separation $\delta_1 = 0.828 = \delta_2$ at closure

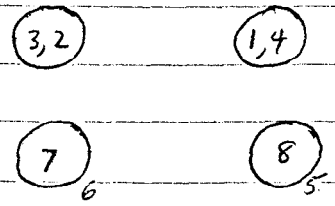
Base Separation = 7.532" $(7\frac{15}{32} + .043$ plate$)$

$\delta_3 = .574$ $(+.0.25 \sim 0.824")$

3.73/in
1.47/cm.

$k > 1$ at table closure 11.65 div/sec $\Rightarrow$ 253.1 sec $\Rightarrow \sim 5.6$ ¢

$k = 1$ at 0.68 revs $\Rightarrow$ .015"


3,2
1,4
7
6
8
5

Instrument Check on 7-20-67 Source 60 mc/

PM-1		Low Trip	OK	~~Alarm~~ Trip	OK
PM-2				Alarm Trip	
IC-1	$> 3 \times 10^{-4}$	Meter Trip	OK	Fast Trip	OK
IC-2	$> 3 \times 10^{-4}$	Meter Trip	OK	Personnel	
IC-3	Responds	Calibration	JH	Alarms	
IC-4	Responds	Calibration	JH	Press	-0.05"
CRM		Meter Trip			

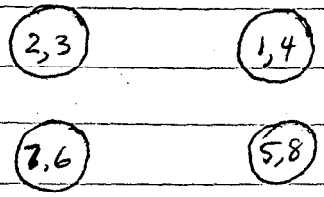
Expt. 39 Eight unit array reflected by 6" Polyethylene Reflector, minus top, in place. Have put units 1, 4, 7, 8, 2 + 3 in position. checking safety of completing assembly.

$\delta_1 = \delta_2 = 3\ 21/32$ $\delta_3 = 3.231$ see p 50.

$k << 1$ No change in instrument levels.

All units positioned + top reflector in place.

$k = 1$ at 36.46 revs. (4.352")



Cell Vol: δ_1 7.2 + 4.094 = 11.394 in

δ_2 11.354

δ_3 10.75 + .063 = 10.813 $m \sim 1.5$ kg

$Vol = (11.354)^2(10.813)(2.54)^3 = 22.6818$ l.

$\bar{\rho} = .0666$ g/cc

Instrument Check on 4-21-67 Source 10 mc 8

PM-1 ✓		Low Trip	OK	~~Alarm~~ Trip	OK
PM-2				~~Alarm~~ Trip	
IC-1	$>3\times10^{-4}$	Meter Trip	OK	Fast Trip	OK
IC-2	$>3\times10^{-4}$	~~Meter Trip~~	OK	Personnel	
IC-3	Responds	Calibration	JA	Alarms	✓
IC-4	Responds	Calibration	JA	Press	−0.05"
CRM		Meter Trip			

Expt. 40 ~~Re~~ Reflected array of Eight units.

Refl. Thickness 15.24 cm Polyethylene.

Horizontal Spacing $\delta_1 = \delta_2 = 4\ 3/32$ 4.094

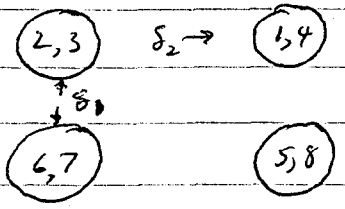
Vertical $\delta_3 = 10.75 + .063 - 6.958 = 3.855"$ (+.25 = 4.105)

$k = 1$ at 29.5' revs.

$k > 1$ at 29.3 revs. 3.53 kw/sec ⇒ 76.7 sec → ≈14.5¢

$k = 1$ at 29.5° revs. (3.055")

~$2.90/kw


2,3
δ2
1,4
δ1
6,7
5,8

Instrument Check on 4-24-67 Source 10 mc V

PM-1		Low Trip	OK	~~Alarm~~ Trip	OK
PM-2				~~Alarm Trip~~	
IC-1	$> 3 \times 10^{-11}$	Meter Trip	OK	Fast Trip	OK
IC-2	$> 3 \times 10^{-11}$	Meter Trip	OK	Personnel	✓
IC-3	Responds	Calibration	✓	Alarms	✓
IC-4	Responds	Calibration	✓	Press	-0.07"
CRM		Meter Trip			

Expt. 41 Eight units Reflected by 6" thick Polyethylene

$\delta_1 = 5\ 13/64$ δ_2 variable to $5\ 13/64$ at closure

$\delta_3 = 11\ 27/64 - 6.958$

$3.53/in$ $k > 1$ at 9.2 revs. (0.5710") 4.525 div/sec ⇒ 98.3 sec ~12¢

$k = 1$ at 9.61 revs. (.6055") $\Delta = .034"$

Expt. 42. Vertical spacing not correct in Expt. 41 should have been $11\ 27/32$.

Have raised top tier of units by 3/8" and top reflector 1/2"

$2.87/in$ $k > 1$ at 5.2 revs (0.276") 6.47 div/sec ⇒ 140.6 sec ~8.6¢

$k = 1$ at 5.67 revs (0.306") $\Delta = .030"$

Instrument Check on 4/25/67 Source 10 mc Ra

PM-1		Low Trip		~~Alarm~~ Trip	OK
PM-2				~~Alarm Trip~~	
IC-1	$> 3 \times 10^{-11}$	Meter Trip	OK	Fast Trip	OK
IC-2	$> 3 \times 10^{-11}$	Meter Trip	OK		Personnel ✓ E.
IC-3	Responds	Calibration	JH		Alarms ✓
IC-4	Responds	Calibration	JH		Press. -0.06"
CRM		Meter Trip			

Expos. 4/3 Eight Units - 6" Polyethylene Reflector.

$\delta_1 = 5\ 3/8"$ $\delta_2 \rightarrow 5\ 3/8"$ at closure.

$\delta_3 = 12.063 - 6.258 = 5.105$

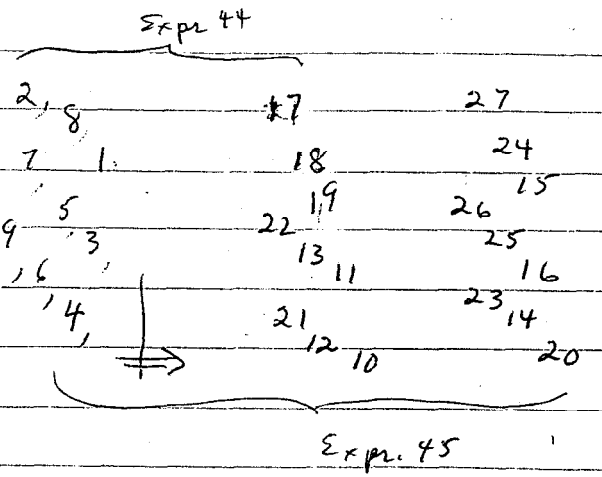
$k < 1$ crack at top of reflector $\sim 1/2"$

Adjust top reflector tray again.

$k < 1$ $M \sim 2$

5/1/67 Have put Bottles #22 & 24 into the system

# 22	2.732 kg U
# 24	2.727 kg U
Total	46.987 kg U



Sample #2

Net wt. soln 28.67 g

Result SF. A 2161

353.2 mg/ml coulometric as U^{238} $\bar{U}$=233.08

sp. gr. 1.4750

345 mg U/ml

Isotope analysis

U^{233}	97.56
U^{234}	1.053
U^{235}	0.025
U^{236}	< 0.0005
U^{238}	< 1.361

Instrument Check on 5-1-67 Source 10 mcr

PM-1		Low Trip	o/c	~~Alarm~~ Trip	o/c
PM-2				Alarm Trip	
IC-1	$> 3 \times 10^{-11}$	Meter Trip	o/c	Fast Trip	o/c
IC-2	$> 3 \times 10^{-11}$	Meter Trip	o/c	Personnel	
IC-3	Responds	Calibration	~~o/c~~	Alarms &	
IC-4	Responds	Calibration	~~o/c~~	Pres. -0.06#	
CRM		Meter Trip			

Expr. 44 Safety check on loading 18 units on fixed table. Have 9 on moveable table & 9 on fixed table.

Multiplication ~1½ on table closure.

∴ safe to load remaining 9 units on fixed table

Expr. 45 Load remaining 9 units

k > 1 at 20.7 revs. (1.71") 11.35 div/sec ⇒ T = 24 hr ⇒ ρ = +5.84

k = 1 at 20.88 revs. (1.74")

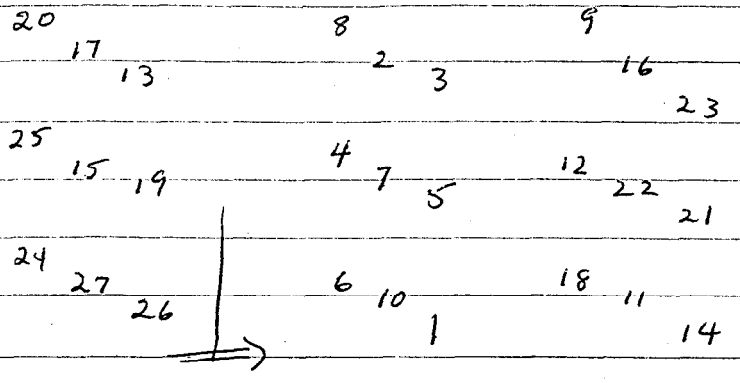
~~S~~pacing for expr. 44 + 45

$\delta_1 = \delta_2 = 2\ 21/32$ base separation = 9.423"

$\delta_3 = 9.423 - 6.958 = 2.465"$

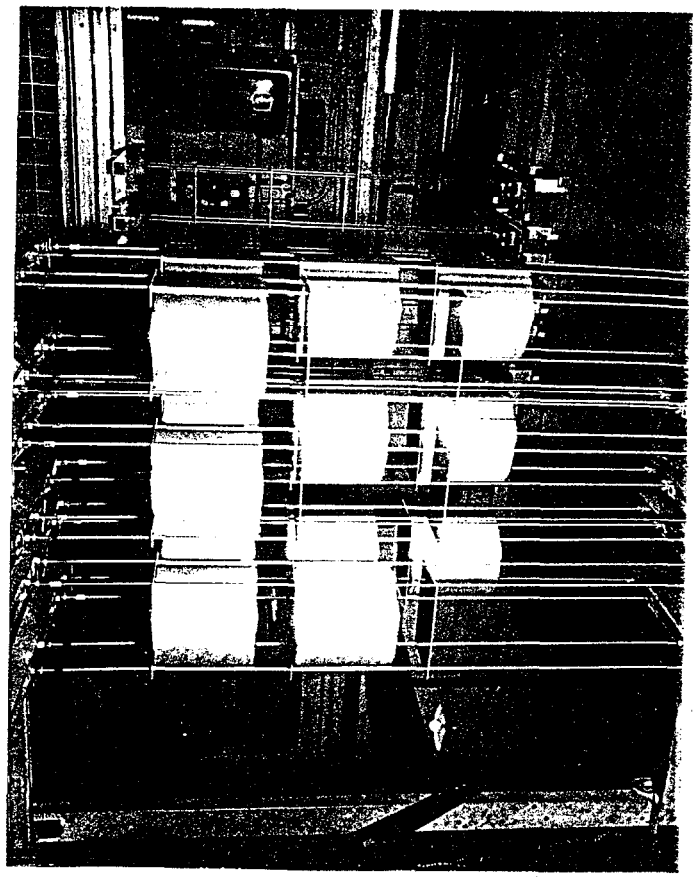
Cell volume = 14.995 liters $\bar{\rho} = \frac{1.5}{14.995} = .10003$ gu/cc

Unit locations.



U233

4.432 kgU/unit 5/2/67 Expt. 46
27 units unreflected



Instrument Check on 5-2-67 Source 10 mc Ra

PM-1 _____ Low Trip OK ~~Alarm~~ Trip OK

PM-2 _____ ~~Alarm Trip~~

IC-1 $>3\times10^{-11}$ Meter Trip OK Fast Trip OK

IC-2 $>3\times10^{-11}$ Meter Trip OK Personnel ✓

IC-3 Responds Calibration JH Alarms ✓

IC-4 Responds Calibration JH Press. -0.06"

CRM _____ Meter Trip _____

Expt. #6 27 Unreflected units

$\delta_1 = \delta_2 = 2\ 29/32$ Base separation 9.373"

$k > 1$ at closure but not above source level.

$k \leq 1$ at closure after raising neutron level with source.

Natural source in system makes establishment of Critical difficult. Negative period after source withdrawal ~ 2200 sec – is a small fraction of a cent from $k = 1$.

Cell volume = 16.1898^3 l. $\Rightarrow C = \frac{1.5}{16.1898^3} = 0.09265$ g/cc

Instrument Check on 5-3-67 Source 10 mc Ra

PM-1		Low Trip	OK	~~Alarm~~ Trip	OK
PM-2				~~Alarm~~ Trip	
IC-1	$> 3 \times 10^{-11}$	Meter Trip	OK	Fast Trip	OK
IC-2	$> 3 \times 10^{-11}$	Meter Trip	OK	Personnel	✓
IC-3	Response	Calibration	✓	Alarm	✓
IC-4	Response	Calibration	✓	Bias	-0.06"
CRM		Meter Trip			

Expr. 47 Repeat Expr. 46 without Source.

$k \leq 1$ at table closure.

Raise neutron level by inserting source.

$k \geq 1$ slight rise in neutron level when source is removed.

Estimate system to be supercritical by a small fraction of a cent. Do not want to run at level necessary to override source in system and measure degree supercritical.

Expr. 48-49

The spacing for these expts is 3 the stacked density is 92.6% of that estimated by K(α) vs $\bar{\rho}$ plot. The N=8 line on the plot does not emanate from the origin, as assumed, therefore the correction for the estimated density in the reflected array was not applicable.

Necessary to restack to array to original estimate.

Loading for expts. 48+49

19 12 23	20 14 8	25 11 16
26 13 26	5 10 1	12 3 22
21 17 24	4 9 15	18 27 8

Instrument Check on 5-5-67 Source 10 mc Ra

PM-1		Low Trip	Ok	~~Alarm~~ Trip	OK
PM-2				~~Alarm Trip~~	
IC-1	$>3\times10^{-11}$	Meter Trip	OK	Fast Trip	OK
IC-2	$>3\times10^{-11}$	Meter Trip	OK	Personnal	✓
IC-3	Responds	Calibration	JK	Alarms	✓
IC-4	Responds	Calibration	JK	Press.	-0.06"
CRM		Meter Trip			

Exp. 48 Reflected (6" polyethylene) 22 unit array.

$\delta_1 = \delta_2 = 6.875"$ base separation 15.583" 39.58

$k<1$ at closure. Spacing between movable plane of unit and fixed plane is not correct.

Exp. 44

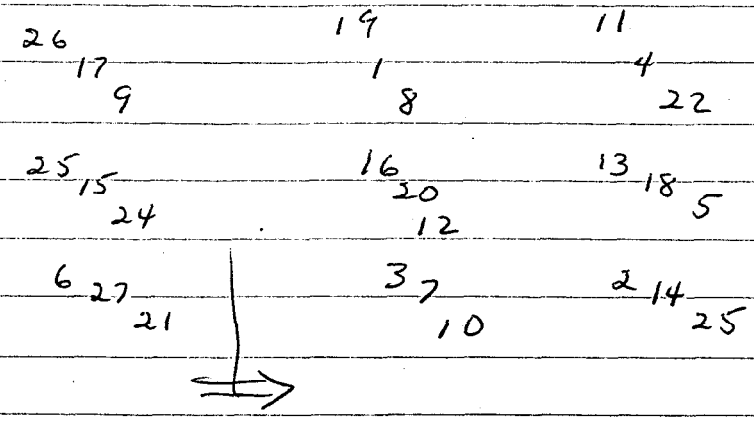
have moved fixed structure forward 3/16".

$k<1$ High multiplication but subcritical.

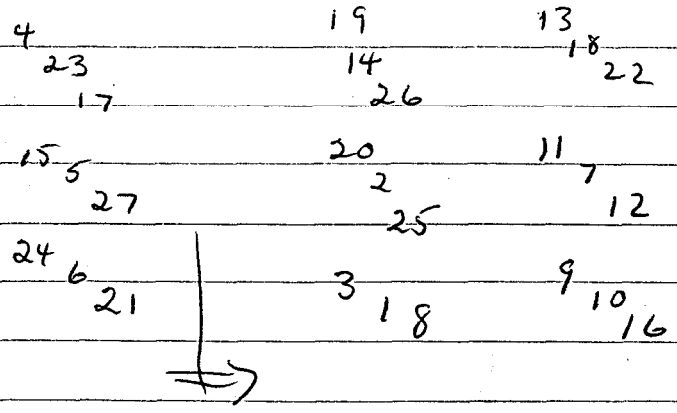
Cell volume = 66.079 liters

$\bar{\rho} \approx \frac{1.5}{66.079} = .0227\ g^{235}/cc$

Loading for expr. 50



Loading for Expr. 51



Instrument Check on 5-8-67 Source 10 mc Ra

PM-1		Low Trip	OK	~~Alarm~~ Trip	OK
PM-2				~~Alarm Trip~~	
IC-1	$>3\times10^{-11}$	Meter Trip	OK	Test Trip	OK
IC-2	$>3\times10^{-11}$	~~Meter Trip~~	OK	Personnel	✓
IC-3	Responds	Calibration	JH	Alarms	✓
IC-4	Responds	Calibration	JH	Press	-0.06"
CRM		Meter Trip			

Expr. 50 27 units reflected by 6" polyethylene.

$\delta_1 = \delta_2 = 8.483$" distance between bases 15.191" (38.58 cm)

$k > 1$ at 16.6 revs (1.30") 3.95 div/sec $\Rightarrow T = 85.8$ sec $\Rightarrow \rho \sim 13.3$ ¢

$k = 1$ at 17.15 revs (1.370") ~1.90 $/in

Expr. 51

Increased spacing in three directions by 3/16"

$k > 1$ 7.89 revs. (0.470") 4.0 div/sec $\Rightarrow T = 86.92$ sec $\Rightarrow \rho \sim 13.1$ ¢

$k = 1$ at 8.81 revs. (0.540") ~487 $/in

$Vol = 63.5 1097 \ell. \Rightarrow \bar{\rho} = \frac{1.5}{63.5} = .02361$

Instrument Check on 5/9/67 Source 10 mc Ra

PM-1		Low Trip	OK	~~Alarm~~ Trip	OK
PM-2				~~Alarm~~ Trip	
IC-1	$>3\times10^{-11}$	Meter Trip	OK	Fast Trip	OK
IC-2	$>3\times10^{-11}$	Meter Trip	OK	Personnel	✓
IC-3	Responds	Calibration	JH	Alarms	✓
IC-4	Responds	Calibration	JH	Press.	−0.06"
CRM		Meter Trip			

Expt. 52 Repeat Expt. 51

k > 1 at 7.89 revs. (0.470") 4.925 div/sec ⇒ T = 107.02 sec ⇒ ℓ ~ 11¢

k = 1 at 8.70 revs. (0.531) 1.80 ¢/in

Expt. 53 Purpose: evaluate effect of Aluminum shelves. Have placed sheets of alum. 1/16" thick (39×30) and (39×15) on top of cans in 1st and 2nd tiers.

k > 1 at 8.30 (0.500) revs. 2.1 div/sec. T = 45.63 sec ⇒ ℓ ~ 20.2¢

k = 1 at 9.65 (0.609) revs. 1.85 ¢/in

Expt. 54 Same as 53. Have removed Al. sheets from 1st tier. Now have sheet resting on 2nd tier.

k > 1 at 8.30 (.500) revs. 3.525 div/sec ⇒ T = 76.6 sec ⇒ ℓ ~ 14.5¢

k = 1 at 9.30 (.580) revs 1.81 ¢/sec.

5/16/67

Have removed packing rings and loaded cylinder with 23" of 5/8 x 5/8 rings from K-25.

Counting Data for Expt. 55

BF_3 Position (in)	C_1 c/m*10'	C_2 c/m*10'	C_4 c/m*10'	TaD (in)	Norm to C_1 at 23"
3	24575	76523	647	24.66	.00758
5	24804	77235	1101		.01278
7	24932	78028	1723		.0199
9	24869	77300	2501		.0289
11	25224	78289	3723		.0425
13	25422	79081	5848		.0662
15	25019	78219	9018	24.64	.1038
17	24760	77385	14606		.1698
19	23587	73514	21661	24.665	.2644
21	23622	74063	33658		.4102
23	22968	72131	79787	24.72	1 —
25	24470	76617	39206	24.715	.4612
26	24229	75595	12443	24.69	.1478
24	23594	74528	71014		.8520
22	24719	76982	65995	24.71	.7685
20	25229	79122	26128	24.718	.2981
18	25347	79069	18004	24.68	.2045
16	25363	78761	11702		.1328
14	25161	78572	7629	24.65	.0873
12	25497	78858	4736	24.66	.0535

Instrument Check on 5-16-67 Source 10 mc

PM-1		Low Trip	OK	~~Alarm~~ Trip	OK
PM-2				Alarm Trip	
IC-1	$>3\times10^{-11}$	Meter Trip	OK	Fast Trip	OK
IC-2	$>3\times10^{-11}$	Meter Trip	OK	Personnel	
IC-3	Responds	Calibration	JH	Alarms	
IC-4	Responds.	Calibration	JH	Press	
CRM		Meter Trip			

Expt. 55 Check for criticality when 14 cans in system.

hr with 7 containers in system 7.42"

" " 14 " " " 16.87"

$k<<1$ No multiplication observed.

Loaded 7 more cans into system now 21.

$k<<1$ no observable multiplication.

Soln hr with 21 cans in system is 24.14

Expt 56 Loaded remaining 6 cans into system.

IC-2 $5\times10\times10^{-10}$	$k \leq 1$	Tad at 24.82"	Solution	26.67
IC-3 .55	$k>1$	tad at 25.09		26.67
IC-4 0.9	$k=1$	24.66		26.67

Make traverse with BF-3 counter.

Pos.	C_1	C_3	C_4	Tad	Norm to C_1
10	25500	75203	3006	24.66	.0339
8	26017	74895	2172		.0240
6	26425	75670	1599		.0174
4	26335	75418	801		.00896
2	26663	76442	564		.00609

↑ Note decrease from 18" to 2" while C_1 increased in accord with IC-2

Bkg on C_4 at 10" is 120 c/m

BF_3 Position (in)	C_1 c/m $\times 10^{-1}$	C_3 c/m $\times 10^{-1}$	C_4 c/m $\times 10^{-1}$	t cal (in)	Norm to C, at 23"
2	55420	163912	1210	24.42	.00691
4	56417	165903	1779	"	.00998
6	57114	167540	3596	"	.01993
8	56546	166481	4897	24.40'	.02741
10	57140	167918	6846	"	.03793
12	56802	165629	10762	"	.05997
14	57326	168194	17809	24.41	.09834
16	58413	169616	27235	"	.14759
18	58279	169708	41656	"	.22626
20	57910	168986	59485	"	.32517
22	55216	162159	140011	24.43	.827
24	55470	163697	154494	24.46'	.845
26	58724	161060	29802	"	.16065
25	59865	172833	88764	24.46	.46937
23	61560	177654	194466	"	1.—
21	63002	183438	86213	24.42'	.43318
19	65481	188189	57925	24.42	.28027
17	67364	193604	38730	24.41	.18200
15	68914	197340	24265	24.40	.11146
13	70534	200831	15936	24.39'	.07152
11	70797	200745	10349	24.389	.04628
9	71385	202342	7100	24.385	.03148
7	70818	201182	4717	24.375	.02108
5	72790	205227	3156	24.392	.01372
3	74983	210538	1952	"	.00824
1	76347	213457	1253	24.38	.00519
0	75703	213101	815	"	.00341

~30 v% glass

Instrument Check on 5-17-67 Source 10 mc 8

PM-1		Low Trip		Alarm Trip	OK
PM-2				Alarm Trip	
IC-1	$>3\times10^{-11}$	Meter Trip	OK	Fast Trip	OK
IC-2	$>3\times10^{-11}$	Meter Trip	OK		
IC-3	Responds	Calibration	JH		
IC-4	Responds	Calibration	JH		
CRM		Meter Trip			

Exp. 57 Repeat Exp. 56 Make traverse along axis

	$k>1$	fast	24.68[5]	Solution 26.63
8[48] AM	$k=1$		24.42	26.63
9[35]		shut down	24.38	26.64[8]

Result of least square fit to $q = q_0 e^{-\gamma d}$

Exp. 56: $\gamma = 0.2172 \pm .0096$ in^{-1}

Exp. 55: $\gamma = 0.2156 \pm .0099$ in^{-1}

Drained and flushed system. Final rinse had ~56 g U/cc concentration.

All but ~ 32 g U (92.5% 233) returned to John Parrott.

Received from John Panot 26.085 kg U (25.448 kg ^{233}U)

Isotopic Analysis

Isotope	wt/%		
233	97.54	sp. gr.	mg/ml
234	1.047	1.2400	207.5
235	.026	1.2484	208.6
236	.001		
238	1.386	ave. 1.2442	208.6
232	6.47 ppm.		

Ave uranium concentration of solution is 208.6 g/l as U^{238},

$$g\,U/l = 208.6 \frac{233.08}{234.05} = 204.3 \text{ g/l}.$$

$$g^{233}U/l = 204.2 \times .9754 = 199.2 \text{ g/l}.$$

Bottle No.	Gross wt kg	tare wt. kgs.	Net kg	Vol l.	Total U kg	^{233}U kg	rad. reading mr/hr.
1	16.050	4.184	11.866	9.54	1.948	1.900	80
2	16.250	4.159	12.091	9.72	1.985	1.936	60
3	16.270	4.200	12.070	9.70	1.981	1.932	60
4	16.500	4.369	12.131	9.75	1.991	1.942	60
5	16.550	4.419	12.131	9.75	1.991	1.942	60
6	16.090	4.060	12.030	9.67	1.975	1.926	55
7	16.250	4.159	12.091	9.72	1.985	1.936	60
8	15.900	3.999	11.091	9.57	1.954	1.906	65
9	16.320	4.234	12.086	9.71	1.983	1.934	55
10	16.200	4.209	11.991	9.64	1.969	1.920	55
11	15.815	3.759	12.056	9.69	1.979	1.930	65
12	16.310	4.309	12.001	9.65	1.971	1.922	65
13	15.900	3.999	11.901	9.57	1.954	1.906	65
14	6.500	3.950	2.550	2.05	.419	.408	40
	total		158.896	127.73	26.035	25.440	

6-13-67

Transfered bottles 8, 9, & 10 into system

Bottle	Vol. (l)	kg U			
8	~~9.52~~	1.954			
9	9.71	1.983		Total	
10	9.64	1.969	solution	V	M
T	28.92	5.906	6.04"	28.92	5.906

6-14-67

4	9.75	1.991			
7	9.72	1.985			
11	9.69	1.979			
	29.16	5.955	14.38"	58.08	11.861
3	9.70	1.981			
12	9.65	1.971			
13	9.57	1.954			
	28.92	5.936	22.61	87.00	17.797
1	9.54	1.948			
5	9.75	1.991			
6	9.67	1.975			
	28.96	5.914	—	115.96	23.711

Instrument Check on 6-14-67 Source 10 mc Ra

PM-1		Low Trip	OK	Alarm Trip	OK
PM-2					
IC-1	$> 3 \times 10^{-4}$	Meter Trip	OK	Test Trip	OK
IC-2	$> 3 \times 10^{-4}$		O.K	alarms ✓	
IC-3	Responds		JT	Personnel ✓	
IC-4	Responds	Calibration	JT	Pres.	−0.06"
CRM		Meter Trip			

Exp. 58. Check criticality during loading.

System contains ~58 l. (Bottles 4,7,8,9,10 + 11)

$k << 1$ tab 38.86" selsyn 14.38"

added Bottles 3, 12, & 13

$k << 1$ tab 38.86 selsyn 22.61

added Bottles 1, 5 & 6

2 PM $k > 1$ tab 23.88^5 Selsyn. 27.22^6

$k = 1$ tab 23.39^5 27.22^5

Make traverse IC4 at 1.0 on bank.

Note: Traverse is made with counter parallel to axis but ~1" off axis.

6-14-67 Expt. 58 Traverse with C-4 located ~1" off axis of cylinder. 1-min counts.

Counter position from Bottom (in.)	Normalizing C-1	C-3	C-4	Norm to 23"	
1	33419	98606	142	146	.00073
2	34780	105977	171	168	.00084
3	33408	98526	235	240	.00119
4	34590	105439	311	308	.00153
5	33414	98388	408	418	.00208
6	33873	103368	541	547	.00272
7	33925	99501	712	719	.00357
8	33569	102606	901	919	.00457
9	34992	92840	1440	1409	.00700
10	32847	99256	1867	1946	.00967
11	32858	98560	2229	2323	.01155
12	32504	97923	3105	3271	.01626
13	32100	97122	4118	4393	.02184
14	32623	92851	5778	6065	.03015
15	32429	98004	7968	8414	.04183
16	32747	99032	10663	11151	.05543
17	32386	97970	15565	16458	.08181
18	31662	96865	20618	22300	.11085
19	32359	97801	27792	29412	.14621
20	31308	95153	41474	45364	.22550
21	30479	92591	82021	92156	.45811
22	31430	95888	163647	178304	.88635
23	34245	93194	201160	201160	1.—

Position (in)	C-1 c/min.	C-3 c/min.	C-4 c/min.	C-4 Normalized to 23"	
24	31442	86443	165238	179969	.89463
25	37832	114255	125315	113433	.56388
26	30609	93841	29720	33250	.16529
27	32124	98147	22869	24379	.12119

Notes:

① Count rates recorded at value $\times 10^{-1}$.

② Traverse made from bottom of vessel beginning at 1" and increasing in increments of 2" to 27"; then returning to bottom from 26" in 2" increments.

$\gamma = .3011 \pm .0034$ in^{-1}

6-15-67 Traverse. (See Notes p.87)

C-4 Position (in) From bottom	C-1 (c/m)	C-3 (c/min)	C-4 (c/m)	C-4 Norm to 23"
1	24930	78433	110	.00071
2	27136	79051	188	.00082
3	24253	76385	167	.00111
4	27262	78982	239	.00141
5	23736	74445	290	.00196
6	27070	78728	445	.00264
7	23643	74659	493	.00335
8	26815	78352	745	.00446
9	24323	76778	1012	.00668
10	27468	79530	1575	.00920
11	25187	78844	1747	.01113
12	27036	78805	2651	.01574
13	25363	79436	3256	.02060
14	26765	77814	4820	.02890
15	25516	79938	6471	.04069
16	26796	78161	8986	.05382
17	26357	82203	12821	.07807
18	26549	77473	17651	.10670
19	26467	88416	23118	.14016
20	25660	75402	34813	.21772
21	26083	~~86450~~	71808	.4418
22	24429	72176	132433	.86495
23	24957	73570	155501	1.0
24	—	—	—	
25	25401	74705	88510	.55920

Instrument Check on 6-15-67 Source 11 mcr

PM-1		Low Trip	OK	~~Alarm~~ Trip	OK
PM-2				~~Alarm Trip~~	
IC-1	$> 3 \times 10^{-4}$	Meter Trip	OK	Fast Trip	OK
IC-2	$> 3 \times 10^{-4}$	Meter Trip	OK	Personnel	✓
IC-3	Responds	Calibration	SJR	Alarms	✓
IC-4	Responds	Calibration	SJR	Pres.	−0.06"
CRM		Meter Trip			

Expr. 58 Repeat traverse.

9:30 AM. k = 1 tad 24.21" selsyn 27.29"

10:37/Ad End traverse – put system on slightly negative period to seek presence of source in solution.

Set tad on 24.1 IC-4 at 1.0 decreased on ~5½ sec period and leveled off at .34

lowered tad to 23.2 system on ~80 sec period. and leveled off ~.02

lowered tad to 22.3 system showed step decrease. ∴ definite different source is present.

$$\gamma = .3036 \pm .0033 \text{ in}^{-1}$$

Fill Cans for Array Expts.

Can No.	Tare Wt(kg)	Gross(kg)	Net(kg)	Can No.	Tare Wt(kg)	Gross	Net
1	0.324	5.876	5.552	26	0.322	5.874	5.552
2	0.323	5.877	5.554	27	0.323	5.875	5.552
3	0.324	5.876	5.552				
4	0.323	5.877	5.554				
5	0.324	5.876	5.552				
6	0.325	5.878	5.553				
7	0.325	5.878	5.553				
8	0.323	5.875	5.552				
9	0.323	5.875	5.552				
10 ✗	0.324	5.865	5.541				
11	0.325	5.877	5.552				
12	0.324	5.876	5.552				
13	0.325	5.877	5.552				
14	0.325	5.877	5.552				
15	0.323	5.875	5.552				
16	0.324	5.876	5.552				
17	0.324	5.876	5.552				
18	0.324	5.876	5.552				
19	0.324	5.876	5.552				
20	0.326	5.878	5.552				
21	0.327	5.879	5.552				
22	0.324	5.877	5.553				
23	0.326	5.878	5.552				
24	0.323	5.875	5.552				
25	0.324	5.876	5.552				

.2085 gU/cc @ 1.28 sp. gr.

$\Rightarrow \frac{.2085}{1.28} = .1628$ gU/g soln.

salt factor is 1.67

$$\therefore \frac{H}{233U} = \frac{(1-1.67(.1628))}{.1628 \times .9754} \frac{233}{9}$$

$= 118.7$

JH

Sample taken during filling of the cans.
Control No. 16330 returned 7/3/67
(sample No. 11)

208.1 gU/l (Colorimetric U^{238})

1.2804 sp. gr.

233 @ 97.54%	= 227.27	207.5 mg/ml	
234 @ 1.047	= 2.45	209.6	ave sp. gr.
235 @ .026	= .061	208.1	⇒ ave 208.5 mg/ml.
236 @ .001	= .002		
238 @ 1.356	= 3.30		
Total	233.08		

$\therefore$ gU/l = $208.5 \times \frac{233.08}{238.04} = 204.05$

$gU^{233}/l = 204.05 \times .9754 = 199.03$

Ave. Volume of Solution per container

$= \frac{5.552 \text{ kg soln}}{1.2804} = 4.336$ liters.

kg U/container = 0.88476 ~ 885 gms. U

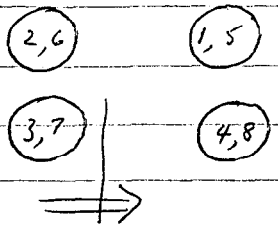
$\cong 863\ gU^{233}$

Average OD measurement on 8 cylinders is 7.19775" ⇒ 18.282cm.
$\therefore$ " ID (10 mil wall) is 7.17775" ⇒ 18.231 cm.
giving cylindrical area of 261.05 cm^2

Measurement of height change over last 2 liters of filling gave ave area of 261 cm^2 : good agreement.

height of Solution (neglecting ridges) = $\frac{4.336}{.261} = 16.613$cm. (6.5404")

Expr. 60



Cell vol: $(18.282 + 2.695)^2 (19.05) = 7.9108$ l.

$\bar{\rho} = \frac{885}{7.9108} = .111.87$ g/cc

Expr. 61 same arrangement; different spacing.

Cell vol = $(18.282 + 1.4605)^2 (18.415) = 7.1775$ l.

$\bar{\rho} = \frac{885}{7.1775} = 0.1233$ g/cc

Instrument Check on 6-19-67 Source 10 mcf

PM-1 Low Trip OK Alarm Trip OK

PM-2 Alarm Trip

IC-1 > 3×10⁻¹¹ Meter Trip OK Fast Trip OK

IC-2 > 3×10⁻¹¹ Meter Trip OK Personnel ✓

IC-3 Responds Calibration JH Alarms ✓

IC-4 Responds Calibration JH Press - 0.06"

CRM Meter Trip

Exp. 69 purpose: check criticality of eight unreflected units. $\delta_1 = \delta_2 = .825" = 2.0955$ 7.5" = 19.05 between bases.

k < 1 M = 2 at table closure.

Instrument Check on 6-20-67 Source 10 mcf

PM-1 Low Trip OK Alarm Trip OK

PM-2 Alarm Trip

IC-1 > 3×10⁻¹¹ Meter Trip OK Fast Trip OK

IC-2 > 3×10⁻¹¹ Meter Trip OK Personnel

IC-3 Responds Calibration JH Alarms ✓

IC-4 Responds Calibration JH Press. - 0.06"

CRM Meter Trip

Exp. 69 Check criticality with $\delta_1 = \delta_2 = 0.575" = 1.4605$ cm and 7.25" = 18.415 between bases.

8.87 ϕ/in k > 1 at 8.9 revs ⇒ 0.547" ≈ 2.89 in/sec. 62.8 sec ≈ 15.964

k = 1 at 9.12 revs ⇒ 0.565"

Expt. 62

same unit arrangement as 60.

Cell Vol = $(18.282 + 1.4605)^2 (18.7325) = 7.3013$ ℓ.

$\bar{\rho} = 0.12121$ gu/cc

Expt. 63 Cell vol = $(18.282 + 1.806)^2 (18.7325) = 7.5552$ ℓ.

$\bar{\rho} = 0.11714$ gu/cc

Expt. 64 Cell Vol = $(18.282 + 1.8771)^2 (18.88) = 7.6767$ ℓ.

$\bar{\rho} = 0.11528$ gu/cc

Expt. 65 Cell Vol = $(18.282 + 1.8771)^2 (18.8087) = 7.6437$ ℓ.

$\bar{\rho} = 0.11578$ gu/cc

Expt. 62 check for criticality with spacing: $\delta_1 = \delta_2 = 0.575$ (1.4605 cm)
distance between bases = 7.375 (18.7325 cm)

7.69 ¢/in $k > 1$ at 6.4 revs ⇒ .357" 5.563 div/sec. 120.9 sec = ~10¢
$k = 1$ at 6.58 revs ⇒ .370"

Expt. 63 Reset spacing: $\delta_1 = \delta_2 = 0.709$ (1.8007 cm) base separation = 7.375" (18.7325 cm)
$k > 1$ at 2.7 Revs. ⇒ 0.118" 7.133 div/sec. 155 sec. ~8.1¢
7.36 ¢/in $k = 1$ at 2.89 Revs ⇒ 0.129"

Expt. 64 Reset spacing ⇒ $\delta_1 = \delta_2 = .739$ (1.8771 cm) base separation 7.437 (18.8899 cm)
$k < 1$ $\mu > 10$

Expt. 65 Reset spacing ⇒ $\delta_1 = \delta_2 = .739$ base separation 7.405 (18.8087 cm)
4.54 ¢/in $k > 1$ at closure 2.9 div/sec 63.02 sec. ~15.9¢
$k = 1$ at 1.16 revs (.035")

Expt. 66 Cell Vol = $(18.282 + 12.954)^2 (30.005) = 29.276$ ℓ.

$\bar{\rho} = 0.03023$ g/cc

Expt. 67 Cell Vol = $(18.282 + 11.684)^2 (28.243) = 26.2551$ ℓ.

$\bar{\rho} = 0.033703$ g/cc

Instrument Check on 6-21-67 Source 10 mc Ra

PM-1		Low Trip	OK	~~Alarm~~ Trip	OK
PM-2				~~Alarm Trip~~	
IC-1	$> 3 \times 10^{-11}$	Meter Trip	OK	Fast Trip	OK
IC-2	$> 3 \times 10^{-11}$	Meter Trip	OK	Personnel	✓
IC-3	Responds	Calibration	JA	Alarms	✓
IC-4	Responds	Calibration	JA	Pres.	-0.08"
CRM		Meter Trip			

Expr. 66. Determine criticality of Eight units reflected by 15.24-cm-thickness of Polyethylene.

Spacing $\delta_1 = \delta_2 = 5.10"$ (12.954 cm.) Separation of bases is 11.813 (30.005 cm.).

$K < < 1$ Conclude reflector effect much less than for higher concentration.

Instrument Check on 6-22-67 Source 10 mc Ra

PM-1		Low Trip	OK	~~Alarm~~ Trip	OK
PM-2				~~Alarm Trip~~	
IC-1	$> 3 \times 10^{-11}$	Meter Trip	OK	Fast Trip	OK
IC-2	$> 3 \times 10^{-11}$	Meter Trip	OK	Personnel	✓
IC-3	Responds	Calibration	JA	Alarms	✓
IC-4	Responds	Calibration	JA	Pres.	-0.08"
CRM		Meter Trip			

Expr. 67 Reset spacing $\delta_1 = \delta_2 = 4.60"$ (11.684 cm.) bases separated 11.513" (29.243 cm.)

$K < 1$ slight response.

Expr. 69 Cell Vol = $(18.282 + 11.3716)^2(28.4124) = 24.98405\ \ell.$

$\bar{\rho} = 0.03542\ g/cc$

Expr. 70 Cell Vol = $(18.282 + 11.3716)^2(28.730) = 25.2633\ \ell.$

$\bar{\rho} = .03503\ g/cc$

Expr. 71 same as 69 $\bar{\rho} = 0.0354$

Sensitivity to tablet separation for Expr. 71 same as for Expts. 40 & 42 ∴ Extrapolate to critical density of 0.0342 giving a cell volume of 25.877 ℓ.

⇒ $\delta_1 = \delta_2 = 11.946$ cm Vertical sep of 28.508 cm.

Expr. 68 Have raised bottom tier 4".
R < 1 slight multiplication ~ 1.4

Instrument Check on 6-23-67 Source 10 mc Ra

PM-1		Low Trip	OK	~~Alarm~~ Trip	OK
PM-2				~~Alarm Trip~~	
IC-1	$> 3 \times 10^{-11}$	Meter Trip	OK	Fast Trip	OK
IC-2	$> 3 \times 10^{-11}$	Meter	OK		Personnel ✓
IC-3	Responds	Calibration	OK		Alarms ✓
IC-4	Responds	Calibration	OK		Pres -0.01"
CRM		Meter Trip			

Expr. 69 Have reset spacing to $\delta_1 = \delta_2 = 4.477$ (11.3716 cm.)
Separation of bases is 11.186 (28.4124 cm.)

2.71 ¢/in R > 1 at 5.0 revs. (0.261") 2.58 div/sec. T = 56.06 sec. ~ 17.9 ¢
R = 1 at 6.0 revs (0.327")
.066

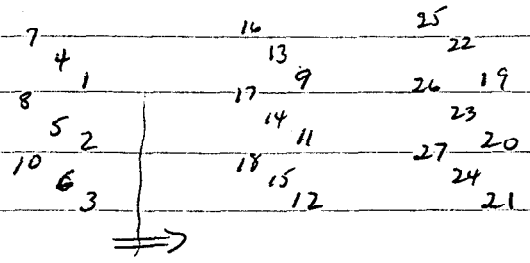
Expr. 70 Have increased spacing vertically between units by 1/8". (i.e., have raised top tier closer (28.730) to top reflector) All else same as expr. 69

1.45 ¢/in R > 1 at 2.6 revs (0.112") 1.12 div/sec T = 24.34 sec. ~ 29 ¢
R = 1 at 5.0 revs (0.261")
.149

Expr. 71 Checked spacing: found units 2, 3 & 6, 7 about 1/8" too close - reset to original 4.477". Have removed 1/8" strip from top tier.

2.71 ¢/in R > 1 at 4.0 revs. (0.198") 1.56 div/sec T = 33.9 sec ~ 24.4 ¢
R = 1 at 5.4 revs. (0.288")

Exp 72.
Unit Arrangement



Instrument Check on 6-27-67 Source 10 mc

PM-1		Low Trip OK	~~Alarm~~ Trip	OK
PM-2			~~Alarm Trip~~	
IC-1	$>3\times10^{-11}$	Meter Trip OK	Fast Trip	OK
IC-2	$>3\times10^{-11}$	Meter Trip OK		Personnel ✓
IC-3	Responds	Calibration JH		Alarms ✓
IC-4	Responds	Calibration JH		Pres. -.09
CRM		Meter Trip		

JH

Expr. 72 27 unreflected units $\delta_1 = \delta_2 = \frac{2.796}{2.75}$

Vertical sep. of bases ($9\frac{13}{32}$ +.063")

$K \leq 1$ Multiplication ~5

Instrument Check on 6-28-67 Source 10 mc

PM-1		Low Trip OK	~~Alarm~~ Trip	OK
PM-2			~~Alarm Trip~~	
IC-1	$>3\times10^{-11}$	Meter Trip OK	Fast Trip	OK
IC-2	$>3\times10^{-11}$	Meter Trip OK		Personnel ✓
IC-3	Responds	Calibration JH		Alarms ✓
IC-4	Responds	Calibration JH		Pres. -.0.1"
CRM		Meter Trip		

Expr. 73 27 unreflected units - $\delta_1 = \delta_2 = \frac{2.796}{2.75}$ JH

$\frac{1}{16}$ $\frac{1}{32}$ Vertical sep. reduced by 1/32" from expr. 72.

$K \leq 1$ Multiplication ~5+

In checking spacing have found $\delta_1 = \delta_2 = 2.796$ instead of intended 2.75.

Exp. 79 Cell Vol = $(18.282 + 6.731)^2 (23.892) = 14.94803$ l.
(25.013)

$\bar{\rho} = 0.059205$ g/cc

Expr. 74 Spacing reset to 2.75 = δ_1, δ_2

1/16 4/32 Vertical sep. same as Expr. 73.

$K < 1$ $M \sim 5$

Expr. 75 Spacing horizontally 2.75" = $\delta_1 = \delta_2$

9/8 1/16 Vertical separation of bases is 9 3/32".

$R < 1$ $M \sim 6$

Expr. 76 $\delta_1 = \delta_2 = 2.75$ Vertical sep. 9 11/32

1/4 1/8 $R < 1$ $M \sim 6^+$

Instrument Check on 8-29-67 Source 10 mc

PM-1		Low Trip	>1K	~~Alarm~~ Trip	OK
PM-2				~~Alarm Trip~~	
IC-1	$>3\times10^{-11}$	Meter Trip	OK	Fast Trip	OK
IC-2	$>3\times10^{-11}$	Meter Trip	OK	Personnel	✓
IC-3	Responds	Calibration	JH	Alarms	✓
IC-4	Responds	Calibration	JH	Pres.	−0.1"
CRM		Meter Trip			

1/4 1/8 Expr. 77 Reset to $\delta_1 = \delta_2 = 2.65$"

Separation between bases 9 11/32"

$3.19/in $R > 1$ at 3.2 revs. (0.148") 5.65 div/sec ⇒ T = 122.8 sec ⇒ P = 9.9 f

$K = 1$ at 3.68 revs. (0.179")

Δ.031"

1/8 1/16 Expr. 78 $\delta_1 = \delta_2 = 2.65$" (6.731 cm.) bases 9 13/32 (9.40625) (23.892 cm.)

$R > 1$ at closure.

$K = 1$ at 1.18 revs. (0.032")

The period is not interputable being a curved line on the Leeds chart. the system

$\bar{\rho} = .05921$

is probably supercritical. Will need to go to higher power to remove inherent source effects.

Expt. 29.

Have placed strip of plexiglas 1/4" thick by 1 1/2" wide and 16" long on top of units 17 and 26 with nylon rope to remove when reaction level is high enough to determine excess reactivity.

$1.08/in

k > 1 at table closure 27.8 div/sec; T = 604.1 sec ~2.7¢

k = 1 at 0.95 rev. (0.025")

ρ_{eff} ~ 1.00004

Expt. 80 Cell Vol. = $(37.7621(8))^2(30.4642) = 51.9873$ ℓ.

$\bar{\rho} = 0.01702$ g/cc

Instrument Check on 7-11-67 Source 10 mc 8

PM-1		Low Trip	not operable	~~Alarm~~ Trip	ok
PM-2				~~Alarm~~ Trip	
IC-1	$> 3 \times 10^{-11}$	Meter Trip	ok	Fast Trip	ok
IC-2	$> 3 \times 10^{-11}$	~~Meter Trip~~	ok	Personnel	✓
IC-3	Responds	Calibration	ok	Alarms	✓
IC-4	Responds	Calibration	ok	Pwr.	-0.1 "
~~CRM~~		Meter Trip			

Expt. 80. 27 units Reflected by 6" thickness of Polyethylene. Cell size h = 14.356" (36.4642 cm) base = 14.867" (37.7622 cm.) Reflector box base dimensions are slightly greater than required: should be 44.6" square but is erected $45\frac{3}{16} \times 45\frac{3}{16}$. ×43 This is imposed by the structure supporting the units. Room temp ~22°C.

k > 1 at 6.4/rec (0.357") 3.41 chi/sec; T = 74.1 sec ⇒ ℓ = 14.9 ℓ

k = 1 at 7.7" rec (0.458")

$V_d = 54.1126\ \ell$.

$\bar{\rho} = .016355$

Instrument Check on 7-13-67 Source 10 mc Ra

PM-1		Low Trip	out	~~Alarm~~ Trip	OK
PM-2				~~Alarm~~ Trip	
IC-1	$> 3\times10^{-11}$	Meter Trip	OK	Test Trip	OK
IC-2	$>3\times10^{-11}$	Meter Trip	OK	Personnel	✓
IC-3	Responds	Calibration	OK	Alarms	✓
IC-4	Responds	Calibration	OK	Pres	-0.1"
CRM		Meter Trip			

Expt. 81 Changed spacing of units, cell is now 38.252 15.06 in base x 38.982 14.56" height. Reflector box inside dimensions are $45\frac{3}{8}\times45\frac{3}{16}\times43.625$".

$k<1$ $M\sim2$

Expt. 82 Have inserted two aluminum sheets resting on top of 1st and 2nd tiers 2(39"×15") and 2(39"×30"). Sheets are 1/16"-thick.

$k<1$ no apparent affect on array observable.

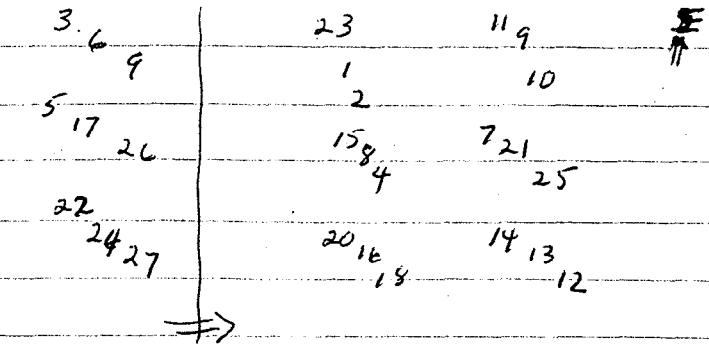
Expt. 83 Have removed Al. sheets and reduced horizontal spacing between units from $7\frac{7}{8}$ to $7\frac{13}{16}$".

$k<1$

Expt. 84 Have lowered tiers 1/16" each so that vertical dimension of cell is now 14.50". height of reflector box is now $43\frac{5}{16}$".

$k<1$ $M\geq2$

Expts. 85 – 92 Unit Arrangement



Expt. 85 Cell Vol = $(37.8714)^2(36.576) = 52.459\ \ell$

$\bar{\rho} = 0.01687$ g/cc

Comparison of sensitivity of separation with expts 50, 51 and correction for aluminum shelves (Expts 86, 87) extrapolate to critical density of 0.01664 g/cc corresponding cell size is (38.046 cm)^2 by 36.744 cm

Have suffered a cool week: Temp today is 20.8°C in assembly room - Has been sufficient time for units to be at this so an equilibrium temp. JK 7/17/67

Instrument Check on 7-17-67 Source 10mc Ra

PM-1		Low Trip	out	~~Alarm~~ Trip	o/c
PM-2				~~Alarm~~ Trip	
IC-1	$>3\times10^{-11}$	Meter Trip	OK	Fast Trip	OK
IC-2	$>3\times10^{-11}$	Meter Trip	OK	Personnel	✓
IC-3	Responds	Calibration	JH	Alarms	✓
IC-4	Responds	Calibration	JH	Pres	−0.1"
CRM		Meter Trip			

Expt. 85. Reset spacing: cell size now $(14.91")^2$ (37.8714) × 14.40" (36.576).
Reflector box 45 × 45 × 43 3/16".

1.23 $/in k > 1 at 3 revs (0.133") 0.66 div/sec; T = 14.34 sec ~ 32.5 ¢

k = 1 at 7.5 revs. (0.438") .305 → 1.11 cm

Expt. 86 Have inserted the 2 aluminum sheets over the tops of the cans in the 1st two tiers. (see Expt. 82)

1.37 $/in k > 1 at 7.0 revs. (0.402") 2.90 div/sec. T = 63 sec ~ 16.6 ¢

k = 1 at 8.6 revs. (0.523") .121

Expt. 87 Have removed aluminum sheet from top of 1st tier. Sheet remains on 2nd tier.

1.40 $/in k > 1 at 7.0 revs (0.402") 3.94 div/sec. T = 85.6 sec ~ 13.3 ¢

k = 1 at 8.27 revs (0.497") .095

Expt. 88 Have removed aluminum sheet 15×39 from second tier on movable half. 30×39" sheet remains on 2nd tier of fixed half of array.

Expr. 88 Partial covering of cans in 2nd tier.

k > 1 7.0 revs (0.402") 4.95 div/sec.

k = 1 8.1 revs (0.484") .082

Expr. 89 Have moved 30×39" sheet from top of 2nd tier cans to top of bottom reflector.

k > 1 7.0 revs (0.402") 15.55 div/sec.

k = 1 7.6 revs. (0.451") .049

Expr. 90 Removed aluminum. Inserted sheet of steel 30"×39" on top of 2nd Tier on fixed half of array.

k < 1 at 7.0 revs. (0.402")

k < 1 at 0.0 revs. (0") μ ~ 1.35

Expr. 91 Moved Steel Plate to Top surface of bottom refl.

k < 1 at 7.0 revs.

k < 1 at 0. μ ~ 1.4 More reactive than Expr. 20.

Expr. 92 Removed steel. Repeat Expr. 85.

k > 1 at 7.0 revs. (0.402") 15.7 div/sec. by only a few cents period bowed.

1.38 δ/in k > 1 at 6.0 revs (0.328") 3.8 div/sec. T = 82.6 sec ~ 13.7 ¢

k = 1 at 7.35 revs. (0.427") .099

Instrument Check on 7-21-67 Source 10 mCi

PM-1		Low Trip	out	~~Alarm~~ Trip	ok
PM-2				~~Alarm~~ Trip	
IC-1	$>3\times10^{-11}$	Meter Trip	ok	Fast Trip	ok
IC-2	$>3\times10^{-11}$	Meter Trip	ok	Personnel	✓
IC-3	out	Calibration		Alarms	✓
IC-4	Responds	Calibration	~~77~~	Pres.	-0.4"
CRM		Meter Trip			

Selsyn zero is +.05"

Expt. 93 20" diameter aluminum cylinder with ½" thick bottom. Check critical height of solution without reflection.

k	Tank	solution	Corrected Soln	
>1	31.46	5.37'	5.32'	2.38 div/sec; T=51.7 sec
=1	22.95	5.36"	5.31" ?	

Expt. 94 Have placed sheet of aluminum (20×20×1/16) adjacent to bottom of vessel.

>1	8.504	5.35°	5.30°	5.40 div/sec; T=112.3 sec
=1	8.23 (.279)	5.34'	5.29'	

Expt. 95 Have placed sheet of Aluminum (18"×20"×½") adjacent to bottom of vessel.

>1	9.61	5.33	5.28°	4.325 div/sec; T=93.9 sec.
=1	9.255 (.355)	5.334	—	?

Instrument Check on 7-24-67 Source 10 mc/

PM-1		Low Trip	cont	Alarm Trip OK
PM-2				~~Alarm~~ Trip
IC-1	$>3\times10^{-11}$	Meter Trip	OK	Test Trip OK
IC-2	$>3\times10^{-11}$	Meter Trip	OK	Personnel ✓
IC-3	Dust	Calibration		Alarms ✓
IC-4	Responds	Calibration	OK	Press −0.1"
CRM		Meter Trip		

Expt. 96 Repeat Expt. 95. 1/8" thick Al. sheet on bottom.

k	Tank (cm)	Solution	Slope (cm)
>1	12.05	5.35	3.64 div/sec. T = 79.1 sec.
=1	11.13	5.34	

Expt. 97 Repeat Expt. 93 20" Vessel.

>1	6.57	5.37	6.9 div/sec.; T = 149.9 sec
=1	6.33 (.25)	5.36 (.007)	

Summary 7/24/67

Expts	Bottom Al. thickness	kt (k = 1)	
97	.500	5.365	6.9
94	.563	5.347	
96	.625	5.342	
	0 extrapolate	5.457	

1-24-67 Have installed 15" dia Aluminum cylinder of annular type (2" feed pipe on circumferance).

System feed valve open 4 turns; Bypass open 2 turns.

Volume per unit length of Tank: 2" I.D.

$\pi 1^2 \times 1 = 3.14159$ in^3/in

$= 20.268$ cm^3/cm.

1" displacement of Tank causes $\left(\frac{4}{15}\right)^2$ in displacement of solution ht in 15" vessel. $= .0178$"

$= .0452$ cm.

Expt. No.	Corrected Soln. ht ~~(in)~~ (in)	(cm)	$\Delta\varrho/\Delta$ht. ℓ/cm.	Δht. (cm)
98	5.975	15.18	11.07	.0131
99	5.885	15.23	10.37	.0176
100	5.960	15.14	10.0	.0136
101	5.940	15.09	10.14	.0140
102	5.951	15.12	9.76	.0210

7-24-67

Expr. 98 Check criticality of 15" dia aluminum cylinder unreflected.

Selsyn Zero 0.015"

k	tad (in)	Selsyn (in)	
>1	7.68°	5.98'	3.52 div/sec; T = 76.5 sec. ~14.5¢
=1	7.39 (.290°)	5.98°	

Instrument Check on 7-25-67 Source 10 mcr

PM-1		Low Trip	out	~~Alarm~~ Trip OK
PM-2				~~Alarm Trip~~
IC-1	>3 x 10⁻¹¹	Meter Trip	OK	Test Trip OK
IC-2	>3 x 10⁻¹¹	Meter Trip	OK	Personnel ✓
IC-3	out	Calibration		Alarms ✓
IC-4	Responds	Calibration	OK	Pres. -0.1"
CRM		Meter Trip		

Expr. 99 repeat 98. Room Temp. 24.2°C.

k	Tad (in)	solution (ht, in)	
>1	6.72	6.02⁵	3.66 div/sec; T = 79.5 sec. ~14.1¢
=1	6.42 (.300)	0.005 ?	

Expr. 100 Have placed sheet of Aluminum 15 x 15 x 1/16 on bottom of vessel.

>1	6.80	5.98⁵ ?	3.53 div/sec;	T = 83.2 sec. ~13.6¢
=1	6.50 (.300)	5.97⁵		

Expr. 101 Changed Aluminum sheet to 15" x 15" x 1/8"

>1	7.13	solution in vent line - about.		
>1	6.50⁵	5.98⁵	3.63 div/sec.;	T = 78.9 sec ~14.2¢
=1	6.19⁵ (.310)	5.95⁻⁵		

7/25/67

Have placed nominal 10" ID aluminum cylinder of annular type into service.

Radius of cyl. from Fox, Gilley, + Gwin Calibration is

12.687 cm = 4.995". Area = 508.29 cm²

.0247 in/in

7/25/67

Expr. 102 Replaced 15×15×1/16 aluminum sheet.

k	tad (in)	selsyn (in)	
>1	6.35	5.88^5	2.06 div/dec.; T = 44.8 sec. ~20.5¢
=1	5.88^5 ,465	5.96^6	

Expr. 103 Nominal 10-in-ID annular cylinder unreplaced - zero is +.063"

>1	6.69	9.81	; 7.38 div/dec.
=1	6.43	9.79	

Expr. 104 Placed 10×10×1/16" sheet of Aluminum on Bottom.

>1	6.67	9.80^5	3.23 div/dec.
=1	6.18	9.77	

Expr. 105 Placed 10×10×1/8" sheet (al.) on bottom.

>1	6.90	9.795^-	2.40 div/dec.
=1	6.27^1	9.76^0	

8-8-67

8" Lia annular cyl.

Feed valve open 4 turns

By-pass valve open 2 1/2 turns.

With 15" head feed rate too slow ~1" in 2 min.

∴ close by-pass 1/2 turn.

at 33.4" solution height. Head is sufficient to have negligible feed rate.

#107 Have added bottle 10 to system.

#108 " " " 8 " " .

Instrument Check on 8-8-67 Source 10 mc Ra

PM-1 _____ Low Trip out Alarm Trip OK

PM-2 _____ ~~Alarm Trip~~

IC-1 > 3 x 10⁻⁴ Meter Trip OK Fast Trip OK

IC-2 > 3 x 10⁻⁴ Meter Trip OK Personnel —

IC-3 out Calibration _____ Alarm ✓

IC-4 Responds Calibration OK Pres. - 0.1"

CRM _____ Meter Trip _____

Expt. 106 8" dia. annular type cyl. Unreflected.

Selsyn zero is 0.0" Rm. Temp 23°C

k	Tank (in)	Ht (in)	
< 1	39.28"	40.5⅜"	exhausted Solution Supply.

Expt 107 add 9.25 liters of solution.

< 1	39.28	48.85	exhausted Solution Supply

Expt 108 add 9.25 liters of solution

< 1	39.28	58.22"	exhausted Solution Supply.

Instrument Check on 8-9-67 Source 10 mc

PM-1		Low Trip	out	Alarm Trip	ok
PM-2				~~Alarm Trip~~	
IC-1	$>3\times10^{-11}$	Meter Trip	OK	Fast Trip	OK
IC-2	$>3\times10^{-11}$	Meter Trip	OK	Personnel	✓
IC-3	out	Calibration		Alarms	✓
IC-4	Responds	Calibration	JH	Pres.	-0.1"
CRM		Meter Trip			

Selsyn Zero 0.02"

Expt. 109 Nominal 11½-in-dia sphere. (in refl. tank.)

k	t$_{sd}$	Solution (corrected)	
>1	4.35	9.19	9.975 div/sec =
=1	4.24	9.18	

Instrument Check on 8-10-67 Source 10 mc

PM-1		Low Trip	out	~~Alarm~~ Trip	OK
PM-2				~~Alarm~~ Trip	
IC-1	$>3\times10^{-11}$	Meter Trip	OK	Fast Trip	OK
IC-2	$>3\times10^{-11}$	Meter Trip	OK	Personnel	
IC-3	out	Calibration		Alarms	✓
IC-4	Responds	Calibration	JH	Pres.	-0.1"
CRM		Meter Trip			
				R.T.	23.1 °C

Have removed reflector tank from sphere.

Expt. 110

k	t$_{sd}$	Solution (Corrected)	
>1	8.70	9.20^8	6.3125 div/sec
=1	8.52^5	9.18^0	

8-10-67 Expr. 111.

Drained 4 liters from system and added 2 liters of Dimineralized water. Mix for 20 minutes.

Expr. 112

added 2 liters of Dimineralized Water mix ~15 min.

Expr. 113

Drained 4 liters of intermediate concentration and added 2 liters of water. Mix for ~ 25 min.

Expr. 114

added 2 liters of water - mix for 45 min.

Expt. 111

k	Tad	Solution (corrected)	
>1	7.16	9.30^5	

shut down.

Expt. 112

>1	7.16	9.64	

Expt. 113

>1	9.40	9.57	3 attempts - all same.

drain.

Expt. 114

>1	8.69^5	9.7[illegible]	2.61 div/sec =
=1	8.32'	9.67	

Expt. 116

Added 1 liters of Water to system; mix ~1 hr.

Expt. 117

Drained 4.6 liters of Solution.

added 4 liters of Water; mix ~ 30 min.

Instrument Check on 5-11-67 Source 10 mc Ra

PM-1 _____ Low Trip out Alarm Trip OK

PM-2 _____ Alarm Trip _____

IC-1 > 3 x 10⁻¹¹ Meter Trip OK Fast Trip OK

IC-2 > 3 x 10⁻¹¹ Meter Trip OK Personnel ✓

IC-3 out Calibration _____ Alarms ✓

IC-4 Responds Calibration JH Pres. -0.1"

CRM _____ Meter Trip _____

R.T. 22.95°C

Expr. 115 Repeat Expr 114 have mixed for 40 min.

k	Tank	Solution (corrected)	
>1	7.47^5	9.76^2	2.6 dis/sec.
=1	7.10^5	9.73^2	

Expr. 116

>1	7.65^4	9.85^5	6.525 dis/sec.
=1	7.43^2	9.82^5	

Expr. 117

>1	14.08^5	10.32	1.3 dis/sec.
=1	13.45^1	10.25^5	

need dilute with 2 liters more of H_2O 8/15/67

Expr. 119

Drained ~2.2 liters of Solution : add 2 liters H_2O

mix for 1 hr.

REQUISITION 684536

Water sample 2
taken 2/9/68

REPORT TO J. T. Thomas

BUILDING NO. 9213

PHONE NO. 35237

	0	0	0	0	0	0	0	1		g U/g
										g Ay/g
										g D/g
										g H/g
										g Mo/g
										g F/g
										SPEC.
										ASSAY

Paul	REPT. BY
2-13-68	DATE
	DEPT.

F

Instrument Check on 8-18-67 Source comc Y

PM-1 _____ Low Trip OK ~~Alarm~~ Trip OK

PM-2 _____ ~~Alarm~~ Trip _____

IC-1 $>3\times10^{-11}$ ~~Meter Trip~~ OK Fast Trip OK

IC-2 $>3\times10^{-11}$ ~~Meter Trip~~ OK Personnel ✓

IC-3 Responds ~~Calibration~~ ✓ alarms ✓

IC-4 Responds ~~Calibration~~ ✓ Pres -0.1"

CRM _____ ~~Meter Trip~~ _____

Expt. 118 Repeat Expt 112. R. Temp. 22.6°C

accidental scram by IC-1 : no change in recorders or meters just fast part of circuit trips.

Sensitivities on IC-1 reset by ERR.

R	Tad	Solution (corrected for +1.02)	
>1	7.70	10.18^7	3.16 div/sec
=1	7.38^5	10.17^0	

Expt. 119

>1	6.79	10.67	2.23 div/sec.
=1	6.33	10.63	

Have installed thermocouple inside sphere ~ 3½ in.

#12 Sample of solution from Expts. 120-124 taken
4/6/67 141.6 mg U/ml. ^{238}U sp gr. 1.1956 Free H^+, N 0.37

$g^U/\ell = 141.6 \times \frac{233.08}{238.04} = 138.65$ $g U^{233}/\ell = 138.65 \times .9754 = 135.24$

$g^U/g_{soln} = \frac{138.65}{1.1956} = 115.97$ good $H/U^{233} = \frac{1-1.67(.11597)}{.11597 \times .9754} \times \frac{233}{9} = 184.55$

after Expt. 124 drained 2.2 liters of solution added 2 liters of H_2O mixed from 1.45 pH to 3.22 pH

Instrument Check on 8-24-67 Source 10 mc ✓

PM-1		Low Trip	OK	~~Alarm~~ Trip	OK
PM-2				~~Alarm~~ Trip	
IC-1	$>3\times10^{-11}$	Meter Trip	OK	Fast Trip	OK
IC-2	$>3\times10^{-11}$	Meter Trip	OK	Personnel	✓
IC-3	Responds	Calibration	SA	Alarms	✓
IC-4	Responds	Calibration	SA	Pres.	-0.1"
CRM		Meter Trip			

Expt. 120 Repeat 119.

	k	Tad	Solution Con.	Soln Temp °C	Rm. °C
	>1	3.19^{5} (.415)	10.45	22.6^{5}	22.5
8:45 AM	=1	2.78	10.39^{8}	22.6^{5}	22.5

2.61 div/sec ⇒ T = 56.72 sec.

Expt. 121 Circulate solution in Resovior for 12 min. To raise temp.

	>1	2.97^{5} (.20)	10.45	24.2
9:20	=1	2.77^{5}	10.42	24.25

7.3 div/sec ⇒ T = 158.63 sec.

Expt. 122 Circulate solution for 30 min.

9:53	>1	2.90	10.49	26.4
	=1	2.63 (.27)	10.45	26.4

4.775 div/sec ⇒ T = 103.76 sec.

Expt. 123

Circulate solution for 1 hr.

11:20	>1	2.694	10.53	29.5
11:35	=1	2.31 (.379)	10.49^{5}	29.5°

3.44 div/sec ⇒ T = 74.75 sec.

Expt. 124 Circulated solution 1 hr.

12:37	>1	2.71'	10.60^{5}	32.25
	=1	2.28 (.451)	10.55^{5}	32.25

2.79 div/sec ⇒ 60.63 sec.

Instrument Check on 8-25-67 Source 10 mc γ

PM-1 _____ Low Trip OK ~~Alarm~~ Trip OK

PM-2 _____ _____ ~~Alarm Trip~~ _____

IC-1 $>3\times10^{-11}$ ~~Meter Trip~~ OK ~~Fast Trip~~ OK

IC-2 $>3\times10^{-11}$ ~~Meter Trip~~ OK Personnel ✓

IC-3 Responds Calibration ERR Alarms ✓

IC-4 Responds Calibration ERR Pres. −0.1"

CRM _____ Meter Trip _____

Inside Sphere = 24°C
Rm Temp = 23.8°C

Expr. 125

	k	Tad	Solution (conc)	Soln Temp °C
	>1	5.26	10.82^{5}	24.2
$9\frac{12}{A}$	=1	$5.02^{.24}$	10.78^{5}	24.2

6.375 div/sec ⇒ T = 138.53 sec.

Expr. 126

Circulate solution 13 min. $9\frac{18}{A}$ to $9\frac{30}{A}$

>1	$\frac{1}{2}$ Tube cooled	14.73	10.86	25.3
=1	~~11.54~~ 11.51		10.80	25.3

5.775 div/sec ⇒ T = 125.49 sec.

Expr. 127

Circulate solution 30 min. $9\frac{55}{A}$ to $10\frac{25}{A}$

>1	0.69		10.98	27.5
=1	$0.17^{.521}$		10.88^{5}	27.5

3.12 div/sec. ⇒ T = 67.80 sec.

Expr. 128

Circulate 30 min. $10\frac{49}{A}$ to $11\frac{19}{A}$

>1	3.93		11.59	29.37
>1	$3.21^{.72}$		11.07^{5}	29.37
=1	$2.76^{.45}$		10.94	29.37

2.54 div/sec ⇒ T = 55.19 sec.

3.44 div/sec ⇒ T = 74.75 sec.

(In sphere) Rm Temp. 24.4° 23.75

Expt. 129 Circulate solution 1 hr. 1 17 PM to 2 17 PM.

k	Tad (in)	Solution (Cont.)	Temp. °C	
>1	8.00⁵	14,685	30.5⁵	7.267 div/dec ⇒ T = 157.21 sec
>1	3.53⁶	11.00⁵	30.5	22 div/dec. ⇒ T = 478.06 sec.
=1	3.45	10.99⁵	30.4	

Instrument Check on 7-1-67 Source 10 mc ✓

PM-1 _____ Low Trip OK ~~Alarm~~ Trip OK

PM-2 _____ ~~Alarm~~ Trip -

IC-1 >3×10⁻¹¹ ~~Meter~~ Trip OK ~~Alarm~~ Trip OK

IC-2 >3×10⁻¹¹ ~~Meter~~ Trip OK Personnel ✓

IC-3 Responds ~~Calib~~ Test Alarms ✓

IC-4 Responds ~~Calibration~~ Test Pres. -0.1"

CRM _____ Meter Trip _____

Rm temp ~~22.5°C~~ ~~22.5°C~~

Expt. 130

4 45/A k	Tad	Soln	Temp °C	
>1	4.76²	10.75¹	~~22.6⁵~~ ~~Stet~~	5.295 div/dec ⇒ T = 114.63 sec
=1	4.48	10.69⁵	~~22.6⁵~~	

Expt. 131 circulate solution 1 hr 10 30/A to 11 30/A

3.35 div/dec ⇒ T = 72.8 sec.

11 45/A >1	2.62	10.88	26.62	
10 22/A =1	2.18	10.80⁵	26.5	

Instrument Check on 9-11-67 Source Cosmic

PM-1 _____ Low Trip OK Alarm Trip OK

PM-2 _____ ~~Alarm Trip~~

IC-1 $> 3 \times 10^{-11}$ Meter Trip OK Fast Trip OK

IC-2 $> 3 \times 10^{-11}$ Meter Trip OK Personnel ✓

IC-3 Responds Calibration JH Alarms ✓

IC-4 Responds Calibration JH Pres.

CRM _____ Meter Trip _____

Expt. 132 temp in sphere 24.5°C

R	tad	Solution (corr)	Temp.	
>1	8.01^5	10.68^5	23.3°	3.1 div/sec ⇒ T = 67.36 sec
=1	0.81^5	10.61^2		

Expt. 133

Circulate solution 1½ hrs.

k>1	4.01^5	11.08^5	29.8°	3.9 div/sec ⇒ T = 84.75 sec.
k=1	3.52	10.88^5	29.8°	

Control # 16525

Sample #13 sent.

Result: 105.9 mg U^{238}/ml Free(H^+) N = 0.50 N

9/19/67

sp gr. 1.1867

$$gU/\ell = 105.9 \times \frac{233.08}{238.04} = 103.69$$

$$gU/g_{soln} = \frac{103.69}{1.1867} = 87.38$$

this value does not check out on curve of gU/gm vs sp. gr. assume gU/ℓ is correct then sp gr. should be ~1.1455 giving ~.0905 gU/g soln.

$$\frac{\div}{U^{233}} = \frac{1 - 1.67(.0905)}{.0905 \times .9754} \times \frac{233}{9}$$

$= 248.95$

sp gr. is correct & these should be 111 mg/g solution ⇒ 131.79 g/ℓ.

Instrument Check on 3-14-67 Source comet

PM-1		Low Trip	ok	Alarm Trip ok
PM-2				~~Alarm Trip~~
IC-1	$>3\times10^{-11}$	Meter Trip	ok	Fast Trip ok
IC-2	$>3\times10^{-11}$	Meter Trip	ok	Personnel ✓
IC-3	Responds	Calibration	ok	Alarms ✓
IC-4	Responds	Calibration	ok	Pres. -.06"
CRM		Meter Trip		

Expt. 134 Unreflected 15" Dia Aluminum cylinder (annulus)

k=	Tad	Solution ht (in) (Zero 0.02")	Rm Temp 22.3°C
>1	4.92^2	$6.48^8 \rightarrow 6.45^8$	2.59 div/sec ⇒ T = 56.28 sec
=1	3.86 (1.00)	$6.46^0 \rightarrow 6.44^0$ (.018)	

Expt. 135 placed 1/16" thick 15×15" sq. sheet of al. on bottom.

>1	3.64^8	$6.47 \rightarrow 6.45$"	7.70 div/sec ⇒ T = 167.32 sec
=1	3.40 (.244)	$6.45 \rightarrow 6.43$ (.02)	

Removed 1/16"-thick piece.

Expt. 136 placed 1/8" thick 15×15 in-sq. sheet of al. on bottom.

>1	3.55	$6.45^8 \rightarrow 6.43^8$	6.20 div/sec ⇒ T = 134.73 sec. Temp 22.8°C
=1	3.30 (.25)	$6.44^6 \rightarrow 6.42^6$ (.012)	

The results of Expts. 137 and 138 are inconsistent. the periods, Tad displacements, solution ht and Temperature are unterpretable.
Need to measure temperature of solution.

These effects could be caused by a tilting of the reactor vessel.

10/2/67 Have determined that inconsistency of Tad readings are caused by air in Tad line. Re Expts. 137-138

Instrument Check on 9-27-67 Source 10 mc Y

PM-1		Low Trip	OK	Alarm Trip	OK
PM-2				~~Alarm Trip~~	
IC-1	$>3\times10^{-11}$	Meter Trip	OK	Fast Trip	OK
IC-2	$>3\times10^{-11}$	Meter Trip	OK	Personnel	~
IC-3	Responds	Calibration	JH	Alarms	~
IC-4	Responds	Calibration	JH	Press.	$-0.1''$
CRM		Meter Trip			

Expt. 137 20-in-dia. Aluminum annulus cylinder. unreflected.

Selsyn zero $-.01''$ Rm Temp 19.6°C

R	Tad (in)	Solution ht (in)	
>1	10.50	5.62	$6.3^{div/sec} \Rightarrow T = 136.90$ sec
=1	8.62	5.61⁵	

Instrument Check on 9-29-67 Source 10 mc Y

PM-1		Low Trip	OK	~~Alarm~~ Trip	OK
PM-2				~~Alarm~~ Trip	
IC-1	$>3\times10^{-11}$	Meter Trip	OK	Fast Trip	OK
IC-2	$>3\times10^{-11}$	Meter Trip	OK	Personnel	~
IC-3	Responds	Calibration	JH	Alarms	~
IC-4	Responds	Calibration	JH	Press.	$-0.1''$
CRM		Meter Trip			

73.5°F

Expt. 138 Same as Expt. 137 Rm Temp. 22.6°C

>1	5.09'	5.61⁸	$4.025^{div/sec} \Rightarrow T_C$ 87.46 sec.
=1	4.65	5.61⁴	

Exp. 139

Have bored cylinder and inserted thermocouple.

Expn. 139 Bare 20" cylinder. Run Tem 22.7°C

k	Tad	Solution	Temp	
>1	3.64"	5.64°	23.4°C	7.334 div/sec ⇒
=1	3.37" + .27"	5.64⁻	23.4°	

Expn. 140 Placed 1/8" × 20 × 20" sheet of Aluminum on bottom of cylinder.

>1	5.08	5.49^{6}	24.1°C	7.617 div/sec ⇒
	4.82^{5} + .25⁵"	5.49^{6-}	24.2	

Expn. 141 Placed 1/16" × 20 × 20" sheet of Aluminum on bottom of cylinder (1/8" sheet removed)

>1	5.05	5.51^{5}	24.3^{5}°C	3.94 div/sec ⇒
=1	4.59^{5} + .45⁵"	5.51^{5-}	24.4^{5}	

Expn. 142 Repeat #139 Bare 20" dia cyl.

>1	4.12^{9}	5.53^{1}	24.7^{5}°C	3.69 div/sec ⇒
=1	3.65^{0} + .47⁹"	5.53^{1-}	24.8 °C	

Instrument Check on 10-2-67 Source comet

PM-1 _____ Low Trip ok Alarm Trip OK

PM-2 _____

IC-1 $>3\times10^{-11}$ Meter Trip OK OK

IC-2 $>3\times10^{-11}$ OK Personnel ✓

IC-3 Responds JR Alarms ✓

IC-4 Responds JR Press. -0.09"

CRM _____ Meter Trip _____ Rm Temp 76°F

Expt. 143 20" Bare cylinder - repeat expt. 142.

R	Twd	Solution	Temp.	
>1	4.70	5.53'	24.5°C	4.21 div/sec.
=1	4.25[5]	5.53'	24.6[+]°C	

Expt 144 Have installed nominal 10-in-dia aluminum cylinder.

Selsyn zero is +0.01" Rm Temp 77.5°F

>1	5.21	11.27'	24.7°C	6.033 div/sec.
<1	4.81 (.40)	11.24[5]	24.7[+]°C	

Expt 145 Placed sheet of 4/16 x 10 x 10" aluminum on bottom.

>1	4.97'	11.28	24.8°C	2.4 div/sec.
=1	4.12' (.85)	11.23'	24.8[+]°C	

Expt. 146 Placed 1/8 x 10 x 10" sheet of Al. on bottom (Removed 1/16" sheet)

>1	5.00	11.27[0] 11.28	24.85°C	3.08 div/sec.
=1	4.24 (.76)	11.22[5]	24.85[+]°C	

Expt. 147 Repeat Expt. 144

>1	14.48	11.31[5]	24.9°C	
=1	Air in end line.		24.9[+]°C	— Repeat this expt
>1	5.21	11.31	25.9°C	5.325 div/sec =
=1	4.72	11.27[5]	26°C	

Drained ~4 liters of solution and added 4 liters of H_2O following expn. 149.

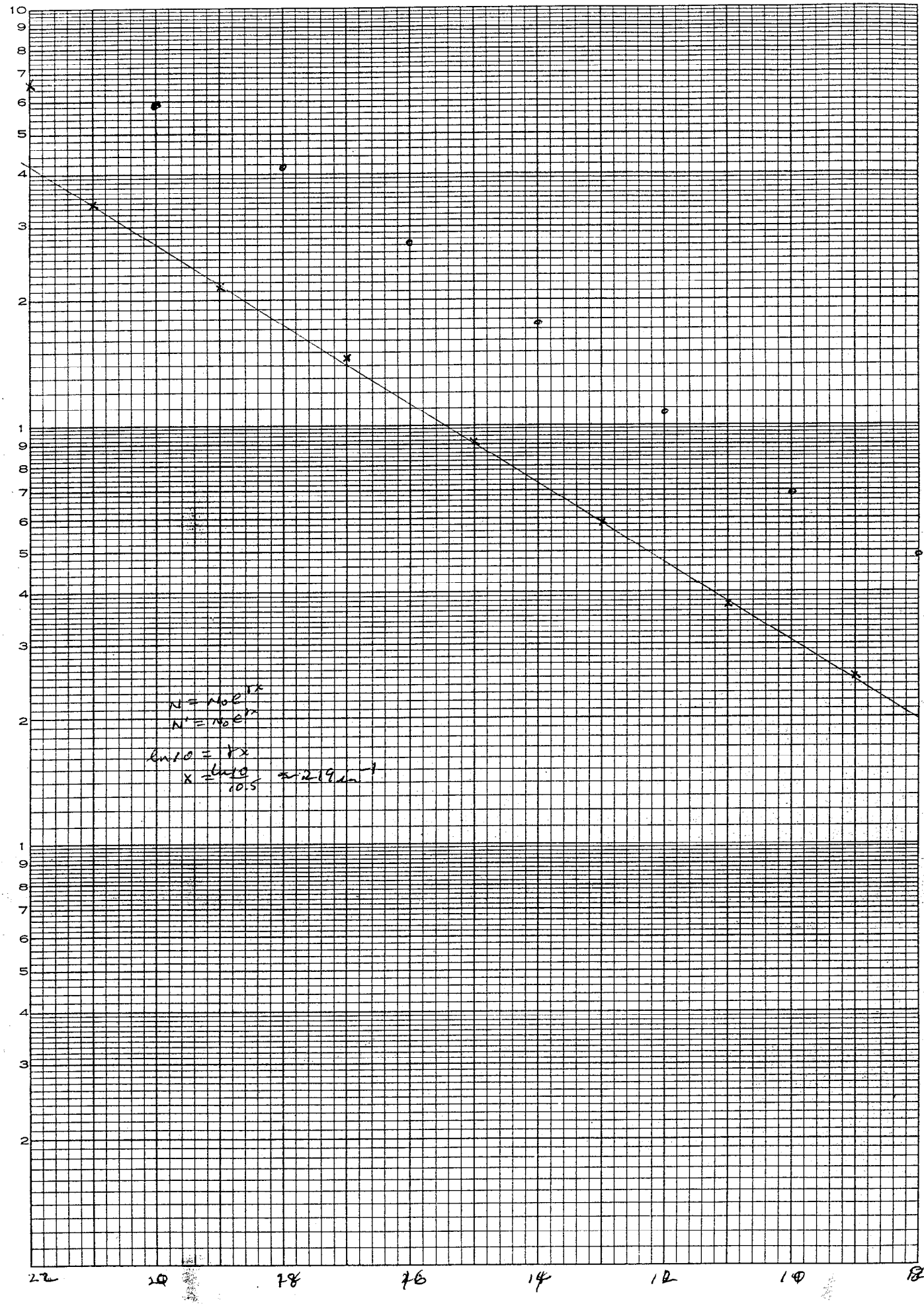
Have taken sample #14A Expn. 148

#14 Control # 16601

133.5 mg/me U^{235} base } gu/l = 130.72

sp gr. 1.1832

free $H^+ \rightarrow N = 0.40$



Instrument Check on 10-16-67 Source 10 mc Ra

PM-1 _____ Low Trip OK Alarm Trip OK

PM-2 _____ ~~Alarm Trip~~

IC-1 $>3\times10^{-11}$ ~~Alarm Trip~~ OK at 3/4 ~~Alarm Trip~~ OK

IC-2 $>3\times10^{-11}$ OK Personnel —

IC-3 Responds JH Alarm —

IC-4 Responds JH Pres. -0.09"

CRM _____

Expt. 148 14.36 liter sphere unreflected.

Selsyn Zero ±.03"

R ~~H~~	Tank (in)	Solution Ht (in)	Solution T°C	
>1	6.42	9.61³ ~~9.58~~	25.5°C	4.725 div/sec.
=1	6.16⁹	9.60⁹ 9.57⁹	25.7	13.745 liters

Expt. 149 Have new pump circulating solution for ~1 hr.

>1	5.18⁹	9.65²	~~9.62~~²	25.75°C ?	5.688 div/sec.
=1	4.95°	9.63¹		25.75°C	

10/20/67 Sample #15 control # 16601

119.3 mg/ml U^{238} } 116.81 gU/l.

spgr. 1.1675

Free $H^+ \rightarrow N$ 0.40

After Expt. 150 drained six liters of solution and added four liters of water.

Sampled drained solution #15.

After Expt 151 added 1 liter of H_2O mixed 1 hr.

After Expt. 152 Sampled Solution #16

added 250cc H_2O and mixed.

10/24/67 Control # 16615

102.9 mg/ml as U^{238} 100.76 gU/l.

spgr. 1.2117 X

H^+ ~~N~~ .036 N

Instrument Check on 1-17-67 Source 10 mc Ra

PM-1 _____ Low Trip ok Alarm Trip ok

PM-2 _____ Alarm Trip _____

IC-1 $> 3 \times 10^{-11}$ Meter Trip ok ($\frac{1}{2}$") Fast Trip ok

IC-2 $> 3 \times 10^{-11}$ Meter Trip ok Personnel ~

IC-3 Responds Calibration JH Alarms ✓

IC-4 Responds Calibration JH Pres. - 0.09

ORM _____ Meter Trip _____ _____

Expr. 150 Try for critical at new concentration Rm Temp 72°F

R	Fuel	Solution	Solution Temp °C	
>1	5.12^2	9.91^2	25°C	2.22 div/sec.
=1	4.64	9.88°	25	~13.69 ℓ.

Expr. 151 try new concentration

>1	4.35	10.68^5	25.7°	8.65 div/sec.
=1	4.12^2	10.65^{-5}	25.7°	~14.21 ℓ.

Expr. 152 try new concentration

>1	4.51^8	11.25^0	25.5°C	3.0 div/dec.
=1	3.90	11.07^8	25.5	

after Expt. 153 take sample #17 add 750cc H_2O to system + mix.

10/24/67 Control # 16615

104.7 mg/mL as U^{238} 102.52 gU/l.

sp.gr. 1.1442

$H^+ \rightarrow$ ~~for~~ N 0.36

Instrument Check on 10-19-67 Source 10 mc Ra

PM-1 _____ Low Trip ok ~~Alarm~~ Trip ok

PM-2 _____ ~~Alarm Trip~~ _____

IC-1 >3×10⁻¹¹ Meter Trip ok Fast Trip ok

IC-2 >3×10⁻¹¹ Meter Trip ok Personnel ✓

IC-3 Responds Calibration SAR Alarms ✓

IC-4 Responds Calibration SAR Press. -0.09"

CRM _____ Meter Trip _____

Expr. 153. Try new Concentration in Sphere.

R	Tud	Solution	Temp.	
>1	5.10	10.75^5	22.4°C	3.24 div/sec.
=1	4.61	10.68^2	22.4°C	

Instrument Check on _____ Source _____

PM-1 _____ Low Trip 10-20-67 Alarm Trip ok

PM-2 _____ ~~Alarm Trip~~ _____

IC-1 >3×10⁻¹¹ Meter Trip ok ~3/4" Fast Trip ok

IC-2 >3×10⁻¹¹ Meter Trip ok Personnel ✓

IC-3 Responds Calibration SAR Alarms ✓

IC-4 Responds Calibration SAR Press -0.09"

SRM _____ Meter Trip _____

Expr. 154 Try new Concentration

>1	6.77	12.48^5	22.2°C	4.787 div/sec.
=1	4.18^2	11.17^0	22.25	
	3.99	11.05^2		
	3.79^5	10.95		
	3.60	10.915		
	3.39	10.885		
	3.17	10.85^8		

Tad	Solution
2.97	10.83[5]
2.80	10.81[0]
2.60	10.78[6]
2.40	10.76[1]
2.20	10.74
2.00	10.71[0]
1.80	10.68[5]
1.60	10.66[0]
1.40	10.64
1.20	10.62
1.00	10.60
.80	10.58
.6	10.56[0]
.4	10.54
.2	10.52[8]
0	10.50[5]
3.60	10.92[8]
3.81	10.97
4.00	11.06[0]
4.20	11.17
4.40	11.28[0]
4.60	11.38
4.80	11.46[5]
5.00	11.58

after Expt. 155 take sample #18

10/31/67 Control No E 16623

101.8 mg/ml as U_3O_8 | also 401.2

normality of free acid. H^+ Normal 0.36

Sp gr. 1.1441 | 1.1392

99.68 gU/l | 99.09 gU/l.

Instrument Check on 10-24-67 Source 10 mc Y

PM-1 _____ Low Trip OK ~~Alarm~~ Trip OK

PM-2 _____ _____ Alarm Trip _____

IC-1 >3x10⁻¹¹ Meter Trip OK Fast Trip OK

IC-2 >3x10⁻¹¹ Meter Trip OK Personnel ✓

IC-3 Responds Calibration JH Alarms ✓

IC-4 Responds Calibration JH Press. -0.09"

CRM _____ Meter Trip _____

Expt. 155

R	Tub	Solution	Temp.	
>1	4.61	11.21	22.2°c	6.5 div/sec
=1	4.00	10.88⁵	22.2⁵	
<1	1.44	10.57⁵	22.2⁵	
>1	4.13	10.95	22.2⁵	3.3 div/sec.
≤1	4.00	10.89⁵	22.2⁵	
=1	4.03	10.92	22.2⁵	

Expt. 156

Have installed 10" dia aluminum annulus cyl.

Selsyn Zero +0.02"

>1	5.00	13.24⁵	23°	3.075 div/sec.
=1	3.92⁵	13.20	23°	

Instrument Check on 10-31-67 Source 10 mc Y

PM-1 _____ Low Trip OK Alarm Trip out
PM-2 _____ [illegible] Trip _____
IC-1 >3×10⁻⁴ [illegible] OK Fast [illegible] OK
IC-2 >3×10⁻¹¹ [illegible] OK Personnel ✓
IC-3 Responds [illegible] JH Alarms ✓
IC-4 Responds [illegible] JH Pres, -0.1"
CRM _____ Meter [illegible] _____

Expr. 157 10" aluminum cyl. unreflected (Repeat 152)

R	Tad	Solution	Temp	
>1	5.774	13.20⁹	21.9°C	3.56 div/sec. Run Temps.
=1	4.68⁵	13.18¹	21.9°C	

10 AM Expr. 158 Placed 1/16"×10×10" sheet of Al. on bottom.

>1	5.60	13.26⁵	22⁺	3.04 div/sec. wrong direction!
=1	4.51	13.23²	22⁺	difference due to solution temps. also possible air in line

2 PM Expr. 159 Same as 158

>1	5.00	13.20⁷	~~1.94 div/sec.~~ air in Tad line abort.
>1	5.45	13.22⁵	1.74 div/sec.
=1	3.77	13.19⁶	

Instrument Check on 11-1-67 Source 10 mc ✓

PM-1 _____ Low Trip OK ~~Alarm~~ Trip Trip on E ~~out~~ not O

PM-2 _____ Alarm Trip _____

IC-1 >3×10⁻¹¹ Meter Trip OK Fast Trip OK

IC-2 >3×10⁻⁴ " " OK Personnel ✓

IC-3 Responds " " OK alarms ✓

IC-4 Responds " " OK Pres. -0.1"

CRM _____ Meter Trip _____

Expr. 160 10" alumin. cyl. with 1/8×10×10" sheet of alum. on bottom.

K	tub	Solution	Temp.	
>1	7.50	13.20[6]	22.2	Rm. 2.96 div/dec.
=1	6.37	13.18[9]	22.2	

Expt[16] drained to 12" ht. and remove 1/8"-thick sheet from bottom.

>1	2.73	13.19[5]	22.2.	2.56 div/dec.
=1	1.57[2]	13.17	22.2	

Expts. 162 - 167

To make changes the solution was drained to ~12" to minimize heating solution by pump.

Instrument Check on 11-2-67 Source Lone #

PM-1 _____ Low Trip OK Alarm Trip ~~OK~~ does not trip on D.

PM-2 _____ ~~Alarm Trip~~

IC-1 $>3\times10^{-4}$ Meter Trip OK Fast Trip OK

IC-2 $>3\times10^{-4}$ Meter Trip OK

IC-3 Responds Calibration JH

IC-4 Responds Calibration JH

CRM _____ Meter Trip _____

Expr. 162

Placed sheet of Cd .023"×10×10" on bottom of cyl.

	R	Tsd	Sdwyn	Temp.	
$8\frac{52}{A}$	>1	11.10	13.16^5	22.03°C	Rm Temp. 2.725 div/sec.
	=1	9.90	13.14^4	22.03°C	
	<1	0	12.84^5		

Expr. 163 Removed Cd-sheet - bare cyl.

$9\frac{10}{A}$	>1	8.60	13.18	22.03	3.06 div/sec.
	=1	7.50	13.16 (13.15)	"	

Expr. 164 Placed sheet of 1/8"×10×10" Aluminum.

$9\frac{26}{A}$	>1	3.75	13.14^4	22.03	4.65 div/sec.
	=1	2.91	13.13^0	22.03	

Instrument Check on 11-3-67 Source 10 mc Ra

PM-1 _____ Low Trip ok Alarm Trip no

PM-2 _____ _____ Alarm Trip _____

IC-1 $> 3 \times 10^{-11}$ Meter Trip ok Fast Trip ok

IC-2 $> 3 \times 10^{-11}$ Meter Trip ok Personnel ✓

IC-3 Responds Calibration ok Alarms ✓

IC-4 Responds Calibration ok Press. - 0.1"

GRM _____ Meter Trip _____ _____

Selsyn Zero is +.04

Expr. 165 Have installed 15" dia alum. vessel (cyl.) with 1/8 x 15 x 15" sheet of Aluminum on bottom.

k	Tub	Solution	Temp.	
>1	2.35	6.92	21.6°C (Rm. Temp)	3.78 div/dec
=1	1.34⁵	6.91⁵	21.6C	

Drained to 6.79" of solution and removed 1/8" thick sheet of al from bottom of cylinder.

Expr. 166 Bare 15" dia.

>1	11.54⁵	6.97⁵	21.6	3.64 div/dec.
=1	11.10	6.97 (6.93)	"	

Drained to 6.79" of solution and placed sheet of aluminum on bottom 1/16 x 15 x 15.

Expr. 167 bottom refl'd (al) 15" dia cyl.

>1	10.50	6.96	21.6	4.475 div/dec.
=1	10.12⁵	6.95⁵	21.6	

After Expt. 168 Drained 6 liters of solution and added 5 liters of H_2O. mixed to 13° por Est conc. now 83 20/2

Instrument Check on 11-13-67 Source 10 mc Ra

PM-1 _____ Low Trip OK ~~Alarm~~ Trip OK

PM-2 _____ _____ Alarm Trip _____

IC-1 $>3\times10^{-11}$ Meter Trip OK Fast Trip OK

IC-2 $>3\times10^{-11}$ Meter Trip OK Personnel OK

IC-3 Responds Calibration TT Alarms OK

IC-4 Responds Calibration TT Pres. -0.1"

CRM _____ Meter Trip _____ _____

Zero +.00"

Expr. 168 16.438 liter sphere

	R	Tad	~~Saturation~~	Temp.	
	>1	6.80^5	10.54	21.6°C	
~11 Am	=1	6.38	10.53^5	21.6°C	15.82 ℓ

Expr. 169 Try new concentration

$2^{30}/_{P}$	>1	33.00	10.19"	29.9°C	Zero?
	=1	32.63	10.19"		
	<<1	—	-.6	for zero	∴ R=1 at 10.79"

16.045 ℓ.

After Expr. 170 ① Drained 2 liters of solution

② took sample # ~~19~~ A

③ added 2 liters of H_2O est. Conc. now ~75 mg/ml.

11/15/65 Sample # E 16682

85.02 mg/gm

sp gr. = 1.1186

After Expr. 171 ① took sample 20

② added 1 liter of water + mixed.

Sample 20A: 81.34 mg/ml as U^{238} sp gr. 1.1122

⇒ 79.64 gU/l.

After Expr. 172 added 500 cc of H_2O mixed.

Instrument Check on 11-14-67 Source 10 mc Ra

PM-1 _____ Low Trip ok ~~Alarm~~ Trip ok

PM-2 _____ ~~Alarm~~ Trip _____

IC-1 $> 3 \times 10^{-11}$ Meter Trip ok Fast Trip ok

IC-2 $> 3 \times 10^{-11}$ Meter Trip ok Personnel ✓

IC-3 Responds Calibration ok Alarms ✓

IC-4 Responds Calibration ok Pres. -0.1"

CRM _____ Meter Trip _____

Expt 170

Check zero 0.00" ~ 83 g/l.

k	Tad	Solution	Temp.
>1	7.50	10.62^5	22.5°C
=1	7.05	10.62	22.5°C.

Expt. 171 Try new concentration, ~ 75 g/l

>1	8.54	11.10	25.8°C
=1	8.23	11.10^6	25.8

Expt. 172 try new concentration ~ 73 g/l

>1	8.57	11.58	29.8°C
=1	8.02	11.52^4	29.75°C

After Expt. 173 add 1 liter H_2O & mix.

Instrument Check on 11-15-67 Source 10 mc Ra

PM-1		Low Trip O K	Alarm Trip O K
PM-2			~~Alarm Trip~~
[illegible]	$>3\times10^{-11}$	Meter Trip O K	Test Trip O K
[illegible]	$>3\times10^{-11}$	[illegible] O K	Personnel ✓
[illegible]	Responds	[illegible]	Alarms ✓
[illegible]	Responds	[illegible]	Press -0.1"
PM		Meter Trip	

Expt. 193 Try new concentration

R	Tcd	Solution	Temp.
>1	10.85^3	11.36	21.70°C
=1	10.28	11.30'	21.70°C

Expt. 174 Try new concentration

R<	1322	16.27	24.75°C

After Expt. 175 added 400 cc of solution ~160 gm/l.

After Expt. 176 added 100 cc of solution ~160 gm/l

Sample 21 A : 76.17 mg/me as U^{238} } ⇒ 74.58 gm/l.
sp. gr. 1.1063

Instrument Check on 11-16-67 Source 10 mc

PM-1 _____ Low Trip OK ~~Alarm~~ Trip OK

PM-2 _____ Alarm Trip _____

IC-1 $>3\times10^{-11}$ Meter Trip OK Fast Trip OK

IC-2 $>3\times10^{-11}$ Meter Trip OK Personnel

IC-3 Responds Calibration JH Alarms ✓

IC-4 Responds Calibration JH Pres. -ok"

CRM _____ Meter Trip _____

Expt. 175 Try at lower temp.

k	Tad	Solution	Temp.
≤1	14.82^5	15.86^4	21.7°C

Expt. 176

≤1	12.97	13.35	24.3°C

Instrument Check on 11-17-67 Source 10 mc

PM-1 _____ Low Trip OK ~~Alarm~~ Trip OK

PM-2 _____ Alarm Trip _____

IC-1 $>3\times10^{-11}$ Meter Trip _____ Fast Trip _____

IC-2 $>3\times10^{-11}$ Meter Trip OK Personnel ✓

IC-3 Responds Calibration JH Alarms ✓

IC-4 Responds Calibration JH Pres -0.1"

CRM _____ Meter Trip _____

Expt. 177

>1	9.05	12.93	21.0°C	
=1	6.57	11.40	21.1°C	Zero?

Check zero and find 999.21 of 0.00
-1.79

Instrument Check on 11-20-67 Source 10 mc Y

PM-1 _____ Low Trip OK Alarm Trip OK

PM-2 _____ _____ Alarm Trip _____

IC-1 >3x10⁻⁴ Meter Trip OK 0" ~~side~~ East Trip OK 0"

IC-2 >3x10⁻⁴ Meter Trip OK ~1" top Personnel ✓

IC-3 Responds Calibration OK Alarms ✓

IC-4 Responds Calibration OK Press -0.1"

CRM _____ Meter Trip _____ _____

Zero is -.02

Expr. 178 15" aluminum annulus cyl.

with 1/8" alum. plate on bottom.

R*	Tap	Solution	Temp.
>1	2.83	7.56⁴	21.3°C
=1	2.44 some air in line	7.55⁶	21.3 est.
<1	0.0	7.43	drained to remove

1/8" alum. from bottom.

Expr. 179 bare cylinder

>1	11.34	7.61	21.4
=1	11.06⁵	7.60⁵ (7.620)	21.4 est

Drain to 7.43" and

Expr. 180 Place 1/16 x 15 x 15" sheet of Al. on bottom

11 AM

>1	10.42	7.59²	21.5°
=1	10.12	7.59	21.6°C est.

Expt. 181 Installed 10" Aluminum cylinder with 4/8 × 10 × 10" al-sheet on bottom

Zero +.04"

	k	Tank	solution	Temp.	
2 3/4	>1	5.30	17.19	21.7	Rm temp.
	=1	3.81⁴	17.17⁸	21.7	
	<1	0	17.07⁵	—	

Expt. 182 Drained to 16.71" Removed 4/8" al sheet.

10" Bare.

<1	0	16.70	21.8°	
>1	17.00	17.24	21.8°	
=1	14.95²	17.22 (17.18)	21.8	
<0	0	16.7		

Expt. 183 1/16 al sheet.

>1	18.81 ~~[illegible]~~	17.20	21.9°
=1	14.54	17.19⁵	

Expt. 184 Installed 14 5/8" dia sphere.

$x\ 80\ g/\ell = (x+2)\ 75\ g/\ell \Rightarrow x = 30$

desire 47 g/ℓ ∴ $20(75\ g/\ell) + 12\ H_2O = 32 \times 47\ g/\ell$.

After Expt. 184 Drained ~12 liters of solution and added 12 liters of H_2O. mix!

After Expt. 185 ① Took Sample #22

② Drained 4 liters of solution

③ added 4 liters of H_2O.

Sample 22 Control # E 16745 12/11/67

52.73 mg U/ml as U^{238}

sp gr. 1.0746

Sphere

Instrument Check on 11-28-67 Source 10 mc ✓

PM-1 _____ Low Trip OK Alarm ~~Trip~~ Trip OK

PM-2 _____ _____ ~~Alarm~~ Trip _____

IC-1 $>3\times10^{-11}$ Meter Trip OK ~0" Fast Trip OK

IC-2 $>3\times10^{-11}$ Meter Trip OK ~1" Personnel ✓

IC-3 Responds Calibration ~~OK~~ Alarms ✓

IC-4 Responds Calibration ~~OK~~ Pres. -0.1"

CRM _____ Meter Trip _____

Selsyn Zero +.035

Expt. 184 Concentration 74.58 g/l. Rm Temp 21.1°C

k	Tank	Solution	Temp
>1	3.04^5	9.52^5	21.9°C
=1	2.45^4	9.52^0	21.9°C

Expt. 185 Try new Concentration ~47 g/l.

>1	3.81	11.46	30.5°C
=1	2.85	11.45^0	30.5°C

After Expr. 186 add 1 liter of H_2O + mix

~33 liters in app.

After Expr. 187 add 400 cc of H_2O + mix

After Expr. 188 add 200 cc of H_2O + mix.

Instrument Check on 11-29-67 Source 10 mc 8

PM-1		Low Trip	OK	~~Alarm~~ Trip	OK
PM-2				~~Alarm~~ Trip	
IC-1	$>3\times10^{-11}$	Meter Trip	OK	0" Fast Trip	OK
IC-2	$>3\times10^{-11}$	Meter Trip	OK	1"	Personnel ✓
IC-3	Responds	Calibration	FH		Alarms ✓
IC-4	Responds	Calibration	FH		Pres -0.1"
CRM		Meter Trip			

Expt. 186 New concentration in $14\frac{5}{8}$" sphere. ~241 g/l

R	Tad.	Solution	Temp.
>1	3.72	12.71^8	21.8°C
=1	2.51^5	12.71^5	21.8°

Expt. 187 try new concentration ~40 g/l.

>1	3.71	13.26	23.8°C
=1	2.78^4	13.25^9	23.8°C

Instrument Check on 11-30-67 Source 10 mc 8

PM-1		Low Trip	OK	~~Alarm~~ Trip	OK
PM-2				~~Alarm~~ Trip	
IC-1	$>3\times10^{-11}$	Meter Trip	OK	0" Fast Trip	OK
IC-2	$>3\times10^{-11}$	Meter Trip	OK	1"	Personnel ✓
IC-3	Responds	Calibration	FH		alarms ✓
IC-4	Responds	Calibration	FH		Pres - 0.1"
CRM		Meter Trip			

Expt. 188

>1	2.625	13.50	22°C
=1	1.32	13.44	22°C

Instrument Check on 12-4-67 Source 10 mcr

~~PM~~-1		Low Trip	OK	Alarm Trip OK	0"
~~PM~~-2				Alarm Trip	
~~IC~~-1	$>3\times10^{-11}$	Meter Trip	OK	0" Fast Trip OK	
~~IC~~-2	$>3\times10^{-11}$	Meter Trip	OK	1"	Personnel ✓
~~IC~~-3	Out	Calibration			alarms ✓
~~IC~~-4	Responds	Calibration	JH		Pres. -0.1"
~~EM~~		Meter Trip			

Expt. 189 new Concentration. Rm Temp 16°C

R	Tab	Solution	Temp.
>1	5.09^2	13.47	17.6
=1	3.855	13.45^2	17.6
<1	2.88	13.40	17.6

Expt. 190 Temp Change

>1	5.50	13.29	19.8°C	?
=1	4.56^7	13.28^5	19.8°C	?
<1	3.40	13.25	19.8°C	13.40

Check zero and find -.015

Set zero at +.065

after Expt. 193 add 300 cc H_2O + mix

Instrument Check on 12-5-67 Source 10 mc Ra

PM-1		Low Trip	OK	Alarm Trip	OK
PM-2				Alarm Trip	
IC-1	$>3\times10^{-11}$	Meter Trip	OK	0" Fast Trip	OK
IC-2	$\geq 3\times10^{-11}$	Meter Trip	OK	1"	Personnel ✓
IC-3	Out	Calibration			Alarms ✓
IC-4	Responds	Calibration	JH		Pres. -0.1"
CRM		Meter Trip			

Expt. 191 Temp change

R	Tad	Solution	Temp.
>1	5.29"	13.489	20.6°C
≥1	4.28	13.48^5	20.7°C

Expt. 192 Temp change

>1	5.82	13.68^0	25°C
=1	4.83	13.64	25°C

Expt. 193 Temp. change.

>1	5.99	13.80^9	28.5°	sphere full + solution in tube.
=1	4.70	13.74^5	28.5	
<1	3.88	13.68		
<1	2.93	13.61		
<1	1.89	13.52		
<1	.176	1344^5		
≥1	4.70	13.70		
1	4.67	13.69^+		

After Expt. 194 took sample 23A+B

Sample 23A Control # E 16745 12/11/67

45558 mg U/ml as U^{238}

Sp gr. = 1.0559

44.6 84/2

Instrument Check on 12-6-67 Source 10 mc Ra

PM-1		Low Trip	OK	Alarm Trip	OK
PM-2				Alarm Trip	
IC-1	$>3\times10^{-4}$	Meter Trip	OK	Fast Trip	OK
IC-2	$>3\times10^{-11}$	Meter [illegible]	OK	11'	Personnel
IC-3	Out	Calibration			Alarm ✓
IC-4	Responds	Calibration	OK		Pressure -0.1"
CRM		Meter Trip			

Expr. 194 New Concentration. Rm. Temp 20.9°C

R	Tad	Solution	Temp.
>1	4.71	13.83^5	21.3°C
=1	3.51	13.79	21.3°C
<1	3.0	13.75^5	
	2.75	13.72^4	
	2.47	13.71	
	1.99	13.67	
	1.51	13.63^5	
	1.26	13.61	
	.99	13.60	
	.5	13.56	
	0	13.52	
	2.27	13.63	
	2.48	13.64	
	2.75	13.66	
	3.0	13.68^5	
	3.29	13.71	
	3.51	13.73	

Tad	Solution	
4.00	13.77	
4.52	13.82	
4.73	13.85	period
3.51	13.80^5	R=1

1-17-68 Drained Storage system.

relays zero = 0"

Expt. 195 Installed nominal 10" annular cylinder.
Bottom reflector plate of aluminum 1/8" thick (10×10)

k	Tank	solution	Temp.
<1	39.18	25.01	21°C

exhausted supplies of solution -

Instrument Check on 12-7-67 Source 10 mc Ra

PM-1 _____ Low Trip OK Alarm Trip OK
PM-2 _____ ~~Alarm Trip~~
IC-1 > 3×10⁻⁶ Meter Trip OK 0⁴ Fast Trip OK
IC-2 > 3×10⁻¹¹ Meter Trip OK 1⁴ Personnel ✓
IC-3 out Calibration _____ Alarms ✓
IC-4 Responds Calibration JH Pres -0.1"
CRM _____ Meter Trip _____

Expt. 196 Installed 15" annular cylinder | Zero -0.03

k	Tank	solution	Temp.	
>1	5.50⁵	10.32⁵	21.3°C	Reflected on bottom by 1/8 × 15 × 15" al.
=1	4.26	10.31		
<1	0.0	10.23	drained to remove al reflector	

Expt. 197 Installed 4/16 × 15 × 15" bottom reflector

>1	11.62	10.34	21.3°C
=1	10.61	10.33⁵	
<1	0.0		drained to remove al. refl.

Expt. 198 Unreflected 15"

>1	12.11³	10.35³	21.3°C
=1	11.56	10.35 (10.38)	

1-17-68 to 1-25-68 Installed Water reflection system

1/25/68 Have put ~ 19 l. of Solution in Storage system at 204 gU/l.

After Expr. 199 changed chamber on IC-2 to submersible type.

After Expr. 200 added 1.5 liters of water and mixed.

Reactor Power Off

9:58:38
(26)

Water Reflected Series

8.62-in dia sphere 5.840 liters.

Instrument Check on 1-15-68 Source 10 mc Y

PM-1		Low Trip	OK	~~Alarm~~ Trip	OK
PM-2				~~Alarm Trip~~	
IC-1	$>3\times10^{-4}$	Meter Trip	OK	Fast Trip	OK
IC-2	$>3\times10^{-4}$	Meter Trip	OK	Personnel	✓
IC-3	Responds	Calibration	JH	Alarms	✓
IC-4	Responds	Calibration	JH	Pres	−0.1"
CRM		Meter Trip			

Expt. 199 Selsyn reads 0.0 H_2O ~ 8" above sphere.

k	tad	Solution	temp.	
>1	18.47	8.80	21.6°C	73 sec period. ρ ~ 154
=1	19.30	8.915	21.6°	? Zero not right check again.

Instrument Check on 1-26-68 Source 10 mc Y

PM-1		Low Trip	OK	~~Alarm~~ Trip	OK
PM-2				~~Alarm Trip~~	
IC-1	$>10\times10^{-4}$	Meter Trip	OK	Fast Trip	OK
IC-2	$>10\times10^{-4}$	Meter Trip	OK	Personnel	✓
IC-3	Responds	Calibration	JH	Alarms	✓
IC-4	Responds	Calibration	JH	Pres	−0.1"
CRM		Meter Trip			

Expt. 200

k	tad	Solution	Temp.	
>1	5.19	7.595	21.9°C	18.2 sec period. ρ ~ 33.54
=1	4.79	7.595	21.9°C	

Expt. 201

Instrument Check on 1-27-68 Source 10 mc Ra

PM-1 _____ Low Trip OK ~~Alarm~~ Trip OK

PM-2 _____ _____ Alarm Trip _____

IC-1 > 3 x 10⁻¹¹ Meter Trip _____ OK Fast Trip OK

IC-2 > 3 x 10⁻¹¹ Meter Trip OK Personnel ✓

IC-3 Responds Calibration JH Alarms ✓

IC-4 Responds Calibration JH Pres -0.1"

CRM _____ Meter Trip _____ _____

Selsyn zero + .05"

Expt. 201 Check new concentration.

K	Fuel	Solution	Temp	H_2O
<1	39.18	8.95"	23.2°C	Full.

Expt. 202 Repeat #201.

>1	4.0 sec	18.30	8.00	23.25	53.8 sec period Q = 197
=1		18.06	8.00	23.25	

Instrument Check on 1-30-68 Source 10 mc Ra

PM-1 _____ Low Trip OK ~~Alarm~~ Trip OK

PM-2 _____ _____ ~~Alarm~~ Trip _____

IC-1 > 3 x 10⁻¹¹ Meter Trip OK Fast Trip OK

IC-2 > 3 x 10⁻¹¹ Meter Trip OK Personnel ✓

IC-3 Responds Calibration JH Alarms ✓

IC-4 Responds Calibration JH Pres -0.1"

CRM _____ Meter Trip _____ _____

Expt. 203 Check excess reactivity in sphere. Selsyn zero = 0.0

>1	4.7	6.63⁵	7.995	22.8°C	40.5 sec period Q = 204 Full Water reflector.
=1		6.40	7.992	22.8°C	
<1		5.40	7.945		

Drain to check zero selsyn reads 0.72

Control # E 16865 2/1/68

Sample # 24 171.2 mg/ml. as U^{238}

$171.2 \frac{253.08}{238.04} = 167.63$ g/l.

Reflector Water sample Reg. # G84535 1/31/68

7.99 ppm U in ~600 liters.

3/20/68

From E.I. Wyatt Control # 46141

5.6×10^{11} fissions/ml. at 10:00 AM 1-30-68

based on ^{99}Mo at 4.8% fission yield

and ^{92}Sr at 6.5% " ".

Exp. 207 Repeat 203. Set selsyn on 0.0

k	Tad	Solution	Temp.	
				40.8 sec period
>1	4.93	7.31	22.8°C	ρ ~ 21.84
<1	drain to	~7.2	system did not respond to Tad motion. Air in Tad line.	
>1	prompt crit.		10:01	

2-15-68 Remarks.

To minimize possibility of air entering the system we have relocated the solution feed valve to be below the uppermost point of the pump by-pass line. (see page 27)

Sample taken of reflector water shows 10^{-8} ppm uranium. Clean sheet of aluminum immersed in water, allowed to dry, gave no ~~wipe~~ detectible contamination on wipe. (Water sample 2 on Req. No. 684536 returned 2/13/68) Reflector water system contains ~165 gals of dem. water.

Added ~17 liters of $UO_2(NO_3)_2$ to system; concentration ~200 γU/l. Storage system reads 900 mr/hr (cutie pie) at surfaces

By-pass open 2 turns When open 2¼ turns will not pump against 2" in sphere.

Periods for Expr. 205:

IC-3	located in Paraffin	5.012 div/sec	T = 108.91 sec.	10.9	1.91 ¢/cc
IC-4	located in H_2O	4.175 div/sec.	T = 90.72 sec	12.8	2.25 ¢/cc

Power off selsyn reads 9897 6/7

8.622-in-dia Sphere

Instrument Check on 2-15-68 Source 10 mc r

PM-1 ______ Low Trip OK ______ Alarm Trip OK

PM-2 ______ [illegible] ______ Trip ______

IC-1 >3×10⁻⁴ ______ Meter Trip [illegible] OK [illegible] Trip OK

IC-2 >3×10⁻⁴ ______ [illegible] OK ______ Personnel ✓

IC-3 Responds ______ [illegible] JH ______ Alarms OK

IC-4 Responds ______ [illegible] JH ______ Press −0.11"

CRM ______ Meter Trip ______

Expr. 205

10 AM Instruments respond as usual – each of IC1, IC2 & PM-1 scram system. Solution pumped into the sphere when unreflected to check sllsyn reading at full. Have stopped several times during filling, turned off pump ~~and~~ for a short period and restarted to see if air ~~would~~ appear in the system – result is negative. Calibration of tad displacement with solution height shows sphere is full when selsyn reads 8.62". System checked for leaks – negative.

Drained solution – pump reflector water.

IC-2 and IC4 are located in reflector tank.

All water in ~~tank~~ gives ~7 7/8" above top of sphere corresponding to slight glass reading of 67.5 cm.

	k	Tad	solution	temp.	
2:25 pm					
3:25 PM	>1	25.23	7.075 / 7.08	22.2°C	5.23 l.
	=1	25.08²	7.075	22.2°	

$(\Delta V)_{tad} \sim 5.7\,cc \Rightarrow 2.25\ ¢/cc$

$2.25\ ¢/cc \times 50\ cc/in \times 4.3\ in/min \times \frac{1}{60}\ \frac{min}{sec} \sim 8\ ¢/sec.$

2/16/68

Have interchange IC-3 and IC-4

IC-3 now in H_2O reflector tank.

IC-4 in paraffin on platform.

Tad adds 38 cc of solution per ~~in~~ displacement, when sphere is full.

After Expr. 206 took sample #25 ask for { spec / sp. gr. / mg/ml }

added 1.50 liters of water to system and mixed.

After expr. 207 added 1 liters of H_2O + mixed.

Sample 25: (Expr. 206) Control No. E 16912 2/19/68

204.5 mg/ml as U^{238} → 200.24 gU/l.

sp. gr. 1.2796

spec. to come

8.622-in ID sphere

selsyn reads 98.9% (power on).

Instrument Check on 2-16-68 Source 10 mc Y

PM-1 _____ Low Trip OK Alarm Trip OK

PM-2 _____ Alarm Trip _____

IC-1 >3x10⁻¹¹ Meter Trip OK Fast Trip OK

IC-2 >3x10⁻¹¹ Meter Trip OK Personnel ✓

IC-3 Responds Calibration OK Alarms ✓

IC-4 Responds Calibration OK Pres -0.11"

CRM _____ Meter Trip _____

Expt. 206 Repeat #205 water height 68.5 cm. (~8" above sphere)

	R	Tad	Solution	Temp.	
9 2/5 A	>1	14.11	7.06⁵	23.3°	
~2009/l	=1	13.95	7.07	23.3°	vol = 5.225 l.
V~17	periods: IC-3 : 3.625 div/sec ⇒ T = 78.77 sec			14.2 ¢	2.3¢/cc
	IC-4 : 4.050 div/sec ⇒ T = 88.01 sec.			13 ¢	2.14
	$(\Delta V)_{Tad}$ = 6.08 cc ⇒ 2.3¢/cc				

Expt. 207 Try new concentration.

1 1/2 PM	>1	13.29⁵	7.22 - 7.23⁵ (time cw, during period)	26.8°C	
~183.6	=1	13.14	7.23⁴	26.25°C	vol = 5.330
V~18.5	periods: IC-3	4.262 div/sec ⇒ T = 92.61 sec		~12.5 ¢	2.12¢/cc
	IC-4	4.587 div/sec ⇒ T = 99.68 sec.		~11.8 ¢	2.00¢/cc
	$(\Delta V)_{Tad}$ = 5.890 cc				

2/14/68 Remark on Press differential: Have cleaned return air ducts grids - note pressure in room increase from -0.11" to 0.07" of H_2O.

#26 Control No. E 16918

194.5 gU^{238}/l → 190.45 gU/l

sp-gr. 1.2529

After Expr. 208 took sample 26.

added 1.5 liters of H_2O and mix.

Periods Expr. 208 IC-3 (H_2O) : 6.567 div/sec.

IC-4 ($C_{25}H_{52}$): 6.734 div/sec.

Periods Expr. 209 Solution cooled during period result not useable.

After expr. 209 added 1.5 liters & mix.

After Expr 210 took sample 27

added 1 liter H_2O & mix.

#27 Control No. E 16918

197.4 mgU^{238}/ml → 173.70 gU/l.

sp gr. 1.2357 (23.8°C)

8.622" ID sphere water Reflected.

Instrument Check On 2-15-68 Source 10 mc

PM-1		Low Trip	OK	Alarm Trip	OK
PM-2				Alarm Trip	
IC-1	$>3\times10^{-11}$	Meter Trip	OK (contact)	Fast Trip	OK
IC-2	$>3\times10^{-11}$	Meter Trip	OK	Personnel	
IC-3	Responds	Calibration	OK	alarm	OK
IC-4	Responds	Calibration	OK	Press.	-.07
CRM		Meter Trip			

9^{A4} Expr. 208. New Concentration; water height in tank 67.5 cm.

		k	Tab	Solution	Temp.	
ρ ~ 174.3						
V ~ 19.5	9^{21}	>1	13.43	$7.31^5 - 7.32^5$	25°C	
	9^{32}	=1	13.32	7.32^5	25°C	5.389 liters

11^{A4} Expr. 209 New Concentration; water height in tank 67.5 cm.

ρ ~ 161.9	$11^{16}/_{A}$	>1	12.87	$7.49 - 7.49^4$	29.5°C	
V ~ 21	$11^{30}/_{A}$	=1	12.73^8	7.49^5	28.1°C	5.483 l.

1^{C5} Expr 210 New concentration; water height in tank 67.5

ρ = 151.1	$1^{30}/_{P}$	k>1	13.30	7.69^2 -	29.95°C	
V ~ 22.5	1^{C5}	k=1	13.15	7.70^2	28.75°C	5.578 l.

periods: IC-3 (H_2O) ~ 4.4 div/sec.

IC-3 ($C_{25}H_{52}$) ~ 4.575 div/sec.

After expn. 211 added 1.5 liters of water + mixed.

Est. vol in system 25 l → ρ ~ 136

After Expn. 212 added 875 cc of water + mixed.

~V 25.875 l. ~ρ = 130 g/l.

After Expn 213 added 360 cc H_2O + mixed.

V ~ 26.235 ρ ~ 129.6

Instrument Check on 2-20-68 Source 10 mc Ra

PM-1 _____ Low Trip OK Alarm Trip OK

PM-2 _____ ~~Alarm Trip~~

IC-1 >3x10⁻¹¹ Meter Trip OK Fast Trip OK

IC-2 >3x10⁻¹¹ Meter Trip OK Personnel

IC-3 Responds Calibration JH Alarms OK

IC-4 Responds Calibration JH Press -0.07

~~RM~~ _____ Meter Trip _____

Air Temp at reactor level 34°C

9 06/Ra1 Expr. 211 New Concentration ; water level in Reflector tank 67.5

~~9 30/A~~

9 30/A | k | Tad | solution | Temp.

9 30/A	>1	15.30⁵	7.82⁵-7.83²	26.5°C	
ρ~144.7	=1	15.15⁵	7.83⁵	26.5°C	5.633 ℓ.
V~23.5					
	periods:	IC-3 (H_2O) 6.325 div/sec			
		IC-4 ($C_{25}H_{52}$) 6.725 div/sec			
	Expr. 212				
11 48/A	k > 1	17.92	8.13	30.25	
ρ~136	k = 1	17.76	8.13⁴	29.60°	5.742 ℓ.

2 15/P Expr 213 New Concentration

ρ~130 2 34/P	k>1	15.84⁵	8.37-8.37⁵	30.5°C	
	k=1	15.69	8.37⁵	29.9°C	5.804

After Exp. 214 Add 300cc H_2O and mix

V = 26.535 ℄ ~ 128.1

Exp. 215 Periods

Pos. Period	IC-3	7.8 div/sec	169.5 sec	7.84
	IC-4	8.3 div/sec	180.4 sec	7.2
Neg Period	IC-3	20.5 div/sec	-445.5 sec	-3.6
	IC-4	21.6 div/sec	-469.4 sec	-3.4

Instrument Check on 2-21-68 Source 10 mc Ra

PM-1 Low Trip OK High Trip OK

PM-2

IC-1 $>3\times10^{-4}$ Meter Trip OK Test Trip OK

IC-2 $>3\times10^{-4}$ Meter Trip OK Personnel

IC-3 Responds Calibration JH Alarm ✓

IC-4 Responds Calibration JH Press -0.07"

CRM Meter Trip

Expr. 214 New Concentration Rm. Temp. at platform 35.5°C
water level in reflector tank 68.2 cm.

	k	Tud	solution	Temp.	
8 45 A					
907	>1	21.21⁴	8.44² 8449	27.3°C	
915 A	=1	21.11	8.44⁹	27.4°C	5.819 l.
11 15	Expr. 215	New Conc.		Water level 67.9	
11 26	<1	16.62	8.76	30.6°C	
11 28	<1	16.75	8.84	30.5	
11 33	≥1	16.87⁵	8.92	30.1	
11 34	>1	16.87⁵	8.92	29.8	pos. period
11 38	~1	16.70	8.82	29.7	
11 39	~1	16.66	8.80	29.7	
11 40	~1	16.60	8.77	29.6	
11 42	~1	16.57	8.74⁸ ΔV = 74 cm³	29.5	
11 44	<1	16.40	8.62	29.4	neg. Period.
11 53	≤1	16.40	8.62³	29.1	5.840 l.

Summary of solution Concentrations for Expts. 208-218

Total mass 3.6605 kg U in system

Expt. No.	Vol (ℓ)	g U/ℓ	sp. gr.	H:U^{233}
206	18.281	200.24	1.2448	126.05
207	19.781	185.05	1.2631	136.92
208	20.781	176.15	1.2504	144.16
209	22.281	164.29	1.2331	154.97
210	23.781	153.92	1.2178	165.76
211	24.781	147.71	1.2086	172.94
212	26.281	139.28	1.1964	183.76
213	27.156	134.75	1.1898	190.23
214	27.516	133.03	1.1877	192.74
215-218	27.816	131.6	1.1850	195.58

$$H:U^{233} = \frac{233}{.975(.975)}\left\{\frac{\text{soln density}}{\text{U density}} - 1.66929\right\}$$

(.975) 8.775

22.0547

These are in error

4/18/46

Instrument Check on 2-22-68 Source Cornell

PM-1 _____ Low Trip ok Alarm Trip ok

PM-2 _____ _____ Alarm Trip _____

IC-1 $>3\times10^{-11}$ Meter Trip ok Test Trip ok

IC-2 $>3\times10^{-11}$ Meter Trip ok _____

IC-3 Responds Calibration _____ _____

IC-4 Responds Calibration _____ _____

CRM _____ Meter Trip _____ _____

Rm Temp at Platform 29°C

Expr. 216 Repeat 215 new Temp. Water level in reflector tunk 68.5cm.

	k	Tad	Solution	Temp.	
8:30					
8:49 AM	>1	14.82[5]	8.49[5]-850	25.3°	(R~1.00053 at full)
	=1	14.82[5] ~3.8cc	8.49[6]	25.7°C	5.874 l.

Period IC-3 non linear.

IC-4 9 div/sec 195.6 sec.

9:39	Expr. 217	Have run pump ~30 min. to raise soln Temp.			
9:57	>1	14.83	8.63	27.0°C	(R~1.00006 full)
	=1	14.59 .24 ΔV=9.12	8.52	27.0°C	sphere has 1.1 cc void
10:4	<1	14.40	8.494	27.0°C	" " 16 cc void
	<<1	.19 ΔV=7.22	—	26.8°C	

Keep in A-3 +.3

Periods	IC-3	6.1 div/sec.	132.5 sec	ρ~10.7
	IC-4	6.6 div/sec	143.4 sec	9.9
	IC-3	-8.1 div/sec	-176.0 sec	-14.60
	IC-4	-9.525 div/sec	-206.97 sec.	-11.54

2/27/68

after Expr. 218 took sample #28

Control No. E 16929

134.4 $mgU^{238}/ml.$ → 131.6 gU/ℓ

sp. gr. = 1.1890 $H/U^{233} = 195.5$

$m_c = .7685$ kg U

2-27-68 Removed 8.62 ID sphere and installed 15" annular cylinder.

Estimated crit. ht of solution

$$\frac{\pi^2}{(10.75+5.5)^2} = \frac{J_0^2}{(19.05+5.5)^2} + \frac{\pi^2}{(h+4)^2}$$

$$(h+4)^2 = \frac{\pi^2}{.03647 - .004133} = 305.12812 \text{ cm}^2$$

$$h + 4 = 17.4694 \text{ cm}$$

$$h = 13.47 \text{ cm} = 5.303 \text{ in.}$$

Expr. 219 IC-3 and IC-4 outside reflector tanks

If styrofoam is removed from bottom of vessel then we have

$$h + 7.5 = 17.4694$$

$$h = 9.9694 \text{ cm} = 3.92496 \text{ in.}$$

Area "5" = 0.1493 cm²

Expt. 218 Change temp. H_2O 68.5

	k	$T_{1/2}\theta$	Solution Temp.		
20 2/PM					
2 13/PM	>1	14.40	8.51⁵	25.8°C	$k = 1.0004^t$ for fast
	=1	14.27	8.51⁵	26.0	

Instrument Check on 2-27-68 Source cobalt

PM-1 _____ Low Trip OK ~~Alarm~~ Trip OK

PM-2 _____ ~~Alarm~~ Trip _____

IC-1 $>3\times10^{-11}$ Meter Trip OK Fast Trip OK

IC-2 $>3\times10^{-11}$ Meter Trip OK Personnel ✓

IC-3 Responds Calibration FH alarms ✓

IC-4 Responds Calibration FH Press - 8.07"

CRM _____ Meter Trip _____

Expt. 219 15" annular cyl. with styrofoam on bottom.
Zero - .03 and lateral reflector of H_2O.

	k	$T_{1/2}\theta$	Solution 15 1/PM	Water Lt.	Temp.	ht of H_2O above soln.
1 45/PM	>1	14.93	5.31 - 5.31⁵	31.5 cm.	25°C	16.7 cm
	=1	14.74⁵	5.31²	31.5 cm.		16.7 cm
	=1	11.01	5.27	43.0		28.31
2 31/PM	=1	13.29⁵	5.29⁶ 5.30	35.3 cm		20.5

Water level at bottom of Cylinder 1.3 cm.

Water thickness on bottom 24.16 cm.

Instrument Check on 2-28-68 Source corner

PM-1 _____ Low Trip OK Alarm Trip ok

PM-2 _____ _____ Alarm Trip _____

IC-1 >3x10⁻¹¹ Meter Trip OK Test Trip OK

IC-2 >3x10⁻¹¹ Meter Trip OK Personnel ✓

IC-3 Responds Calibration ~~OK~~ alarms ✓

IC-4 Responds Calibration ~~OK~~ Press -20.7"

CRM _____ Meter Trip _____ _____

Zero -.03"

Expt. 220 15" Annular cyl. styrofoam on bottom

Find critical height with water level at 37.4cm.

8 30/Apr

k	Tank	Solution	H_2O	temp.
>1	12.725	5.25⁵	37.4	24°C
=1	12.52	5.25⁵	37.4	24°C
<1	12.52	5.25⁵	38.3	24°C
=1	13.22	5.27⁵	35.3	24°C

Expt. 221

Removed styrofoam from bottom. Bottom refl. now water

11 5/A

>1	12.62²	4.63⁵	31.4	25°C
=1	12.45⁵	4.63⁵	31.4	25°C
=1	12.3C	4.63⁴	32.8	
=1	12.23⁵	4.63⁴	33.1	
=1	12.04	4.63¹	33.5	
=1	11.84	4.63	34.2	
=1	11.64	4.62⁵⁻³	34.9	
>1	11.64	4.62⁵⁻³	35.4	
=1	11.4C	4.62⁵	35.4	
=1	11.26	4.61⁶	36.0	
<1	11.26	4.61⁶ 4/27	32.2	dump water solid ht 4.630

$9^7/_8$ I D cyl $\Rightarrow A = 494.118\ cm^2$

Estimate of 10" dia cyl. ht for k=1 with styrofoam.

$$B_m^2(\text{sphere}) = B_m^2(\text{cyl})$$

$$.03647 = \frac{\lambda_0^2}{(12.7+5.5)^2} + \frac{\pi^2}{(h+4)^2}$$

$$(h+4)^2 = \frac{\pi^2}{.03647 - .01746}$$

$$(h+4) = (519.17885)^{1/2}$$

$$h+4 = 22.7855$$

$$h = 18.7855\ cm = 7.40" \rightarrow 6.8$$

Styrofoam Removed

$$h + 7.5 = 22.7855$$

$$h = 15.2855\ cm = 6.02"$$

From Expt. 221 : $h + 5.7 = 22.7855$

$$h = 17.2855 = 6.81" \rightarrow 6.2$$

10" Annular Cylinder.

Instrument Check on 2-29-68 Source 10 mc Y

PM-1 _____ Low Trip OK ~~Alarm~~ Trip OK

PM-2 _____ _____ Alarm Trip _____

IC-1 $>3\times10^{-11}$ Meter Trip OK Fast Trip OK

IC-2 $>3\times10^{-11}$ Meter Trip OK Personnel _____

IC-3 Responds Calibration OK Alarms ✓

IC-4 Responds Calibration OK Pres. -0.07"

CRM _____ Meter Trip _____ _____

Expt. 222

Water height at bottom of 10" cyl. is 1.8cm. Thickness bottom refl. 24.3cm.

Solution selsyn zero is +0.04.

Cylinder has styrofoam on bottom.

	R	Tab	solution	H_2O	Temp
9 07 AM					
9 15	>1	10.62'	6.81[5]	43.5	25°C
9 25	=1	10.46	6.81[3]	43.5	25°C.
	=1	10.50[5]	6.81[5]	43.0	25°C
	=1	10.64	6.82	42.0	25°C

11 AM Expt. 223 Removed styrofoam - bottom refl. now water.

11 12 A	≥1	11.20[9]	6.13[5-8]	40.1	25°C
11 20	=1	11.05[8]	6.13[5]	40.1	25°C
	=1	11.12	6.14	39.8	25°C
	=1	11.20[6]	6.14[4]	39.1	25°C

3-1-68 Removed 10" dia cyl; installed 8" diam annular ph

Estimated Critical ht with Styrofoam is 9.26"

" " " " with H_2O is 8.63"

2/3/80

page		sp. gr.	g/l U	Remarks (isotopic)
62		1.4750	353.2	colulometric on U^{238}
82		1.244	208.6 (U^{233}/U^{238})	isotopic. ^{238}U colo.
91		1.2804	204.05	isotopic
134	9/6/67	1.1956	138.65	Free H^+ N - 0.37
142		(1.1867)?	103.69	" " 0.5N
150	10/6/67	1.1832	130.72	" " 0.4N
152	10/20	1.1675	116.81	" " 0.4N
152	10/24	1.2117	100.76	" " 0.36N
154	10/24	1.1442	102.52	" " 0.36N
158	10/31	1.1441	99.68	" " 0.36
		1.0392	99.09	—
170		1.1186	83.23	—
180		1.0746	51.62	
188		1.0589	44.6	
200		1.2726	200.24	(spec.
202		1.2529	180.45	—
210		1.1890	131.6	—
218		1.1848	133.85	
220		1.1544	110.25	
231		1.1401	94.888	
238		1.0683	47.8	
		1.0658	49.7	

Check Parrotta Transfer analyses. —

$H^+ \rightarrow .325N$

$\rho = 1.174$ sp. gr.

8" annular cylinder
area = 324.29 cm²

Instrument Check on 3-1-68 Source Comet

PM-1		Low Trip	OK	~~Alarm~~ Trip	OK
PM-2				~~Alarm Trip~~	
IC-1	$>3\times10^{-4}$	Meter Trip	OK	Test Trip	OK
IC-2	$>3\times10^{-4}$	Meter Trip	OK	Pressure	
IC-3	Responds	Calibration	~~OK~~	Alarms	
IC-4	Responds	Calibration	~~OK~~	Pres. -0.07	
CRM		Meter Trip			

Expr. 224 selsyn zero -.02"

Water level at bottom of cylinder is 2.0 cm. (25 cm)

Cylinder has styrofoam on bottom

	R	Tad	Solution	H_2O	Temp.
10^{20}					
10^{32}	>1	11.01⁴	8.98⁵	48.5	25°C
10^{45}	=1	10.81	8.98⁴	48.5	25°C
	=1	10.82	8.98⁴	48.0	
	=1	10.86	8.98⁴	47.8	
	=1	10.89	8.98⁵	47.5	
	=1	11.01	8.98⁶	46.1	
11^{20}	Expr. 225 Removed styrofoam. Bottom refl. now Water.				
11^{32}	>1	12.11	8.31⁹ 8.32¹	46.0	25°C
11^{45}	=1	11.91	8.31²	44.0	25°C
	=1	12.11	8.32⁶	43.70	25°C

3/8/68 to 3/14/68

Sphere leaked when first installed. Crack found in bottom entry tube to sphere. Sphere welded and inside coated with Glyptol.

Recalibrate sphere.

Installed sphere 3/15/68 checked for leaks none observed.

After Expt. 226

Removed 12.7 liters of solution.

Took Sample No. 29.

Added 4.9 liters of H_2O and mixed 2 hrs.

Total volume of solution ~20 liters containing 1.9828 kg U.

3/19/68 Sample 29 Control No. E 16994

136.7 mg/ml as U^{238} $\Rightarrow$ $136.7 \times \frac{233.05}{238.04} = 133.85$ g/l.

sp gr. = 1.1848 $H/U^{233} = 190.7$

6.864 liter Sphere

Instrument Check on 3/15/68 Source 10 mc Ra

FM-1		Low Trip	OK	Alarm Trip	OK
FM-2				~~Alarm~~ Trip	
IC-1	$>3\times10^{-4}$	Meter Trip	OK	Test Trip	OK
LC-2	$>3\times10^{-4}$	Meter Trip	OK	Personnel	✓
IC-3	Responds	Calibration	OK	Alarm	✓
IC-4	Responds	Calibration	OK	Pres.	−0.04"
CRM		Meter Trip			

Selsyn zero −0.03 power off selsyn reads .8914?

Expr. 226 sphere is full at selsyn reading of 8.69 + .03 = 8.72"

	~~Leak~~ k	Fuel	Solution	Water	Solution Temp	
10.59 AM						
11:08	>1	11.06	6.87^5	66 cm	23.7°C	Vol: 6.16 l.
11:15	>1	11.06	6.98^5	66 cm	23.7°C	
11:18	=1	10.92	6.98^5	66 cm.	23.7°C	

after Exp. 227 took sample 29

Estimated critical conc. at full is .094 kg/l.

Need to add 1.2 liters of water.

3/18/68 : add + mix. FA

$\frac{233^{08}}{235^{04}} = .97916$

3/20/68 Sample 30 Control No. E 16998

112.6 mg/ml as U^{238} 110.25 gU/l $H/U^{233} = 233.7$

1.1544 sp. gr.

Schym: Power off .22164

Instrument Check on 3-18-68 Source Co-60

PM-1 _____ Low Trip OK Alarm Trip OK

PM-2 _____ Trip _____

IC-1 >3x10⁻¹¹ Motor Trip OK OK

IC-2 >3x10⁻¹¹ Motor Trip OK Personnel ✓

IC-3 Responds Calibration OK Alarms ✓

IC-4 Responds Calibration OK Pres -0.05"

CRM _____ Motor Trip _____ _____

Expt. 227 New Concentration

q^{45}_{Am}	k	tud	Solution	H_2O	Solu. Temp.	Solu Vol.
q^{43}_{Am}	>1	14.11	8.11^5	65.8 cm.	23.8°C	6.798 l.
q^{22}_{Am}	=1	13.97	8.10^9	65.8	23.8°C	6.796 l.

Expt. 228 New Concentration

1 PM	≤1	12.33	9.00	65.8	26.3°C
155	≤1	12.33	8.98^9	65.8	25.3°C
2 PM	≤1	12.67	9.21	65.8	25.1°C

222

3/28/68 By pass open 1 3/4 turns

aclagn Power off .99141

6.96 Liter sphere

Instrument Check on 3-19-68 Source 10 mc Y

PM-1 _____ Low Trip OK ~~Alarm~~ Trip OK

PM-2 _____ ~~Alarm~~ Trip _____

IC-1 $>3\times10^{-11}$ Meter Trip OK Test Trip OK

IC-2 $>3\times10^{-11}$ Meter Trip OK Personnel OK

IC-3 Responds Calibration FH Alarms OK

IC-4 Responds Calibration FH (poor) Pres. -0.05"

~~CRM~~ _____ Meter Trip _____

Expr. 229 Same as 228 "lower temp".

	R	Tad	Solution	H_2O	temp
8^{45}					
9^{05}	≤ 1	11.58	9.21	65.8 cm	24.2C
9^{06}	≤ 1	12.70	10.02	65.8	24.2
9^{14}	≤ 1	14.04	11.00	65.8	24.2
9^{23}	>1	15.41	12.01	65.8	24.3
9^{40}	$=1$	14.32	11.21	65.8	24.4°C
9^{43}	<1	10.90	8.75	65.8	24.4
9^{48}	>1	16.00	12.44^{5}	65.8	24.4
10^{11}	≤ 1	14.32	11.22	65.8	24.4
10^{12}	$=1$	14.42	11.28^{5}	65.8	24.4
10^{14}	<1	12.70	10.0	65.8	24.4

3/20/68

Removed 6.96 liter sphere and installed 15 in dia annular cylinder.

10[35] AM By pass open 2 turns – head at 3.8" reduces feed to zero

reset By pass to 1 3/4 head at 3.9 " " " "

Defective bypass valve – need to replace diaphragm.

1[35] PM By pass open 2 turns with new diaphram.

15" Dia. annulate cylinder.

Instrument Check on 3-20-68 Source 10 mc Ra

PM-1		Low Trip	O/C	Alarm Trip	O/C
PM-2				~~Alarm Trip~~	
IC-1	$>3\times10^{-4}$	Meter Trip	O/C	Fast Trip	O/C
IC-2	$>3\times10^{-4}$	Meter Trip	O/C	Personnel	✓
IC-3	Responds	Calibration	SN	Alarms	✓
IC-4	Responds	Calibration	SN good	Pres	−0.05"
CRM		Meter Trip			

Expt 230

selsyn zero is +.03" Bottom reflector thickness 24.2 cm.

~~1:30~~ 1:45 pm Rx	Tank	solution	water	Temp
21	27.00	4.04	39.5	24°C

seem to have exhausted solution supply.

1:45 set by pass open 1½ turns

21	39.18	4.935	39.5	24°C

exhausted supply.

Vol in vessel is ~14.5 liters ∴ estimate hold up of system to be about 5.5 liters.

3/21/68

Removed 15" dia annular cyl.

Installed. 10" dia " " with Styrofoam on bottom

By pass open 2 turns.

10" Annular Cyl.

Instrument ~~Check~~ on 3-21-68 Source 10 mc Ra

PM-1 _____ Low Trip OK ~~Alarm~~ Trip OK

PM-2 _____ ~~Alarm Trip~~ _____

IC-1 $>3\times10^{-4}$ _____ OK Fast Trip OK

IC-2 $>3\times10^{-4}$ _____ OK Personnel ✓

IC-3 Responds _____ OK Alarms ✓

IC-4 Responds _____ OK Pres -0.05"

RM _____ Meter Trip _____

Expt. 231 10" annular cylinder with Styrofoam bottom refl.

selsyn zero -.025" Bottom refl. thickness 24.4 cm.

	k	Tank	Solution	Water	Temp.
10^{01}_{Am}	>1	4.63	7.72^{3} ÷5	45 cm.	25°C
10^{14}	=1	4.43	7.72^{1}	45 cm	25°C
	=1	4.48	7.72^{2}	44.5	25°C
	=1	4.54	7.72^{4}	44.0	25°C
	=1	4.63	7.72^{5}	43.5	25°C
10^{55}_{A}	Expt. 232	Have removed styrofoam from bottom of Cyl.			
n^{07}	>1	4.71	7.03^{1}	43.6	25°C
	=1	4.46^{5}	7.02^{9}	42.6	25°C
	=1	4.51	7.03	41.4	25°C

3/22/68

Removed 10" dia cyl and installed 8" dia annular cyl. with Styrofoam on bottom

8"-dia Annular Cyls

Instrument Check on 3-22-68 Source 10mc Y

PM-1 _____ Low Trip ok Alarm Trip ok

PM-2 _____ Alarm Trip _____

IC-1 > 3 x 10⁻¹¹ Meter Trip ok Fast Trip ok

IC-2 > 3 x 10⁻¹¹ Meter Trip ok Personnel

IC-3 Responds Calibration ~~SW~~ alarms on

IC-4 Responds Calibration ~~SW~~ Vac -0.05"

CRM-1 _____ Meter Trip _____

selsyn zero reads +0.07"

Expt. 233 8" cylinder has styrofoam on bottom.

there are 25 cm of reflector water on bottom of vessel.

	k	tad	solution	H_2O	Temp.
2:00 PM	>1	4.73	10.71³	~~52~~ cm	25°C
2:30 PM	=1	4.45	10.70⁷	52 cm.	25°C
	=1	4.63	10.71¹	49.9	25°C
	=1	4.73	10.71³	48.6	25°C

2:52 PM Expt. 234 Removed styrofoam from bottom of cyl.

3:07	>1	4.17⁵	10.08¹	~~45.5~~ 50.9	25°C
	=1	3.73	10.07⁶	50.9	25°C
	=1	3.76	10.07°	50.2	25°C
	=1	4.17	10.08⁹	45.8	25°C

3/26/68

Installed 12.985 liter sphere.

Expt. 235

R	Tud	selsyn
<1	5.55	6.74
	6.32	6.76
	6.62	6.77
	6.92	6.78
	7.30	6.79
	7.60	6.80
	7.95	6.81
<1	8.30	6.82
~1	8.60	6.83

After Expt. 235 took sample #31 A+B

Drained 7.4 liters of solution from system

Added 16.4 liters of water and mixed.

12.985 liter Sphere

Instrument Check on 3-26-68 Source 10 mc Ra

PM-1		Low Trip	OK	~~Alarm~~ Trip OK
PM-2				Trip
IC-1	$>3\times10^{-4}$	Meter Trip	OK	OK
IC-2	$>3\times10^{-4}$	Meter Trip	OK	Personnel ✓
IC-3	Responds			Alarms ✓
IC-4	Responds			Pass
CRM		Meter Trip		

selsyn zero: 0.0

Expt. 235

	k	Tad	Solution	Water	Soln Temp.	
215 ppm						
248	>1	8.86	6.84^{-2}	66 cm.	24.5°C	9.050 liters
	=1	8.70	6.83^{8}	66 cm.	24.5°C	

Sample 31A Control No. E 17020

92.02 mgU/m.l as U^{238} 94.998 gU/l.

Specific 1.1401

After Expr. 236 added 500 cc of solution from Expr. 206.

After Expr. 237 added 500 cc of Solution from Expr. 206

12.985 liter sphere

Instrument Check on 3-27-68 Source 10 mc Ra

PM-1 _____ Low Trip OK ~~Alarm~~ Trip OK

PM-2 _____ ~~Alarm Trip~~ _____

IC-1 $>3\times10^{-11}$ Meter Trip OK Fast Trip OK

IC-2 $>3\times10^{-11}$ Meter Trip OK Personnel ✓

IC-3 Responds Calibration ~~JH~~ Alarms OK

IC-4 Responds Calibration ~~JH~~ Pres -0.05"

CRM _____ Meter Trip _____ _____

Expt. 236 Try new Concentration

Selayne power off in $.99198^5$ reads 0.0.

K	Tad	Solution	Water	Solution Temp
<1	14.24	12.09	66 cm	24.5°C

Expt. 237 Try new Concentration

<1	14.10	13.00	66.	29°C

After Expt. 238 added 400 cc of solution from Expt. 206

After Expt. 239 added 400 cc of Solution from Expt. 202

12.885 liter Sphere.

Instrument Check on 3-28-68 Source comet

PM-1		Low Trip	OK	Alarm Trip	OK
PM-2				~~Alarm Trip~~	
IC-1	$>3\times10^{-11}$	Meter Trip	OK	Fact Trip	OK
IC-2	$>3\times10^{-11}$	Meter Trip	OK		Personnel ✓
IC-3	Responds	Calibration	FH		Alarms OK
IC-4	Responds	Calibration	FH		Pres -0.05"
GSM		Meter Trip			

Expt. 238 New Concentration.

Depth of water above sphere is 7 in.

	k	Tad	Solution	Water	Soln Temp.
8:40 AM					
8:53 AM	<1	12.28	13.02	66 cm.	25.2°C

1:45 PM. Expt. 239 New Concentration

2:02 PM	<1	13.08	15.02	66 cm.	27.5°C

After Expt 240 added 200 cc of Solution from Expt 206

Instrument Check on 3-29-68 Source 10 mc

PM-1 _____ Low Trip OK Alarm Trip OK

PM-2 _____ ~~Alarm Trip~~

IC-1 $>3\times10^{-4}$ Meter Trip OK Test Trip OK

IC-2 $>3\times10^{-4}$ Meter Trip OK Personnel

IC-3 Responds Calibration OK Alarm OK

IC-4 Responds Calibration OK Bias -0.05v

CF/CM _____ Meter Trip _____

Expr. 240 new Concentration

	k	Fuel	Solution	H_2O	Temp.
9 30 AM	≠1	14.54	15.02	66cm.	26°C

system subcritical. Add 200 cc Solution from Expr 206.

2 20 PM Expr. 241 new Concentration

2 44	>1	14.385	~~15.005~~ 14.995	65.8cm.	27.9°C
2 53 PM	=1	9.82	11.21	65.8cm.	27.5°C

After Expt 242 took Samples 32A + B

4/4/68 Control No. E 17033

sample 32A

48.82 mg/ml as U^{238} 47.803 g U/L.

1.0683 sp. gr.

H/U233 = 549.1

Sample 32B

4-23-68 50.75 mg/ml as U^{238}

1.0658

Instrument Check on 4-1-68 Source 10 mc Ra

PM-1		Low Trip	OK	Alarm Trip	OK
PM-2				Alarm Trip	
IC-1	$>3\times10^{-11}$	Meter Trip	OK	Fast Trip	OK
IC-2	$>3\times10^{-11}$	Meter Trip	OK		Personnel ✓
IC-3	Responds	Calibration	JH		alarms ✓
IC-4	Responds	Calibration	JH		Pres -0.05"
CRM		Meter Trip			

Experiment 242 Repeat 241 new temp.

S^{40}/A	R	Tad	Solution	H_2O	Temp.	
859	>1	8.29	10.86^5	65.8 cm.	25°C	
906	=1	7.55	10.82	65.8	25.2°C	
	≤1	7.55	10.82	61.8	25.2°C	
		7.95	10.82^5	0		
		8.05	10.85			
		8.15	10.85^5			check full height.
		8.25	10.86^0			
		8.35	10.85^5			
		8.45	10.96^5			
		8.55	11.05			
		8.65	11.13			
		8.75	11.21			

Removed sphere + installed 10" dia. Annular cylinder with styrofoam on bottom.

Expt. 243 10" annulus cyl. Reflected / styrofoam bottom.
Refl. thickness on bottom 24.4 cm.
Selsyn zero +.04"

2 PM	k	Tub	Solution	H_2O	Temp.
22⁵	>1	7.66⁵	12.45●	60.5	26°C
	=1	7.14	12.44²	60.5	
	=1	7.17	1244²	60.0	
	=1	7.25⁵	1244²	58.9	
	=1	7.66⁵	1245⁵	55.5	

Expt. 244 Removed styrofoam.

3 10					
	>1	7.42	11.80⁵ (2)	55.0	26°C
	=1	6.80	11.79⁵	55.0	
	=1	6.83	11.79⁵	54.3	
	=1	7.42	11.81	50.0	

Ext ht 18.4"

1" w/ styrofoam.

8" dia Annular Cyl.

Instrument Check on 4-2-68 Source 10 mcr

PM-1		Low Trip	OK	Alarm Trip	OK
PM-2				Alarm Trip	
IC-1	$>3\times10^{-4}$	Meter Trip	OK	Fast Trip	OK
IC-2	$>3\times10^{-11}$	Meter Trip	OK	Personnel	✓
IC-3	Responds	Calibration	SH	Alarms	✓
IC-4	Responds	Calibration	SA	Pres	−0.05"
CRM		Meter Trip			

Expr. 245 8" cyl w/ Styrofoam on bottom

Chgn zero +.02" 25cm refl. on bottom

k	Tad	Solution	H_2O	Temp	
<1	—	>20"	74 cm.	25°C	Check expectations before proceeding.

Instrument Check on 4-4-68 Source 10 mcr

PM-1		Low Trip	OK	Alarm Trip	OK
PM-2				Alarm Trip	
IC-1	$>3\times10^{-11}$	Meter Trip	OK	Fast Trip	OK
IC-2	$>3\times10^{-11}$	Meter Trip	OK	Personnel	
IC-3	Responds	Calibration	SH	Alarms	
IC-4	Responds	Calibration	SA	Pres	−.04" (Replacing door)
CRM		Meter Trip			

Expr. 246.

k	Tad	Solution	H_2O	Temp.
<1	39.18	26.67	103 cm.	25°C

exhausted solution supply.

Expr. 247 Removed Styrofoam from bottom of vessel.

<1	39.18	26.87	103cm.	26°C

exhausted Solution Supply.

4/7/68 Installed 15" dia annular cylinder with Styrofoam on bottom.

Instrument Check on 4-5-68 Source 10 mc Ra

PM-1		Low Trip	OK	High Trip	OK
PM-2					
IC-1	$>3\times10^{-11}$	Meter Trip	OK		OK
IC-2	$>3\times10^{-11}$	Meter Trip	OK		Personnel ✓
IC-3	Responds	Calibration	JK		Alarms ✓
IC-4	Responds	Calibration	JT		Pres. -0.04
CRM		Meter Trip			

Scram Zero + 0.01 — bottom refl. thickness 24.2 cm.

Expt. 248 15" cyl. w/ styrofoam bottom reflector.

	k	Tad	Solution	H_2O	Temp.
8:55					
9:17	>1	4.21	$7.71^{.05}$	48.0	25°C
	=1	3.82	7.71	48.0	25°C
	=1	3.98	7.71	47.0	25°
	=1	4.21	7.71^{2}	46.0	25°
	=1	4.54	7.71^{9}	44.7	25°
	=1	4.76^{8}	7.72^{2}	43.7	25°

Expt. 249 Removed styrofoam from bottom of vessel.

10:40	>1	9.39	7.12^{9}	42.0	26°C
10:55	=1	9.06^{5}	7.12^{5}	42.0	26°C
	=1	9.39	7.13^{-}	41.0	26°C

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