

BOOK9R

4422 on bottom edge

Notes:

Front, side, back cover too dark to reproduce: CA-24 ART-HC on front of book.

Blank pages: inside front cover opposite page 1, 2-5, 163-288, 290-294, 296-300, inside opposite 300

-page 10 has 1 8.5x11 sheet stapled to it

Scanned by:

Sheila Finch

RSICC /Oak Ridge National Lab.

July 28, 1999

SOME INSTRUCTIONS FOR USE OF THIS NOTEBOOK

This notebook is assigned to personnel performing research and development work and must be used for all original calculations, notes and abstracts from reports.

Assignee is responsible for the safeguarding of this notebook in accordance with security regulations.

This notebook must be returned to issuing office when completed or upon termination of assignee.

Every page or entry should bear a date and the signature of the person who made the entry.

Entries should be made in ink whenever it is reasonable to do so.

Alteration or amplification of entries made on previous dates should be made as separate entries under their own dates and cross referenced to the previous entries.

Charts, drawings and graphs drawn on special paper should be glued or otherwise securely fastened in place and should individually bear a date and signature. Do not obscure any information.

The notebook should be periodically reviewed by one or more independent persons in the department and should be signed and dated by them. Likewise, they should make a statement that they have "read and understood the foregoing material." Witnessing stamps for this purpose are available in your department's office.

It is advisable to preface each new item, such as a heat treatment, process or reaction, etc., with a very brief description of the purpose, objective or approach.

Description of the invention or discovery should be complete enough to be understood by anyone skilled in the art.

Reference to name or catalogue number should be made when standard items are being discussed, i.e., Westinghouse pump.

In cases where work is conducted in cooperation with others, it is often necessary to meet with them from time to time and discuss new developments. The occurrences of such conferences should always be entered in your notebook regardless of recording elsewhere, giving the date, who was present (if possible), and an outline of the subjects discussed. This often will establish error in occasional claims of other parties that you have appropriated information from them revealed during an interview, and thus provide you with patent protection.

10-9-21

OAK RIDGE NATIONAL LABORATORY

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OAK RIDGE, TENNESSEE

NOTEBOOK NO. 4422

Assigned to: A.D. Callahan

Department: Physics Div.

Location: Bldg. 9213, y-12

Date: March 1, 1955

This notebook is assigned to personnel performing research and development work and must be used for all original calculations, notes and abstracts from reports.

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Subject

This document consists of 301 pages
CLASSIFICATION CONTROLLED
DATE 25-60 6-3-60
Edgar J. Murphy
COORDINATING ORGANIZATION DIRECTOR
OAK RIDGE NATIONAL LABORATORY
AUTHORITY DELEGATED BY AEC 9-10-57

CA-24

1

Table of Contents

SUMP

ARE container #14 Na_2UF_6
 59.65% U
 93.16% U^{25} enriched
 12.31 kg mix transferred to sump

ARTU - container #2 Na_2UF_6
 59.70% U
 93.18% U^{25} enriched

ARTU - container #1 Na_2UF_6
 59.76% U
 93.85% U^{25} enriched

IN ENRICHER

		59.53% U	93.11% U^{25}
AREU 1	13416.5 gm salt	7986.8 gm U	= 7436.5 gm U^{25}
		59.62% U	93.16%
AREU 13	13378.4 gm salt	7976.2 gm U	= 7430.6 gm U^{25}
		59.66% U	93.15%
AREU 15	9428.5 gm salt	5625.0 gm U	= 5239.7 gm U^{25}
		59.60% U	93.14%
	36,223.4 gm salt	21588.0 gm U	= 20,106.8 gm U^{25}
	912.8 gm salt	544.0 gm U	= 506.7 gm U^{25}
	35310.6 gm salt	21044 gm U	= 19600.1 gm U^{25}
		59.60%	93.14%

$$P_{\text{Na}_2\text{UF}_6}^{1400^\circ\text{F}} = 4.52 \frac{\text{gm}}{\text{cm}^3}$$

$$P_{\text{U}}^{1400^\circ} = 2.69 \frac{\text{gm U}}{\text{gm Na}_2\text{UF}_6}$$

$$\rightarrow 7812 \text{ cm}^3 \text{ Na}_2\text{UF}_6$$

28 July 55

7

ARE Container #2 Containing 8.66418 kg of Uranium in furnace in Rm 108 preparatory to heating up enricher.

29 July 55

1400 - ARE Container #1 transferred into the enricher. Na_2UF_6 heel remaining in container - 129.0 gms.

1530 - ARE Container #13 transferred. Na_2UF_6 heel remaining - 318.1 gms. ^{8.16558 kg U}

1830 - ARE Container #15 transferred. Na_2UF_6 heel remaining - 4971.0 gms. ^{8.59074 kg-U}

1900 - Piston inserted $9\frac{3}{4}$ turns to light upper probe. Piston backed off 9 turns for cooling enricher. Power taken off enricher and allowed to cool.

1 Aug 55

0800 - 21,588 kg-U have been transferred from containers into the enricher and overflow pot. Overflow pot contains ~ 544 gms-U.

1200 - Veeder Root counter on enricher zeroed 9 turns above the fuel level.

8.

9 Aug 55

1400 - over flow pot on enricher removed and the enricher connected to the sump tank. The enricher contains ~ 21.044 kg - U.

15 Aug 55

✓ 0900 - First ~250# batch fuel 31 transferred to sump.

✓ 1200 - Second ~250# batch fuel 31 transferred to sump.

30#/24" ✓ 1530 - Third ~250# batch fuel 31 transferred to sump.

134" ≈ 60# ✓ 1800 - Small addition fuel 31 transferred to sump. Sump now contains 769# of fuel 31.

20 Aug 55

✓ 1825 Sample # $\frac{2.4 \#}{1.105 \text{ kg}}$ drawn out of sump.

✓ 1900 $\frac{61.6 \#}{2.60 \#}$ drawn out of sump (134" of sump level)

2300 - ARE container #14 transferred into sump. It ~~is~~ originally contained 14.920 kg Na_2UF_6 .

Heel remaining 49.1 g Na_2UF_6

Undetermined amount left in the intermediate transfer pot.

705.3	→ 704.8 lbs fuel 31 in sump after large removal
	27.1#
	12.310 kg Na_2UF_6 added fm container #14
732.4	731.9 lbs of mix in the system. 731.67/11

The U²³⁵ container #14 was 93.16% enriched.

✓ From container #14, 12.310 kg Na₂U²³⁵F₆
7.843 kg U²³⁵
6.841 kg U²³⁵
were transferred into Sump. The Intermed.
Transfer pot contains 2.561 kg Na₂U²³⁵F₆
or 1.528 kg U

Three samples were taken from Sump
totaling 966.7 gms of Mix

Total wt of Mix in Sump 732.4 #
731.9 #
Total wt of U²³⁵ in sump 6.841 kg = 15.08 #

Wt % of U²³⁵ in sump $\frac{15.08}{732.4} = 2.06$. This is
before the above three samples were removed.

Repeat 769.4 # barren fuel originally in system (sump)
1st sample removed 2.435 # = 1.105 kg barren fuel removed for sampling
20 Aug 55 → 61.7 # = 28 kg " " " to allow for enriched fuel
705.3 # barren fuel now in system
12.310 kg Na₂U²³⁵F₆ added to sump 59.65 wt % U
27.1 # Na₂U²³⁵F₆ added
732.4 # fuel in sump

27.1 # Na₂U²³⁵F₆ = 15.08 # U²³⁵ 93.16% enriched

A check of the weights of the intermediate
transfer tubing and pots indicates a source of error.
The first check raised the wt % of U²³⁵ from
2.06% to approx. 2.13%. More checking to be done.

10

21 Aug 55

732.4 # fuel in sump
15.08 # U^{235} " "2nd sample removed
1st U removed272.2 gm fuel removed into liner & 61.355 gm into sampler
333.6 " " " (total)

approx 1:00 AM

2.27 wt % U^{235} based on 93.5% enrichment factor
41.6% Zn by wgt 7.56 gm U^{235} 3rd sample removed
2nd U removed

307.8 " " " " & 63.783 " " "

approx 3:00 AM

371.6 gm fuel removed
2.28 wt % U^{235} 93.5% enrichment4th sample removed

198.8 " " " " & 62.825 " " "

3rd U removed261.6 gm fuel removed
2.29 wt % U^{235} if 93.5% enriched
41.6% Zn by wgt.5th sample removed

414.2 " " " " & 64.345 " " "

4th U removed478.5 gm fuel removed
2.25 wt % U^{235} if 93.5% enriched

approx 11:00 AM

41.9% Zn by wgt

8-21-55

Total 1.445 Kg = 3.185 # fuel removed
732.4 - 3.2 = 729.2 # fuel in sump after
first four U samples were made.07 # = 31.3 gm U^{235} removed in first four samples15.08 - .07 = 15.01 # U^{235} in sump $\frac{15.01}{729.2} = 2.058$ wt % U^{235} in sump.

GENERAL WORKS

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S35
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MATHEMATICS

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G6
- CR QA Gottschalk, W. H. Topological dynamics, by W. H. Gottschalk and
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Am3 publications, v.36) Providence, R. I., American Mathematical Society,
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297 McGraw-Hill, 1956.
H5
- CR QA Szasz, Otto. Collected mathematical papers. Edited by H. D. Lipsich.
3 Cincinnati, University of Cincinnati, Dept. of Math., 1955.
S96
- CR QA Volterra, Vito. Opere matematiche. Pubblicate a cura dell'Accademia
3 Nazionale dei Lincei col Concorso del Consiglio Nazionale delle
V6 Ricerche, v.1. Roma, Accademia Nazionale dei Lincei, 1954.
- CR QA Waerden, B. L. van der. Algebra. Unter Benutzung von Vorlesungen
155 von E. Artin und E. Noether. v.1-2. Berlin, Springer, 1955.
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PHYSICS AND ASTRONOMY

- CR, T, QC Andrew, E. R. Nuclear magnetic resonance. Cambridge, The University
H 173 Press, 1955.
A53
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776 par Radio-Lorraine (Nancy Université) au cours de l'année scolaire
D6 1952-1953. Paris, Société d'Édition d'Enseignement Supérieur, 1954.
- T, H QC Engel, Alfred von. Ionized gases. Oxford, The Clarendon Press,
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E5

NA 19 data

17 8/21

Mix 10 times - $t_p = 8''$.

18

Sample 2.27 \pm 0.03 W/U U 41.6 w/o Zn

Mix 10 times.

2.20 \pm 0.03 W/U U 40.3 w/o Zn

18

Mix 10 times

19

2.29 \pm 0.01 W/U U 41.6 w/o Zn

20-21

M ⁻¹	—	4.25	5.14	5.22	} illustrates uncertainty
		6.21	6.46	6.26	
		<u>1.21</u>	1.25	0.937	

7% discrepancy between analysis
& volumetric values
of conc.

22

No mix - another sample -

2.25 W/U U 41.4 w/o Zn

23

Mix 30 times - 10 16

2.25 ~~W/U~~ W/U U 41.5 w/o Zn

(Variable probe 1 3/4" below top of BE -
depth as 11 16.)

21 Aug 55
6:45 P.M.
5th U sample

Material removed from sump for sampling.

62.128 gm in sampler
107.2 gm in liner (overflow)
169.33 gm total fuel solution removed
2.25 wt% U²³⁵ if 93.5% enriched
41.5% Zn by wgt

3.80 gm U²³⁵ removed

21 Aug 55
Fuel addition
approx 10:45 PM

6th U sample
1:40 A.M. 8-22-55

91.0% Zn
by wgt

subject to correction
2550 gm Na₂U₂F₆ added at 10:45 P.M. 21 Aug 1955
- 60.99 gm to analyst } 2.67-93.16%
- 394.8 gm in liner } 2.68 ± 0.02 wt% U (total)
2094.2 gm effective addition } 93.16 enrichment

~~1164.52~~
= ~~1250.03~~ gm U²³⁵ @ 93.16% 1711 gm U²³⁵
~~1250.03~~ gm U 1514.7 gm U

7306.27 gm U from previous loading
total U in reactor 8556.30 gm 2.57 wt%
total fuel in reactor 333.55 Kg 4 1/2% off
= 331.45 + 2.09 Kg

21 Aug 55
x 10:45 PM

330.684 Kg fuel + 6.807 Kg U²³⁵ in sump
~~2550 " added = 1911 " 57.4% U²³⁵~~
~~333.234 " fuel 8.2179 Kg U²³⁵~~

6th sample
22 Aug 55
1:40 AM

.456 Kg fuel sample removed .0122 Kg U²³⁵ 2.68% U²³⁵
~~332.778 Kg fuel 8.2057 Kg U²³⁵~~
330.228 Kg fuel 6.7943 Kg U²³⁵

2.550 Kg addition subject to change
See pg. 13

8-22-55

1:40 AM

6th U sample
 60.99 gm sampler 2.68 wt % U
 394.8 gm liner
455.79 gm total

7th 5:30 AM

U sample
 61.3 gm sampler 3.08 wt % U
 265.0 gm liner
326.3 gm total

8th 7:35 AM

U sample
 60.2 gm sampler 3.56 wt % U
 122.2 gm liner
182.4 gm total

10:05 AM

9th U sample
 60.3 gm sampler 4.03 wt % U
 176.3 gm liner
236.6 gm total

10th U sample

62.4 gm sampler 4.46 wt % U
 203.2 gm liner
265.6 gm total

8-23-55

11th U sample 1: AM

65.109 gm sampler 4.77 wt % U
 258 gm liner
323.109 gm total

Totals for samples 6 to 11

1.7878 gm fuel removed
 65.48 gm U "
 61.04 gm U²⁵ "

Original Na₂UF₆ in ART # 2 was 12411 gms

[93.18% U²⁵ keel 32.5 gms
 59.37 wt % U] - total Na₂UF₆ removed 12378.5 gms

Undetermined amount left in transfer pot etc.
 Approx. 7349.1 gm U added to sump from ART container # 2.

Values after ARE # 14 emptied into sump

fuel removed	330.683 Kg fuel	7.3063 Kg U	and	6.8065 Kg U ²⁵
	1.788 Kg fuel	.0655 Kg U	and	.0061 Kg U ²⁵
	removed (6 to 11)			
Na ₂ UF ₆ added from ART # 2	328.895 Kg fuel	7.2408 Kg U	and	6.8004 Kg U ²⁵
	12.378 additions 2 to 7	7.3491 Kg U	and	6.8479 Kg U ²⁵ added
	341.273 Kg fuel	14.5899 Kg U	and	13.6483 Kg U ²⁵

Fuel inventory to start of use of enricher

108.0 Kg barren fuel #31
 115.6 " " " "
 112.4 " " " "
 12.5 " " " "
 1) 348.5 Kg barren fuel originally in sump
 17.6414 Kg salt AREU #14 59.65% U 93.16% U²⁵
 12.3785 Kg salt ARTU #2 59.40% U 93.18% U²⁵
 5.4885 Kg salt ARTU #1 59.76% U 93.25% U²⁵
 2) 381.0084 Kg put in sump (barren fuel + salt)
 29.1054 Kg barren fuel removed
 1.6145 Kg fuel removed 1st 5 samples
 1.7899 " " " " samples 6 & 11
 5.447 " " " " 12 & 13
 3) 33.0545 Kg solution removed
 33.0544 ← Pd sol. Wabady
 2-3 347.954 Kg total in sump (to include 9th addition and 13th sample)

AREU #14 8733.6 gm U x .9316 = 8,136.2 gm U²⁵
 ARTU #2 7352.8 gm U x .9318 = 6,851.3 " "
 ARTU #1 3279.9 gm U x .9325 = 3,058.5
 19366.3 gm U total added = 18,046.0 gm U²⁵
 131.7 gm U removed 122.4 gm U²⁵
 19234.9 gm U in sump = 17923.6 gm U²⁵

(5.58%) (347.954 Kg) = 19,415.8 gm U (by analysis)
 19415.8 - 19234.9 = 180.9 gm U = dev. of .93%
 for 5.58% U to = 19234.9 U = 344.711 Kg
 a loss of 3.243 Kg of solution. solution

additions from enricher

122.1 gm U / 0.1 in insertion
 15.3 gm U / counter div
 153 gm U / revolution
 x .03 wt % U per 100 gm U added

TIME	no. addition	Enricher position			Estimated		Analysis concentration
		FOUND	TURNE TO	BACKED OFF TO	U addition	concentration	
8:38:15	1	00000	00100	00090	153	5.624 cal 5.626 .03	5.62
8:24:55	2	00090	00140	00130	612	5.80 .03	5.66
12:15 AM	3	00130	00180	00170	612		5.84
	4	00170	00220	00210	612		6.02
	5	00210	00282	00272			6.29
	6	00272	0028.8	0027.8			
	7	0027.8	0029.7	0028.4			
	9	0028.4	0030.0	0029.0		no apparent addition	
	7	00290	0030.6	0029.6			

Continued on page 245

calculated addition from enricher to agree with chemical analysis.

1 { 255.5 gm sol = 152.3 gm U = 283.7 gm U²⁵
 257.9 " " = 153.7 " " = 286.4 " "
 255.5 " " = 152.3 " " = 283.7 " "
 258.1 " " = 153.8 " " = 286.4 " "
 2) 1165 = 687.8 = 640.6
 3) 1165 = 697.3 = 646.7
 4) 1160.51 = 691.7 = 644.2
 1171.7 = 698.3 = 650.4
 5) 1753.5 = 1045.1 = 973.4
 1770.0 = 1054.9 = 982.5
 totals 4580 gm sol = 2729.2 gm U = 2541.9 gm U²⁵
 4623 gm sol = 2755.0 gm U = 2566.0 gm U²⁵
 correct U - 347.655 Kg sol 21.8674 Kg U } totals at
 correct solution - 350.942 " " 22.0741 Kg U } time of
 critical

BACKGROUND COUNTS 20 AUG, 1955

9:00 A.M.

Scaler	DISC.	MULTIPLICATION		SOURCE	BARREN FUNNEL	COUNTER POSITION	ROD
		GAIN	5 MIN CTS.				
1	20	8	9x16+11 155	IN	UP	0	OUT
2	15	16	8x16+8 136	"	"	0	OUT
3	30	8	61x64+16 3930	"	"	0	OUT

Scaler	DISC.	MULTIPLICATION		SOURCE	BARREN FUNNEL	COUNTER POSITION	ROD
		GAIN	5 MIN CTS.				
1	20	8	9x16+4 148	IN	UP		
2	15	16	9x16+4 148	"	"		
3	30	8	63x64+15 4047	"	"		

Scaler	DISC.	MULTIPLICATION		SOURCE	BARREN FUNNEL	COUNTER POSITION	ROD
		GAIN	5 MIN CTS.				
1	20	8	32x16+5 517	OUT (P/S)	UP		
2	15	16	38x16+4 612	"	"		
3	30	8	59x64+56 3832	"	"		

Scaler	DISC.	MULTIPLICATION		SOURCE	BARREN FUNNEL	COUNTER POSITION	ROD
		GAIN	5 MIN CTS.				
1	20	8	12x16+6 198	IN	DOWN		
2	15	16	14x16+7 231	"	"		
3	30	8	45x64+24 2909	"	"		

On 13 July 1955 the operational source (ARE #1) PN ~~57~~⁵¹ was tested to produce 5.47×10^6 n/sec.

8/20/55

Scott
Crudele
Lynn

INSTRUMENT CHECK					
					PN 123
Time	6:25	PM	Source	Yon E	
			Channel		
	A	B	C	D	E
Range	$\frac{10}{1000}$		10^{-10}	$\frac{10}{1000}$	900 V.
Source Dist.	20"	OK	30"	36"	10"
% F.S. Trip	80		80	78	100
Counters 1, 2 & 3. etc.					

8/21/55

Spencer
Snyder
Sandin

CA 24	Exp.	1	Run	1
Sheet	Date	Aug 21 1955	Time	1201 AM
Purpose	Multiplication Curve (Mixing Operation)			

Mixing @ 10 times. Pressurizing to 8 pounds on the sump.
Variable probe located 9 inches below fill probe.
Approximately 300 gms of solution removed from sump for 100 gm sample

1st U sample

2.27 toos weight percent ~~U₂₃₅~~ ~~based on~~

~~enrichment factor of 93.5%~~

~~93.16%~~

41.6% Zr

1:55A mixing 10 times. Pressurizing to 7 pounds on the sump.

2:25A Variable probe unchanged.

~~2:25A~~ Channel "E" temporarily removed from scram circuit.

2:55 " " Back in Scram Circuit

2.28 ± 0.03 weight percent ~~U₂₃₅~~ ~~based on~~

~~enrichment factor of 93.5%~~

40.3% Zr

2nd U sample

2:58A Mixing 10 times. Pressurizing to 8 pounds on the sump.

Variable probe unchanged.

3:50A PS-2, PS-3 adjusted to 8 pounds. This done to eliminate tripping on PS-3 only thus opening only one valve.

3rd U sample

2.29 ± 0.01 weight percent ~~U₂₃₅~~ ~~based on~~

~~enrichment factor of 93.5%~~

41.6% Zr

INSTRUMENT CHECK PN 123					
Time: 4:00	AM	Source: TON E			
	PM	Channel:			
		A	B	C	D E
Range		$\frac{10}{1000}$	OK	10^{-10}	$\frac{10}{1000}$ 900V
Source Dist.		8"		12"	24" 10"
% F.S. Trip		100		85	100 100
counters		1, 2 & 3	OK		

6:00 A.M.

MULTIPLICATION				
Scaler	e/	min. BS/	min.	Mult. 1/A
1				
2				
3				

6:15 A.M. Total volume of carrier plus fuel

too small to reach fill probe on fill cycle. Bubbling of He through fuel cause liquid to hit Hi level probe & dump variable probe now $\frac{3}{4}$ " below fill probe.

6:25A Variable probe now 1" below fill probe for reasons given above.

6:35A Variable probe now 2" below fill probe i.e. 1" below top of Be.

731.9 lbs of mix in Sump
7.421 kg U

6.97% $\frac{93.5}{100}$
6.91% $\frac{93.16}{100}$

6:50 A

Multiplication				
Scaler	c/5 min	BG/5 min	Mult	1/M
1	40x16+6 = 646 ⁶⁴⁶	152	4.25	
2	55x16+2 = 882 ⁸⁸²	142	6.21	
3	25x64+31 = 1631 ¹⁶³¹	3989	1.21	

Two 5 min Count rates
0.0125 to 0.015

Rod at 19.32

liquid level 2" below fill probe at 11.1 pounds in the sump tank.

6:55A

MULTIPLICATION				
Scaler	c/5 min	BG/5 min	Mult	1/M
1	48x16+13 = 781 ⁷⁸¹	152	5.14	0.20125
2	57x16+5 = 925 ⁹¹⁷	142	6.46	0.1528
3	27x64+63 = 1755 ¹⁷⁵⁵	3989	1.25	0.814

8:57A

Variable probe unchanged

Will go thru a fill to get normalization points for counters at their present positions via standard multiplication procedure. Will then dump to give additional mixing. Counters will then be moved so that they will be looking through more Be to see the fuel annulus. Multiplication procedure will then give a new set of points for the same fuel loading so that counters can be normalized to new positions.

Additional mixing seems desirable since there is an apparent +7% discrepancy in fuel concentration between the analysis and the amount of fuel that should be in the reactor on a volumetric basis.

9:03A

counter positions unchanged MULTIPLICATION fuel loading unchanged				
Scaler	c/5 min	BG/5 min	Mult	1/M
1	789 46x16+10 = 746	152	5.22	.1922
2	889 54x16+13 = 877	142	6.26	.1598
3	3739 59x64+1 = 3777	3989	.937	1.068

Rod at 19.32

9:25A Counter #2 moved 10 ft. away from reactor base still pointing at center of reactor.

MULTIPLICATION					
Scaler	av.	c/ 5 min.	BG/ 5 min.	Mult.	T/M
1	782	$47 \times 16 + 13 = 765$			
		$49 \times 16 + 15 = 799$	152	5.15	1992
		$24 \times 16 + 8 = 392$			
2	384	$23 \times 16 + 7 = 375$			
		$49 \times 16 + 32 = 816$	142	6.32	1580
		$44 \times 16 + 32 = 728$			
3	3222	$51 \times 16 + 11 = 827$	3989	.807	1.240

Rod at 19.32

av counts/5 min on counter #2 before moving is 895

av counts/5 min on counter #2 after moving is 384

normalizing background on counter #2 to give same ~~counting~~ multiplication gives for the ~~new~~ background ~~129~~ counts/5 min.

U but 5th sample

11:00 AM Fourth sample taken from sump for check on analysis. WT of sample removed ~~64.25~~ 478.50

WT of U²³⁵ " 10.77 gms

Total WT of mix in sump 729.2 #

" " " U²³⁵ " " 15.01 #

wt% U²³⁵ = 2.25 for fourth U sample 4.14% Z₁

8-21-55

SCOTT
CRUDELE
LYNN

1:05 P.M. - Mixing 30 times. After mixing for three times had to adjust pressure switches

2:30 P.M. Start mix number 4. 6.9 tripping pressure

mix 5 6.7 " "

mix 6 6.5 " "

3:10 Clean valves, change if necessary.

4:58 Start mix number 7.

Variable probe line mounted on sump probe.
& would not light.

Variable probe line reconnected to variable probe
& probe set to 7" below top of Be.

Continuation of mix. # 7. With selector on fill position, the pressure was increased to 10 lbs before the variable probe light went on. System then dumped.

6:20 P.M. Finished mix number 30.

2.25 wt %
41.5 % Zn

6:45 P.M. Fifth v sample taken from sump. # 11

7:55 Moved variable probe to a position such that the bottom of the copper connectors are $10\frac{3}{16}$ " above the ceramic of the cone fitting. This should put the

end of the probe approx. 2" below the fill probe and 1" below the top of the Be.
 The variable probe is $30\frac{3}{16}$ long.

8:50 P.M. Raised system to 11.1 # but did not reach variable probe

9:08 Lowered variable probe $\frac{1}{4}$ " more. Now $1\frac{1}{4}$ " below Be.
 Raised system to 11.1 # but did not reach the variable probe

9:22 Lowered variable probe by $\frac{1}{4}$ ". At $1\frac{1}{2}$ " below top of Be
 Raised sump pressure to 11.1 # but did not reach the variable probe.

9:40 Lowered variable probe by $\frac{1}{2}$ ". At 2" below top of Be
 Variable probe light went on when sump pressure reached 11.0 lbs.

9:52 Raised variable probe $\frac{1}{4}$ ". At $1\frac{3}{4}$ " below top of Be

10:09:50 Variable probe light on with sump pressure at 11.1 lbs.

330.684 kg
~~6.8065~~ kg
 in sump
 11:55 8-22-55 date
 but one mpt date
 that is correct

~~6806.8 kg~~
~~6806.8 kg~~
~~6806.8 kg~~

MULTIPLICATION					
Scaler	Disc gain)	5 m	25 5 min.	Mult.	1/M
947					
762.1	20	46 x 16 + 7 = 743			.199
		48 x 16 + 14 = 782	152		.205
		22 x 16 + 3 = 355			.164
372	2 15	16 24 x 16 + 4 = 336	61		.172
		16 16 x 16 + 55 = 1079			
	3 30	8 25 x 16 + 29 = 398	9		

rod at 19.32

10:30
to
11:15

Fuel addition approx. 5 #.
see pg. 11

25

11:35

INSTRUMENT CHECK					
Time <u>11:35</u>	Source <u>8</u>		PN <u>123</u>		
	Channel				
	A	B	C	D	E
Range	<u>10⁻¹⁰</u>		<u>10⁻¹⁰</u>	<u>10⁻¹⁰</u>	<u>900V</u>
Source Dist.	<u>14"</u>	<u>OK</u>	<u>20"</u>	<u>30"</u>	<u>60"</u>
% F.S. Trip	<u>85</u>		<u>100*</u>	<u>75</u>	<u>100</u>
	<u>Counts 1, 2 + 30x</u>				

Check/dumping system by tripping on channel E. Checked OK.

~~11~~

8-22-55

Spencer

Snyder

Sandin

C.A. <u>29</u>	Expr. <u>1</u>	Run <u>2</u>
Sheet: _____	Date <u>Aug 22 1955</u>	Time <u>12:25</u> ^{AM} PM
Purpose	<u>Second Mixing Cycle</u>	
	<u>Approx 5 lbs. fuel added</u>	

~~###~~ Mixed 15 times. Pressurized to 8 lbs on the sump. Mixing done by using fill position to raise to 8 lbs on the sump then switching to dump position. Done because of faulty pressure switch.

26

Note Henceforth all analyses will be reported as weight percent of total Uranium

6th V
1:40A Sample withdrawn - total withdrawn see ~~table~~ ^{PIR}
Analysis yields $2.68 \pm .02$ wt percent U (total)
41.0% wt % Zn

~~333.56 Kg fuel in sump~~
~~333.56 Kg U²³⁵ in sump~~

subject to correction (see p 11)
332.778 Kg fuel in sump
8.2029 Kg U²³⁵ " "

6th sample above
60.99 gm sampler
394.8 gm liner
455.79 gm total removed
~~2.67% U²³⁵ removed~~ $\frac{9316}{95.5} \times 2.68$
 ~~$\therefore 72.2$ gm U²³⁵ removed.~~

1:45 A

MULTIPLICATION

Scaler	c/	S	min. BG/	S	min.	Mult.	1/M
		$57 \times 16 + 3 = 915$.1661
1		$58 \times 16 + 1 = 929$		152			.1636
		$27 \times 16 + 4 = 436$.1399
2		$27 \times 16 + 7 = 439$		61			.139
		$65 \times 6 + 5 = 4165$.9577
3		$57 \times 6 + 20 = 3668$		3989			

2:15 A

Variable probe $1\frac{3}{4}$ " below Be.
 Pressure on sump 11.05 \bar{c} p. sig.
 Rod at 19.325

CA. 24 Expr. 1 Run 3
 Sheet _____ Date Aug 22 1955 Time 9:25 AM
 Purpose Third mixing cycle
 Approximately $5\frac{1}{2}$ lbs N_2O_4
 → added fm ART container #2

Note

Mixed 15 times. Pressurized to 8 lbs
 on sump by same method as run 2.

5:30A ^{746 V} Sample removed ~~3.07 wt% for 75.16% enrichment~~
 Uranium 3.08 ± .02 wt % total
 Probe raised $\frac{3}{4}$ " 40.3% Zn by wt
 61.3 sampler
 265.0 liner
 326.3 gm total removed for samp
~~10.0 gm U~~

5:30A

MULTIPLICATION					
Scaler	C	$\frac{1}{7}$ min. BG	5 min.	Mult.	1/M
1	1210	$78 \times 16 + 2 = 1250$			
		$73 \times 16 + 2 = 1170$	152		.1256
2	556	$35 \times 16 + 9 = 569$			
		$33 \times 16 + 14 = 542$	61		.1097
3	524	$83 \times 64 + 43 = 5355$			
		$80 \times 64 + 17 = 5137$	3789		.7604

Variable probe 1" below Be top
 Sump pressure 11.2 lbs did not hit vari
 Rod at 19.32 probe.

6:00A = started heating enricher

C.A.	24	Expr.	1	Run	4
Sheet		Date	Aug 22 1955	Time	7:00 AM
Purpose	Fourth mixing cycle				
	Approximately 5 1/2 pounds U_3O_8 added from ART container #2				

~~||||~~ Mixed 15 times. Pressurized to 8 lbs on the sump by same method as run 2.

07:35A ^{8 lbs} Sample removed ~~3.547 g for 73.16% enrichment.~~
3.56 wgt % total Uranium
40.0 % wgt % Zn

60.2 sampler

~~120.2%~~ 11.0 cr

108.4% total fuel removed
~~182.9~~

7:55A

MULTIPLICATION					
Scaler av.	c/	5 min.	BG/	5 min.	Mult. 1/M
1 1531	93	$93 \times 16 + 15 = 1503$			
	90	$90 \times 16 + 8 = 1448$	152		.0993
2 697	45	$45 \times 16 + 14 = 734$			
	42	$42 \times 16 + 8 = 680$	61		.0875
	72	$72 \times 64 + 36 = 4644$			
3 4666	73	$73 \times 64 + 15 = 4687$	3989		.8549

On Variable probe at 11.05 lbs on the sump. Variable probe 1" below top of Be. During run level dropped to 10.8 lbs on sump. went below variable probe level.

Red at 19325

CRITICAL POSITIONS

C.A. _____ Expr. _____ Run _____

Table Pos. _____ L _____ T _____

Control-Rod _____ Channel _____

1 _____ A _____

2 _____ B _____

3 _____ C _____

4 _____ D _____

Tim Crit. _____ ~~_____~~ _____ min.

INSTRUMENT CHECK for E

Time 8:35 ^{AM} ~~PM~~ Source PK 123

Range	Channel				
	A	B	C	D	E
	$\frac{10}{1000}$		10^{-10}	$\frac{10}{1000}$	9000
Source Dist:	10"	OK	10"	98"	10"
FS Tap	80	OK	100	80	100
Counters	1 & 2 OK		counter	3 ?	

CA. 24	Expr. 1	Run 5
Sheet	Date Aug 22 1955	Time 9:35 AM
Purpose 5 th mixing cycle		
a approximately 5½ pounds		
added from ART container #2		

10:00 A.

Mixed 15 times by same method as run 2. Pressure on pump 8 lbs.

10:05 A

9th V Sample removed. ~~4.015 wt % U₂S₅ 13.16% oxidized~~
4.03 wt % total uranium
60.3 sampler

.176.3 liner

236.6 total removed for sample

11:00 A.M.

run not complete

11:55

MULTIPLICATION			
Scaler	c/ 5 min. BG/ 5 min.	Mult.	1/M
1 1924	120 x 76 + 14 = 1934	152	.0790
	119 x 16 + 10 = 1914		.08
2 922	56 x 16 + 7 = 903		
	58 x 16 + 12 = 940	61	.0662
3	x 64 + =		
	x 64 + =	3989	

Variable Probe raised $\frac{1}{2}$ ". Now $\frac{1}{2}$ " below top of Be. Raised by $\frac{1}{2}$ " again should now be at top of Be. See second part of run.

On variable probe at 11.1 lbs sump pressure.

On fill probe at 11.2 lbs sump pressure

~~Pressure dropped so level fell down to below variable probe before rod could be fully withdrawn.~~

Repeat run:

On variable probe at — lbs sump pressure — variable probe above fill probe.

On fill probe at 11.2 lbs sump pressure

Rod out at 19.45

pressure @ 10.8 on sump at start of multiplication point

pressure at end of 5 min run, 10.25 lbs

pressure at start of 2nd 5 min run 10.35

pressure at end " " " " " 9.9 lbs

22 Aug 58

12:40

Gas flow increased in fission chamber.

Scott
Cradle
Lynn12:50 5V₅₁ (thinner valve) replaced

1:50

Repeat last multiplication run #5

CA.	29	Expr.	1	Run	5A
Sheet		Date	22 Aug 1958	Time	2:10 PM
Purpose	Repeat run 5				

source "1N"

rod 19.144 inches

999.865 rod position at mid-plane

MULTIPLICATION					
Scaler	c/	min.	DS/	min.	Mult. 1/M
1745	1991	(129 X 16 + 7)	152		.078
	1901	(118 X 16 + 13)			
932	917	57 X 16 + 5	61		.065
	2947	59 X 16 + 3			
	4382	68 X 16 + 30			
4368	3935	68 X 16 + 3	4365		1 ← new logd. pt.

Disc. & gain positions not changed (pg 16)

2:10 light
Fill probe on at 11.0 # pressure

2:12 " " light out.

2:15 Pressure 10.9 #

2:20 Pressure 10.7 # after first count

2:25 pressure 10.45 # after 2nd count.

The blow-by switch has been wired to give visual indication in room 108.

Variable probe still at ~~11.2~~ top of Be

CA. <u>27</u>	Expr. <u>1</u>	Run <u>6</u>
Sheet _____	Date <u>22 Aug</u>	19 <u>55</u> Time <u>6:05</u> PM
Purpose <u>6th mixing cycle. Approx.</u>	<u>5th Na₂UF₆ added from container</u>	
ART <u>#2</u>	_____	

~~THH THH~~ Mixed 15 times by raising sump pressure to 8 # & then dumping the system. George Nestle found a leak in his fittings & fixed it. Valves not touched.

7:00 P.M. 10th U sample removed

4.46 wt% U

62.9 gm sampler

203.2 gm liner

265.6 gm total

8:09:10 On fillprobe at 11.2 #

8:16 Counter # 3 missing on number 8

Counter # 1 out

99.987 rod in.
 source "IN"
 rod at 19.145"

MULTIPLICATION			
Scaler	c/ 5 min.	By 5 min.	Mult. 1/M
1	27 X 16 +	152	
	X 16 +		
1245	77 X 16 + 13		048
1265	21314 82 X 16 + 2	61	
	7602 118 X 64 + 50	4365	
	8448 132 X 64 + 0	1389	.47

Disc. + gain pos. same as (Pg. 16)

8:26 P Pressure at 11.0 #

8:31:15 P Raised system to 11.2 # to light fill light.

8:35:20 P Fill light out

9:05 P Lowered variable probe $\frac{1}{4}$ "

9:20 P Counter #1 fixed - Jones plug pulled from jack
 in room 108

Counter #3 repaired

9:40 P Repeat run 6

9:55:14 P Fill and V.P. lights on at 11.2 lbs.

10:06:00 P V.P. light out

10:06:24 P Fill probe light out

CA 24 Expt. 1 Run 6A
 Sheet _____ Date 22 Aug 1955 Time 10:05 PM
 Purpose Repeat run 6, variable
probe lowered $\frac{1}{4}$ " at 9:05 P

rod in 99.877
 rod out 19.145
 source "1N"

MULTIPLICATION

Scaler	Ct.	5 min.	Mult.	1/M
2633	2666	166 X 16 + 10	772	.058
	7599	162 X 16 + 7	152	
	1291	80 X 16 + 11	378	
1305	1319	82 X 16 + 7	61	.047
	9497	148 X 64 + 25	9365	.966
9513	8649	150 X 64 + 49	3789	1.17

Plac. & gain pos. not changed

10:14 Pressure is 11.0 lbs.

10:55

CA 24 Expt. 1 Run 7
 Sheet _____ Date 22 Aug 1955 Time 10:55 PM
 Purpose 7th mix cycle, last
addition (approx 5#) made from
container #ART #2 into pump
~~not to ART #1 (closed line)~~

11:25 Container ART #1 placed in heater.

8/23/55

1201 A

Mix cycle from 7th loading still to be done.

Spencer 12:25 Mix cycle started. Using mix position.

Snyder ~~###~~ ~~###~~ ~~###~~ Mixed 15 times. Pressure on sump 8.1 lbs.Sandin Variable probe has been raised $\frac{1}{8}$ " and is at 12.5 in. on the scale. It is now $\frac{1}{8}$ " above fill probe.

1:00 A 11th Sample of V removed. 4.77 ± 0.2 wgt % total V removed:

65.109 gm	from sampler
256	left in liner
<u>323.109</u>	total removed.

1:25 A

MULTIPLICATION

Scaler	c/5	5 min.	Mult.	1/M
13133	$194 \times 16 + 5 = 3109$	152	152	.0465
	$197 \times 16 + 4 = 3156$	772		.246
	$93 \times 16 + 5 = 1493$	618		.0417
21462	$89 \times 16 + 6 = 1430$	378		.259
	$152 \times 16 + 14 = 2446$	3988		.414
39625	152 $\times 16 + 7 = 2449$	4365		.454
	$150 \times 16 + 7 = 2407$			

Variable probe $\frac{1}{8}$ " above fill probeHit ^{variable} fill probe at 16.2 lbs sump pressure

1:39:30 A

1:40:45 A

off variable probe

1:41:21 A

off fill probe

Rod at 19.142

2:37 A Original total of Na_2UF_6 in ART
 container #2 12411 gms.
 Heel Na_2UF_6 32.5 gms.
 Total, removed 12378.5 gms. (59.37⁴ wgt% U)
 undetermined amount left in transfer pot.
 roughly 7349.1 gms U added to
 reactor from ART container #2

3:10.0 # Filling from ART V container #1

330.683

~~552.778~~ Kg fuel in sump before container

— .4558 Kg #2 used and after 5th U sample
 — .3263 Kg 6th sample removed
 — .3263 Kg 7th sample removed
 — .1804 8th sample removal
 — .2366 9th sample removal
 — .2656 10th sample removal
 — .3231 11th sample removal

328.895

~~331.746~~

Kg fuel in sump

+ 12.378 Kg added from ART container #2

(amt left in intermediate transfer
 pot must yet be subtracted)

341.273

~~343.825~~

Kg fuel provisional total in sump.

10.1 gm Total U removed in 7th sample

6.4 gm " " " " 8th "

9.5 gm " " " " 9th "

11.8 gm " " " " 10th "

15.4 gm " " " " 11th "

53.2 gm total U removed in samples 7-11 inclusive

49.6 gm " U²⁵ " " " " "

8.2029 Kg U²⁵ in sump before container # 2
used and after 6th U sample

- 0.996 Kg U²⁵

8.1533 Kg in sump

+ ~~7.3441~~ ^{6.8469} U²⁵ added for ART container # 2

~~15.502~~ Kg U²⁵ ~~added for ART cont~~

15.000 in sump (less amt in
intermediate transfer pot)

16.101 Kg total U in sump (less amt
in intermediate transfer
pot.)

4.68 wgt % U calculated for wgt's
deviates for analyzed wgt % of 4.77
by 1.9%

~~341.273~~ Kg fuel in sump

~~17.6899~~ Kg U

CA: 24 Expr. 1 Run X 8
 Sheet _____ Date Aug 23 1955 Time 4:26 ^{AM} ~~PM~~
 Purpose 8th Mixing cycle & mult. curve.
approx 5 1/2 lbs added fm
ART container #1

Mixed 15 times. Pressure on pump 8 lbs.

INSTRUMENT CHECK PN-123

Time 2:55 Source to E

	Channel				
	A	B	C	D	E
Range	$\frac{10}{1000}$	OK	10^{-10}	$\frac{10}{1000}$	900V
Source Dist.	12"		18"	30"	8"
% F.S. Trip	85		80	75	80
counters 1,2,3	OK				

5:00 A

12th U sample removed.

5.17^{±.01} wt % total U

removed 59.5220 gm sampler

21.9 gm liner

278.5 gm total fuel removed

14.44 gm U removed

5:55A

MULTIPLICATION				5.17 ± .01
Scaler	av	c/5 min. BG/5 min.	Mult.	1/M
		293 × 16 + 2 = 4690 152		.0318
1	4782	304 × 16 + 9 = 4873 772		.161
		146 × 16 + 13 = 2349 61		.0258
2	2368	149 × 16 + 2 = 2386 378		.160
		177 × 64 + 35 = 11,363 3989		.352
3	11,343	176 × 64 + 58 = 11,322 4365		.385

Hit fill probe at 11.2 lbs sum pp pressure

6:08:08

Off variable probe. Went back on of its own accord.
~~off fill probe~~

Rod at 19.144

~~off~~ off variable probe but did not go
 off fill probe within 17 minutes.

C.A. 24 Expr. 1 Run 9
 Sheet _____ Date Aug 23 1955 Time 7:20 ^{AM}
 Purpose Mixing Cycle & Mult. Curve
Approx $5\frac{1}{2}$ lbs added fm
ART container #1

Mixed 15 times. Max pressure on sump 8 lbs.

7:45 13th Fuel sample removed.

removed: $5.58 \pm .02$ wgt % total U
⁴⁷¹ 61.5 gm sampler
 204.7 gm liner
 266.2 total fuel removed

5.58% of 347.954 Kg fuel = 19,415.8 gm U
 Calculated value is 19,239.9 gm U
 180.9 gm U diff.
 .93% error
 $(5.58\%) \times = 19,239.9$ if $\times = 347.711$ Kg fuel

8:00 A.M.

5.58 ± .02

MULTIPLICATION

Scaler	c/5 min	5 min	Mult	1/M
1 8241	511 × 16 + 4 = 8180	152		.0184
	508 × 16 + 14 = 8302	772		.0937
2 4072	252 × 16 + 7 = 4039	61		.0150
	296 × 16 + 9 = 4105	378		.0928
	176 × 64 + 25 = 11,289	3989		.3526
3 11,313	177 × 64 + 9 = 11,337	4365		.3858

8:10 A.M. Hit both probes at 11.3 lbs sump pressure
 8:13 A.M. off variable probe
 8:19 A.M. off fill probe

Rod at 19.147

B₁ on scale at .00011

ART containers ~~#1~~ and #2 contain
~~93.25%~~ ^{0.25} gm total V.
 93.18% " " " "
 ART #2 93.18% V²⁵
 " #1 93.25% V²⁵

23 Aug 55
 4:00 PM
 fill.

347.954 Kg fuel in sump
 19234.9 gm V in sump
 17923.6 gm V²⁵ in sump

1:30 PM.
 to
 5:00 P.M.

Moved filter trap from sump to top of reactor
 & placed new filter trap in sump pressure line.
 Helium supply line to cabinet #1
 altered. Two new flow meters
 installed.

*Scott
Cradell
Lynn*

INSTRUMENT CHECK						
Time	6:05 AM	Source	PH123			
		Channel	A	B	C	D
Range	10 ¹⁰⁰		10 ¹⁰⁰	10 ¹⁰⁰	10 ¹⁰⁰	900V
Source Dist.	20'	OK	30	30	30	8'
Setting	75		75	75	75	
% F.S. Trip	80	1	70	78	100	
Counts 1, 2, 3 OK						

C.A.	29	Exp.	1	Run	9A
Sheet		Date	23 Aug 1955	Time	3:30 PM
Purpose	Repeat last run #9 and check for leaks. Probes not changed. Variable probe 1/8" above fill probe.				

347.954 Kg fuel in sump
 19234.9 gm U in sump
 17923.6 gm U²³⁵ in sump

6:51:15 V.P. on & F.P. on at 11.2 lbs.
 6:56:50 ^{5.5 min} V.P. light off
 7:06:45 ^{15.5 min} F.P. light off

INSTRUMENT CHECK					
Time	AM	Source			
		Channel	A	B	C
Range					
Source Dist.					
% F.S. Trip					

MULTIPLICATION					
Scaler	c/5	min. BG	5	min.	Multi 1/M
8290	8351	52X16 + 15	152		.0183
	8230	514X16 + 6	772		.0933
4034	4074	254X16 + 10	61		.0151
	3773	249X16 + 9	378		.0937
8898	8718	34 X ²³⁶ 14			
	8077	35 X ²³⁶ 117	4365		.491

source "1N"
 control rod 19.150 out
 B₁ = .00011

8:40 First addition from enricher.
 Found turned to backed to
 00000 00100 00090
 Estimated U addition 153 gm
 " concentration 5.62 $\frac{gm\ U}{gm\ sol.}$
 Analysis " 5.62 \pm .02 $\frac{gm\ U}{gm\ sol.}$

9:00

CA 24 Exp. 1 Run 10
 S 23 Aug 1955 9:00 PM
 Purp 10th mixing cycle & multi curve.
 To calibrate enricher feed mechanism.
 Enricher data above.

Mixed 15 times. Max pressure 8 lbs, on sump.

9:47

Completed mixing.
 14th fuel sample
 5.62 \pm .02 wt % U
 64.378 gm sampler
 227.0 gm liner
 291.4 gm total

Correct U
 Correct fuel

{ 344.675 Kg fuel + 19.3708 Kg U or
 347.921 Kg fuel + 19.5531 Kg U
 first addition + 14th fuel sample

11:05

Start multiplication cycle.

MULTIPLICATION						5.62 \pm .02
Scaler	c	5	min. 30/5	mult.	1/M	
8102	8170	510	X16+15	752		.0188
	8033	502	X16+1	772		.0953
	4013	250	X16+13	61		.0153
3984	3756	247	X16+4	378		.0949
	9970	39	X256+225			
10082	10194	39	X256+210	4365		.433

source "IN"
 control root 19.400

11:32:17 V.P. & F.P. on at 11.2 lbs
 11:36:35 V.P. out
 11:45:44 F.P. out
 11:53 Pressure at 11.1 - lbs

12:30

CA 24 Expr. 1 Run 114
 Sheet _____ Date Aug 29 1955 Time 12:35 AM
 Purpose Mixing Cycle & Mult. Curve.
 approx 612 gm U added

Mixed 15 times on mix position. Max. Pressure in sump 8 lbs.

1:00A

Sample removed 5.66 ± ^{0.04} wgt % U

evidently not a good mix or plugged line

15th Fuel Sample
 63.696 Sample
 180.5 Live
 244.2 TOTAL

MULTIPLICATION					5.66 ± .04
Scaler	c/	5 min.	BG/	5 min.	Mult. 1/M
10,046	10,138	633 × 16 + 10 =	152		.0151
	19962	622 × 16 + 10 =	772		.0768
4983	4972	310 × 16 + 12 =	61		.0122
	24993	312 × 16 + 1 =	378		.0759
11,017	10,985	42 × 16 + 23 =	3989		.3621
	311,048	43 × 16 + 40 =	4365		.3962

on variable probe at 1:58:15 A
 off variable probe at 2:01:45 A
 Fill probe off at 2:06:50 A
 B₁ ~~0.00015~~ 0.00014
 Rod at 19.41

2nd Enricher addition

Found Turned Down to Returned to
 00090 00140 00130

Estimated U addition - 612 gms

correct U
 correct fuel

344.686 Kg fuel and 19.5093 Kg U } included 2nd addition and
 or 347.935 " " 19.6931 Kg U } 15th sample

4:00A

C.A.	27	Expr.	1	Run	11 B
Sheet		Date	195	Time	AM PM
Purpose	Mixing cycle for mult. curve. repeat of last point. no U added unless small amt in plug.				

Mixed 15 times. Max. Sump pressure 8.5 lbs.

4:15A

MULTIPLICATION					5.66 ± .04
Scaler	c/	5 min.	BG/	5 min.	Mult. 1/M
		× 16 +	152		.0149
110,225	639	× 16 + 1 =	772		.0755
		× 16 +	61		.0124
24,905	306	× 16 + 11 =	378		.0771
		× 16 +	3989		.3485
311,445	178	× 16 + 53 =	4365		.3814

4:33:15 A On variable probe 11.25 lbs sump pressure.
 4:39:00 A off fill probe
 Rod 19.425
 B₁ = 0.00014

correct V
correct fuel } 345.452 kg fuel + 2.01744 kg U } includes 3rd addition and 16th fuel sample
348.712 kg fuel 20.3647 kg U }

C.A.	24	Expr.	1	Run	12
Sheet		Date	24 Aug 1955	Time	5:25 AM
Purpose	Mixing Cycle & Mult curve Plunger lowered same amount as last time (4.0)				

Mixing 15 times. Max sump pressure 8.9 lbs

4:50 A Sample removed 5.84 ± .01 wgt % U
16th Fuel Sample 63.939 Sample

3rd Enricher addition. 327.2 liner
388.1 Total

0555

MULTIPLICATION				
Scaler	c	5 min.	5 min.	Mult. 1/M
1	14,895	925 x 16 + 13 = 14,813	152	.0102
		935 x 16 + 14 = 14,974	772	.0518
2	7,352	456 x 16 + 12 = 7,308	61	.0083
		460 x 16 + 15 = 7,375	378	.0514
		214 x 16 + 52 = 3,424	3989	.2909
3	13,712	213 x 16 + 54 = 3,406	43.65	.3183

0620:30 Hit variable probe at 11.25 lbs sump pressure.

0623:35 OFF variable probe

raised sump pressure to 11.30 lbs. Back on variable probe.

0.636

Rod at 19.45

B₁ = 0.0021

~~sample removed~~
correct V } 346.205 kg fuel and 20.8415 kg U } includes 4th addition and 17th sample
correct fuel } 349.476 kg fuel and 21.0384 kg U }

C.A.	24	Expr.	1	Run	13
Sheet		Date	24 Aug 1955	Time	7:40 AM
Purpose	Mixing Cycle & Mult curve Plunger lowered 4.0				

Mixed 15 times. Max 8.5 lbs sump pressure.

0830 Sample withdrawn
17th Fuel Sample

52,5329 gm Sample
356.2 gm liner
408.7 - Total

4th enricher addition

analysis — 6.02 ± 0.01%

Enricher reading

Found	Turned down to	Returned to
00170	00220	00210

Estimated conc. from enricher addition.

52

29 Aug 55
Scott
Cruddale
Lynn

INSTRUMENT CHECK				
Time	3:30 PM	Source	PN 123	Y-O-E
Range	1/1000	Channel	A	10 ⁻¹⁰
Source Dist.	15"		B	10 ⁻¹⁰
% F.S. Trip	75		C	10 ⁻¹⁰
	Chk 2.3 OK		D	10 ⁻¹⁰

rod midplane position 000255

5:55:23 V.P. & F.P. on at 11.25 lbe

6:00:24 V.P. out at 11.2 lbe

6:09:20 F.P. out at 11.2 lbe

24460 { 24500
24420
11920 { 11910
11940
13280 { 13300
13260

MULTIPLICATION				
Scaler	5 min. DS	5 min. DS	M.P.	T.M.
3870	382 X 64 + 51	152		.0062
1	381 X 64 + 38	772		.0316
2	186 X 64 + 6	61		.0051
2	186 X 64 + 37	378		.0317
3	207 X 64 + 53	3989		.300
3	207 X 64 + 11	4365		.329

source "in"

rod out at 019.506

B_i = .00035

Reading of 11 m/s at mid plane of samp

53

Values for 1st time critical

6.29 wt% U ^{93.177%} 93.18% enriched includes 5th addition and 18th sample
Fifth enricher addition.

correct U - 1347.655 Kg sol = 21.8674 Kg U
 correct fuel - 350.942 Kg sol = 22.0741 Kg U

2.96 mol % U

C.A.	29	Exp.	1	Run	14
She		Date	24 Aug 1955	Time	8:50 PM
Purp	Mix cycle + multi curve. Plunger lowered 6.2 turns.				

20.3754 kg U
20.5676 kg U

Mixed 15 times. Max 8. lbe pressure in samp

Enricher readings returned to
 Found ^{turned down to} 00210 ₀₀₂₂₀ returned to 00272
 estimated fuel addition 1069.5 gm U
 estimated concentration
 turned down 6.2 turns

Estimated amt of fuel added 1069.5 gm U and 1794 gms fuel.

Estimated concentration 6.30 %
 Estimated fuel 348.124 kg fuel 21.911 kg U not corrected
 Estimated fuel 351.312 kg fuel 22.478 kg U for sample 18
 18th sample taken from samp

9:50

N_a = 11.8 wt %

F_e = 42.3 wt %

64.2	gm sampler
240.2	gm liner
304.4	gm total

U = 6.29 ± .02 wt % U

F_e = 39.7 wt %

10:35 Started to fill core.

11:05:34 V.P. & F.P. both on at 11.3 lbs on ^{sump} ~~surf~~

Rod mid-plane position 000.255

11:11:10 V.P. out at 11.25 lbs sump pressure

11:17:00 V.P. on. Pressure increased slightly.

11:18 Start withdrawing rod. source "in".

11:22:15 V.P. out at 11.2 lbs sump pressure

11:30 B₁ at .001 control rod at 12.030 - source withdrawn a short distance to keep level down.

11:33:20 F.P. out at 11.1 lbs sump pressure

11:35: source withdrawn a short distance to keep level down

11:40 source withdrawn a short distance

11:41:40 source out (first position yellow light)

At this time rod at 14.22 but level not constant

8 level outside South wall opposite reactor 3 m/s/hr. and 30 m/s/hr at reactor surface

CRITICAL POSITIONS			
C.A. 24	Expt. 1	Run 14	
Rod Pos.		T	P
	Control Rod		Channel
1	14.22 at time of critical	A. 39	$\frac{100}{5}$
2		B. 0006	
3	14.36 at 11:54 and still falling	C. 44	5×10^{-11}
4		D. 40	$\frac{100}{200}$
		E. 2	7000

values at 11:54

Tim Crit. 11:41:40 ^{PM} Duration 25 min

11:54 Cannot hold level steady. Pressure dropping slowly. Now at 11.0 lbs in sump.

11:58 PM Withdrew rod to get a positive period. 016.080 ^{147 measured} 25 Aug 55 B₁ at .001 B₂ approx. 150 sec. rod at 016.080

12:04 B₁ at .01 Counter gain at 2

12:06: Rod inserted to level reactor at 015.048

12:06:45 source withdrawn slowly

12:08:40 source full out.

12:11 Sump pressure at 10.9 lbs

12:12 Control rod at 015.30 + level dropping slightly due to pressure dropping. (assumed).

39 min after fill probe out

56
25 Aug 55

12:16 AM Rod at 015.556

12:17 AM Rod at 015.585 and rod dropped.

12:18 AM System dumped

CA.	24	Expr.	2	Run	1
Sheet		Date	Aug 25 1955	Time	1:15 AM
Purpose	Determine change of reactivity vs. liquid level				

0 position .29

Variable probe moved from $12\frac{1}{2}$ " to $10\frac{3}{4}$ "

Now 1" below top of Be

0200:50 On variable probe at 10.9 lbs.

0208:15 On fill probe 11.3 lbs

0228:20 off Fill probe.

0234:25 Source out.

~~0236~~ Rod at 14.35

0240 $B_1 = .0049$ Rod 14.31

0241:21 held const 14.215

0241:35 fuel level dropping 14.255

375
20

244

0243:30	$B_1 =$ 0.0044	Rod	14.28
0243:45	$B_1 = .0045$		14.305
0246:40			14.35
0247:10			14.37
0247:40			14.388
0248:30	$B_1 = .0047$		14.364
0249:50			14.375 <i>27 min after F.P. out</i>
0250:15		<i>4</i>	14.39 <i>11 psig surge.</i>
0251:15			14.395
0252:00	$B_1 = .0044$		14.405
0253:05			14.412
0254:00			14.425
0254:55			14.438
0255:40			14.465
0256:05	$B_1 = .0045$		14.495
0301:20	$B_1 = .0044$		14.51
0302:30			14.50 14.52
0302:30	$B_1 = .0047$		14.562
0305:00	$B_1 = .0047$		14.58
0306:00			14.60
0306:50	$B_1 = .0046$		14.62
0309:10	$B_1 = .0045$		14.662 ←
0310:30			14.688
0312:10			14.72

0312:30	$B_1 = .0045$	Rod	14.74
0313:45			14.76
0316:55	$B_1 = .0046$		14.79
0319:05	$B_1 = .0046$		14.82
0320:20	$B_1 = .0046$		14.86
0321:45			14.899
0322:30			14.931
0325:20	$B_1 = .0047$		14.969
0327:40	$B_1 = .0047$		15.02
0329:20			15.07
0331:40			15.12
0333:55	$B_1 = .0047$		15.17
0336:35	$B_1 = .0046$		15.23
0337:40			15.27
0339:40			15.312
0341:00			15.35
0342:50			15.365
0343:45			15.425
0345:00			15.44
0346:25			15.48
0346:45			15.502
0347:15			15.54
0347:30	$B_1 = .0049$		15.60 rising
0351:30			15.63
0352:45			15.645

0353:20			15.672
0353:30			15.705 15.706
0354:00			15.76
0355:00			15.782
0355:30			15.81
0356:20			15.823
0356:45			15.85
0357:10			15.90
0357:40			15.922
0357:55			15.935
0358:50			15.96
0400:00	$B_1 = .0048$		15.995 10.5 lbs in samp.
0401:40			16.04
0402:35			16.095
0403:55			16.13
0404:15			16.17
0405:10			16.248
0405:35			16.378
0406:10			16.28
0408:30			16.32
0411			

Source full out
 $B_1 = .0047$
 Source in light on at source out position
 no apparent effect on instruments.

0412

0412 Rod full out

0422:00 $B_1 = 1.0048$ R 17.29

0424:16 17.40

0424:40 17.54

0425:10 17.745

0427:35 17.98

0432:00 Inserted Rod to midplane
adjusted variable probe until
above fuel to $10 \frac{7}{8}$ or $1 \frac{1}{2}$ below fill probe.

0436 Inserted source & refilled to
fill probe

0445 at fill probe sump pressure 11.2 lbs.

0449 off fill probe

0452 with dew source to mid position

0504 Rod at 14.33

0509 Rod still at 14.33

Reactor ^{on} 97.7 sec period at 9.84
Rod at 15.2-

CRITICAL POSITIONS		
CA	29	Expr 2 Run 2
Probe Pos.		I T
Control Rod		Channel
14.27	A 76.5	$\frac{1000}{200}$
	B .051	?
	C 3.4	5×10^{-9}
	D 68.5	$\frac{1000}{1000}$
	E 3.7	750V
Tim Crit.	2:34	AM PMA Duration 2 hr at .0046 min.

5:00 A.M.

5:11 A Reactor down
& started raising temp. of Be & fuel.

Midplane position of rod still .30

CA. 24	Expr. 3	Run 1
Sheet	Date 25 Aug 1955	Time 10:06 AM
Purpose Mixing Cycle to achieve uniform temperature distribution (1 Mix)		

10:18:00 On Fill probe 11.2 lbs sump pressure.
still $1\frac{1}{2}$ " between fill probe & variable probe

10:20:30 Off Fill probe

11:10 A. Fuel dumped.

12:15 V.P. moved to $12\frac{3}{8}$ " and should now be at same height as F.P.

C.A. 24	Expr. 4	Run 1
Sheet	Date 25 Aug 1955	Time 2:31 PM

Purpose To adjust probe levels.
Run 1 - to get V.P. and F.P. at same level.

2:56:25 F.P. on at 11.1 lbs sump pressure

2:56:35 V.P. on " " " " "

2:59:44 V.P. out

3:04:02 F.P. out

3:07 Lowered V.P. slightly. Attempting to get both probe lights to go on together. Both probes on.

3:09:15 F.P. out

3:07:40 V.P. out

3:10: Increased pressure

3:14:43 F.P. on

3:18: V.P. on

3:18:04 F.P. off

3:19:12 V.P. off

3:27 Both probes on at 11.0+ lbs pressure

3:29:19 V.P. out

3:30:09 F.P. out

3:57 P.M. F.P. on V.P. out flow rate at 4.1

4:11:51

4:17:03 V.P. out

4:17:40 F.P. out rate too low

64
25th Aug. 55

5:27 PM. V.P. set. $\frac{1}{8}$ " above F.P.

5:33:12 V.P. & F.P. on; flow gage then set at 3.6

5:34 Rod at mid-plane 000.302

5:35 Started to withdraw rod.

CRITICAL POSITIONS

C.A. 24 Expr. 5 ~~6~~ Run 1

Pos. _____

Code of Rod _____

Class _____

1 15.815 at 6:03 PM
and both probes lit

A. 70

$\frac{100}{200}$

2 _____

B. .0048

3 _____

C. 4.0

5×10^{-10}

4 _____

D. 76

$\frac{1000}{100}$

E. 1.2

900

Tim Crit. 5:52

~~PM~~ **PM**

Duration _____

min.

C.A. 24 Expr. 5 Run 1

Sheet _____

Date 25 Aug

1955

Time 5:25

~~PM~~ **PM**

Purpose Set V.P. at same settings as 24-1-14

to check temp coefficient and

pressure drop. Temp had been approx 25°
1200 to 1225.

5:53:15	V.P. out	
6:02:03	V.P. on at 11.05 lbr sump pressure.	
6:05:05	V.P. out	
	Rod positions	Pg 54
6:05:05	15.015	11:22:15 VP out
6:06	15.035	11:33:20 FP out
6:07	15.074	11:54 CRod 14.360
6:08	15.096	
6:09	"	
6:10	"	
6:11	"	
6:12	15.120	
6:13	15.147	
6:13:35	F.P. out	8:34 min to drop $\frac{1}{8}$ " (stop clock)
6:14	15.182	
6:15	"	
6:16	15.210	
6:17	"	
6:18	"	
6:19	"	
6:20	15.228	first temp. readings
6:21	15.228	
6:22	15.352	
6:23	"	
6:24	15.379	
6:25	15.379	

time	rod	
6:26	15.379	
6:26:15	15.410	
6:27	15.445	
6:28	15.450	
6:29	15.500	
6:30	15.500	
6:31	15.500	
6:32	15.545	
6:33	15.595	
6:34	15.620	2 1/2 min. after F.P. out 24-1-14 rod at 14.36
6:35	15.662	B ₁ at .0048 — pressure 10.8 pencil line.
6:36	15.704	
6:37	"	
6:38	15.756	
6:39	15.798	
6:40	"	
6:41	15.852	
6:42		<p>Raise rod - positive period. 128 sec = 8 ft 3.66 inches on rod Rod out 19.510 pressure 10.8 B₁ ↑ to .032 rod driven to mid- position 000.296 & source in.</p>
6:50		400 m/h at mid plane of sump
7:12		150 m/h at " " " "
7:42		70 m/h " " " "

Pressure $\approx .1177$ #/in fuel ht.
 Hydrostatic pressure of reactor to "fill probe" (71") = 4.826 # 67
 11.25 # ≈ 95.9 " of fuel height.

C.A.	24	Expr.	6	Run	1
Sheet		Date	25 Aug 1955	Time	8:50 PM
Purpose	To check and adjust pressure regulator and flow gauges. Check Hg manometer.				

10: (lbs/in²) (2.036) = in of Hg. gage pressure.
 Sump pressure at 11.05 lbs = 21.84" Hg.

10:48 F.P. on 21.84" Hg = 10.75 lbs (by equation)
 V.P. adjusted to about $\frac{1}{32}$ to $\frac{1}{16}$ above F.P.
 Both probes on.

11:04:34 V.P. out

11:22:30 F.P. off. By adjusting valves to increase pressure on moderator. This may have caused pressure to drop to sump causing F.P. to go off. Moderator at 10 #

11:32 F.P. on

Rod at 000.295 mid-position

CRITICAL POSITIONS

C.A. 24 Expr 6 Run 1

Table Pos _____

Control Rod	Chan.
12:02 → 15.648 and staying fairly constant	A 64 $\frac{100}{50}$
	B .001
	C 5.6 $\frac{100}{10}$
	D 80 $\frac{100}{200}$
	E .5 $\frac{100}{900}$

Tim Crit. 11:52 ~~AM~~ PM Duration _____ min.

TIME	ROD
12:04	15.615 15.615
12:05	15.590
12:06	15.556
12:07	15.580
12:08:30	15.588
12:09	15.602
12:14	15.602
12:15	15.628
12:19	15.628

26 Aug 55
 0023 12:02:50 on variable probe pressure controller adjusted to decrease pressure.
 0024 v. p. off

as a result of pressure change Instrument level dropped, Rod adjusted to maintain constant levels.

0026	Rod at	15.662	
0029		15.681	
0030		15.70	
0033		15.70	
0037		15.72	
0039		15.739	
0044		15.739	off Fill probe

	Counter #		Rod	notes
	R	I		
00:36	55	118	15.72	
00:40	56	43	15.739	
00:41	56	74	15.739	
00:42	55	172	15.739	
00:43½	55	159	15.739	
00:45	56	152	15.739	
00:47	55	60	15.739	
00:48	56	99	15.739	
00:49½	56	45	15.739	
00:51	56	76	15.739	
00:53	56	79	15.739	
00:57	54	244	15.76	

pressure regulator adjusted to raise

	R.	F	Kod
01:00	56	5	15.760
01:02	56	38	15.760
01:03	55	128	15.760
01:04½	56	23	15.760
01:06	56	50	15.760
01:07½	56	2	15.760
01:09	56	37	15.760
01:11½	56	98	15.760
01:13	55	212	15.760
01:16	56	197	15.760
01:19½	58	44	15.760
01:21	57	162	15.760
01:22½	58	203	15.760
01:24½			15.739
01:26	57	201	15.739
01:27½	58	111	15.739
01:29	57	237	15.739
01:31	57	237	15.739
01:32½	58	31	15.739
01:34	57	115	15.739
01:35½	56	136	15.739
01:37	57	61	15.739
01:38½	57	125	15.739
01:41½	57	32	15.739

Pressure regulator adjusted to raise again

Fill probe on

Run	7
Date	26 Aug 1955
Purpose	Check Effect of Source and Rod Calibration

	R	I	Kod	
01:43	56	58	15.739	
01:44½	56	162	15.739	
01:48	56	87	15.739	Source removed Full out
01:50	55	11	15.739	
01:51½	53	296	15.739	
01:54½	59	149	15.771	
01:56:20		on variable probe		pressure regulator adjusted to lower
01:57	53	209	15.771	
01:59	54	101	15.799	
02:00½	53	131	15.799	
02:02	52	131	15.799	B ₁ = .00086
02:08½		trying to determine effect of source in out position or power level instruments	15.872	B ₁ = .00205
02:12	124	209	15.798	pressure regulator adjusted again to lower.
02:14	122	182	15.798	
02:16	121	63	15.823	B ₁ = .002
02:17½	120	125	15.823	
02:19½	121	186	15.870	B ₁ = .002
02:21	122	39	15.870	Pressure regulator adjusted again to lower
02:22½	122	102	15.870	
02:24	124	191	15.870	off variable probe P.R. adjusted slightly to raise
02:25		Source dropped to out position		

	R	I	Rod	
02:26 $\frac{1}{2}$	126	131	15.870	$\beta_1 = \frac{.00210}{.00205}$
02:28 $\frac{1}{2}$	130	41	15.800	
02:30	127	133	15.800	
02:32	128	116	15.800	$\beta_1 = .00210$
02:34 $\frac{1}{2}$	129	155	15.800	
02:45 $\frac{1}{2}$	308	130	15.807	$\beta_1 = .005$
02:49	302	152	15.807	
02:51	289	179	15.835	
02:53 $\frac{1}{2}$	292	164	15.860	$\beta_1 = .0048$
02:55	289	254	15.860	
02:56 $\frac{1}{2}$	290	3	15.860	same full out
02:59 $\frac{1}{2}$	293	118	15.860	
03:02	291	39	15.860	
03:05	Drove rod in to reduce level for period measurement shld be 19.55 * 19.55			
03:12	Drove rod all the way out (19.604) - reactor rising on 116 sec. period relevelled at 16.01 (approx 8.6 ft)			
03:19	on variable probe p.k. adjusted to			
Note approx. 0.1% timer accuracy.				raise
03:25 $\frac{1}{2}$	207	206	15.91	15.960 A 71.2 at $\frac{1000}{200}$ D 74.3 at $\frac{1000}{1000}$
03:28	204	147	15.93	15.980 $\beta_1 = .047$ C 3.825 x 10 E 9.0 250
03:30	200	119	15.96	16.010
03:32	204	81	15.96	16.010 $\beta_1 = .048$
03:33 $\frac{1}{2}$	204	109	15.96	16.010 p.k. adjusted to lower.
03:35	199	204	15.96	16.010

03:39 P.R. adjusted to raise.
 on variable probe
 03:44 R.R. adjusted to lower Hg level 28.4 inches
 03:48 off variable probe pressure adjusted to raise

Inserted rod to lower level for period measurement.

17.95
 Drove rod out to 18.00 inches
 reactor rising on 165 sec period (6.54) Relevelled at 16.03 ^{15.98}

04:04½	202	20	16.01	16.06	A = 70.5	$\frac{1000}{200}$
04:06½	200	253	15.96	16.010	D = 73.5	$\frac{1000}{1000}$
04:08	199	178	15.96	16.010	B ₁ = .047	
04:09½	193	232	15.96	16.010	C = 3.8	5×10^{-9}
04:11	189	128	15.963	16.033	E = 4.1	750V
04:13	187	80	"	16.033		
04:14½	186	60	"	16.033		
04:17	186	46	"	16.033		

Inserted rod to lower level for period measurement
 Drove rod out to 18.95 inches reactor rising
 on 130 sec period (approx 7.94) Relevelled at

04:42	177	200	corrected rod position 16.003	16.053	A = 71.5	$\frac{1000}{200}$
04:44½	178	125	16.003	16.053	D = 74.3	$\frac{1000}{1000}$
04:45	180	39	16.003 16.019	16.069	B ₁ = .048	
					C = 3.8	5×10^{-9}
					E = 4.2	750V

rod @ MP @ 000.35
 changed back to 000.30

06:00 Lowered variable probe to $\frac{1}{2}$ below fill probe
 In order for level to reach v.l. had to
~~go~~ ^{fill} ~~went~~ from dump to fill ~~to dump~~. Hg level
 Raised pressure by adjusting P.R. Hg level
 at variable probe 21.71 in Hg.
 Closed off regulator system until variable
 probe went out. Opened up at that time.

On 25 Aug 1955 fuel level dropped at
 approximate rate of .0119 in/min. On this basis
 when fuel level was $\frac{1}{2}$ " below fill probe
 Rod was between 14.662 and 14.688. $B = .0045$
 Now attempting to reproduce that condition at
 50°C higher temperature Rod full out @ 19.55
 leveled at Rod = 17.148 ^{17.10} $B_1 = .0042$

$$A = 67.5 \quad \frac{100}{200}$$

$$D = 75 \quad \frac{1000}{100}$$

$$C = 4.1 \quad \times 5 \times 10^{-10}$$

$$E = 1.6 \quad @ 900V$$

Selsyn probably slipped above

0550 Rod in to drop power level

0600 Raised level to fill probe

0612 Raised B_1 to .0045 (Rod may have jumped
 again)

Source out

Will try to reproduce red position vs
liquid level curve of 25 Aug 1955

06:16	On Fill probe		
06:16:15	off fill probe	15.85	
06:17:00		16.025	
06:17:20		16.08	
06:17:30		16.119	$B_1 = .0043^{0.42}$
06:20:30		16.155	
06:22:45		16.199	$B_1 = .0040$
06:23:30		16.265	$B_1 = .0040$
06:26:00		16.310	
06:26:45		16.37	
06:27:30		16.41	
06:30:30		16.465	$B_1 = .0040$
06:31:15		16.509	$B_1 = .0041$
06:33:00		16.542	
06:33:45		16.579	
06:34:20		16.65	$B_1 = .0041$
06:36:45		16.699	
06:37:00		16.715	
06:37:30		16.739	
06:38:00		16.782	$B_1 = .0040$
06:38:30		16.828	
06:39:00		16.870	

All values should be adjusted by 4.05

Should be adjusted 1.0%

06:40:40	16.910	$B_1 = .0040$
06:41:30	16.950	
06:42:00	16.982	
06:43:00	17.032	
06:43:30	17.093	
06:44:00	17.172	
06:44:30	off variable probe	21.5
6:46	rod in, source in, dump.	

Changed Mid plane position of Rod to 0.030
From 0.025

08:15 Enricher turned 0.6 to $\frac{28.8}{27.8}$

CA 24	Expr. 7	Run 2
Sheet	Date 26 Aug 1955	Time 8:50 AM
Purpose Mixing cycle of Rod		
Calibration		
6 th addition from enricher		
1 st " " 1 st critical pt.		

0930 Mixed 15 times max sump pressure 8 lbs.
Variable probe set back to approx $\frac{1}{32}$ "
~~below~~ ^{above} fill probe.

approx 6.33 wt% U

10:20 Filling reactor

10:34 on fill probe Hg pressure 22.1 in Hg.
11.2 lbs gauge.

went up on 66.8 sec period 16.03 Rod position

CRITICAL POSITIONS			
CA. 29	Expr. 7	Run 2	
Table Pos.			
Control Rod		Channel	
1 14.13	A 69.5	$\frac{1000}{200}$	
Hg hgt. 21.9	B .040		
Sump pressure 11.1	C 3.8	5×10^{-9}	
4	D 71.5	$\frac{1000}{1000}$	
	E 4.8	750V	
Tim Crit. 9:10:50 PM ^{AM}	Duration 35	min.	

~~12.6~~
13.24

11:25 lance full out. no change in ^{power} any channel

11:30 Rod at midplane to drop level

11:45 Raising on 71.66 sec period equivalent to ^{12.4} ~~12.6~~ Rod at 16.03

$$\frac{16.03}{1.90} \text{ "rod"} = 12.6 \text{ \& } \text{ due to approx. } 100 \text{ gm U}$$

CRITICAL POSITIONS

C.A. _____ Expr. _____ Run _____

Table Pos. _____ I _____ T _____ R _____

Control Rod	Channel
1. 14.25	A. 71 $\frac{1000}{200}$
Height 21.9	B. 1090
2. Sun pressure 11.1	C. 3.8 5×10^{-9}
4. _____	D. 73.5 $\frac{1000}{1000}$
	E. 5.1 750

Tim Crit. 11.45 ^{AM}/_{PM} Duration _____ min.

Fill probe ~~off~~ on v.p. ~~off~~ during run

CRITICAL POSITIONS

C.A. 24 Expr. 7 Run 3

Table Pos. _____ I _____ T _____ R _____

Control Rod	Channel
1. 17.155	A. 70 $\frac{1000}{200}$
2. _____	B. 048
3. _____	C. 76 $2.5 \cdot 10^{-9}$
4. _____	D. 72 $\frac{1000}{1000}$
	E. 52 750

Tim Crit. _____ ^{AM}/_{PM} Duration _____ min.

C.A. 24 Expr. 7 Run 3

Sheet _____ Date 26 Aug 1955 Time 12:30 PM

Purpose Repeat run 2. V.P. $\frac{1}{32}$ to $\frac{1}{16}$ above F.P.

Pressure 21.86 Hg $\frac{1}{16}$ # gage
 Placed rod at 16.03 ~~and got a 71.6 sec period~~ ~~and got a 71.6 sec period~~ ~~and got a 71.6 sec period~~
~~and got a 71.6 sec period~~ and got a 71.6 sec period ~~and got a 71.6 sec period~~ 12.5 $\frac{1}{16}$
 Then leveled at 14.155

CRITICAL POSITIONS

C.A. 24 Expr. 7 Run 3

Table Pos. _____ I _____ T _____ R _____

Control Rod	Channel
1. 17.155	A. 70 $\frac{1000}{200}$
2. _____	B. 048
3. _____	C. 76 $2.5 \cdot 10^{-9}$
4. _____	D. 72 $\frac{1000}{1000}$
	E. 52 750

Tim Crit. 12:35 ^{AM}/_{PM} Duration _____ min.

13:05

~~Withdrew rod~~
 Level still constant - rod at 14.155

13:08:07 F.P. out

13:20 Inserted rod to 9.855 to reduce level.
 Inserted source to "yellow light on".

13:25 Rod in at .308 source out

13:40 Source IN (red light position)

13:45 V.P. was moved from approx. $\frac{1}{32}$ to $\frac{1}{16}$
 above F.P. to 1" below fill probe
 (approx. top of Be).

13:55 Increase pressure in sump - selector on fill position.

14:10 Pressure at 11. # gage = 21.8 " Hg.

14:27:15 V.P. on 21.82 " Hg and 11.0 # gage.
 Keep adjusting control valve "more restrictive"
 to obtain a "feel" for it and try to keep
 V.P. light just on.

C.A. 24 Expt. 7 Run 4
 Sheet _____ Date 26 Aug 1955 Time 16:30 PM
 Purpose Check rod position Vs pressure level. Effect of source position from out to full out

V.P. still at top of Be or 1" below F.P.
 Pressure at 11.0 lbs gage 21.67 " Hg (top)

CRITICAL POSITIONS

C.A. 24 Expt. 7 Run 4

Control Rod	Clear
source out - 15.460	A .66 $\frac{1000}{50}$
source full out 15.460	B .0105
	C .46 $\frac{1000}{200}$
	D .85 $\frac{1000}{200}$
	E .64 750

Tim Crit. 16:45 PM Duration _____ min.

17:23 Rod 15.46

17:28 V.P. on Rod at 15.43

17:35 Rod at 15.43

17:42 Rod at 15.392

18:10 Rod at 15.410
 18:10 Closed valve on down stream side of pressure regulator valve. Neutron level began to drop.
 18:12:30 V.P. off 21.63" Hg
 18:16 Open valve on down stream side of pressure regulator valve. Neutron level rises slightly & then leveled off!
 18:18:15 V.P. on
 18:20 Source moved from full out to out.
 18:21 Rod at mid plane 1.307

C.A. 24 Expt. 8 Run 1
 Sheet _____ Date 26 Aug 1955 Time _____ AM/PM
 Purpose Mix cycle & rod calibration.
7th addition from puricker.

18:25 Raised V.P. to $\approx \frac{1}{32}$ " above F.P.

C.A. 24 Expt. 7 Run 5
 Sheet _____ Date 26 Aug 1955 Time 18:30 ~~PM~~
 Purpose Repeat run 3. V.P. $\frac{1}{32}$ above F.P.

1835 FP on
 1843 VP on Pressure 22.05" Hg & 11.2 lb/gage.
 1845 VP on
 1846 VP off
 1846:30 VP on
 1848 VP off

CRITICAL POSITIONS

C.A. 24 Expt. 7 Run 5
 Table Pos. _____

	Control Rod	Count
level	14.06 at 19:15	79 $\frac{1000}{200}$
1	14.08 at 18:15	
2	16.03 on period	.0049
3	21.96" Hg	7.9 2.5×10^{-9}
4	14.07 at 1940	75 $\frac{1000}{1000}$
		E. 5.9 7.50

Tim Crit. 18:15 ~~PM~~ Duration 1:25
85 min.

19:15
 FP on
 VP off

1945 Dumped.

approx 6.35% wt % U

CA 24	Exp. 7	Run 6
Sheet	Date 26 Aug 1955	Time 1950 PM
Purpose Mixing cycle & rod calibration.		
7th addition from enricher		
2nd 100 gm addition.		

Enricher position: - moved down by 0.6 turns \approx 100 gm. U
 Found turned to returned to
 0027.8 0029.4 00284

2120 F.P. on Hg at 22.05" ; gage at 11.2

Rod at 14.07 gave 72.8 sec positive period
 that equals 12.3 ϕ
 Levelled at 12.868

2132:10 V.P. on out at 2134
 2134:30 Rod at 14.070 22.01 # Hz.

$\frac{14.070}{12.868} = 1.202$ inches of rod \approx 100 gm U

CRITICAL POSITIONS			
CA 24	Exp 7	Run 6	
14.07	72.8 sec	72	100/200
12.868	levelled	0.047	
	at 20.04 Hz	5.6 7.6	2.5×10^{-9}
		D. 77	$\frac{1000}{1000}$
		E. 5.7	750w
Tim Crit.	2130	AM	Duration min.

21:50 with B₁ at .05

A 20	inset/h	n	door in hallway
48	inset/h	y	" " "
38	"	y	outside of south wall 8' from ground
10	"	y	" " " at "
.3	inset/h	n	" " " 8 " "
.1	"	"	" " " at "
200	inset/h	y	thru large freight door
220	"	y	open " "
13	inset/h	n	" large freight door
20	"	"	open " "

No significant readings at guard shack at 1850.

2209 Rod in 0.302

2237 Rod at 14.070 gave ^{81.3}~~76~~ sec period = 11.35¢

2243 Levelled at 12.870
B₁ = .05 21.92 " Hg

2304 Rod at 12.860

2305 Rod at 12.867

2306 Rod at mid plane 0.300

2320 Start withdrawing rod, 21.91" Hg, source in.

2328:20 source out

2330:00 Rod at 14.070, 74 sec period = 12.2 ¢

2144 when level Levelled at 12.864 B₁ = .048 21.92 " Hg.

2134 Rod-12.890

2170 12.877

2350 Rod at 12.870 then inserted to mid-position 0.305, source in.

27 Aug 1955
CA 24-7-6

0008 Start withdrawing rod

0013 source out

0015 Rod at 14.07

0019 Start leveling

0030 Rod 14.07 gave 76 sec period = 11.9 ¢
levelled at 12.870 B₁ = .048 21.92 " Hg.

0032 Rod at 12.878

0033:30 " " 12.860

0040 " " 12.870

0045 Dumped -

INSTRUMENT CHECK						
Time	AM PM	Source				
		Channel				
		A	B	C	D	E
Range		1000	OK	1000	1000	910
Source Dist.		10"	↓	12"	36"	6"
% F.S. Trip		90	↓	100+	80	100+
Counters #1, 2, 3 OK						

CA. 24	Expr. 8	Run 1
Sheet _____	Date 28 Aug 1955	Time 10:25 AM
Purpose Temperature vs. Reactivity @ 1300°F		

10:57:45 On variable probe Hot Hg 21.78 in.
 11:07:30 off variable probe

Rod reading 0.030 before withdrawal
 Reactor rising with rod at 17.906
 89.6 sec ~ 10.9¢
 relevelled at 15.239

Rod inserted to mid plane 0.030 preparation
 to checking reproducibility of period measurement

12:19 Reactor rising on a period of 85.7 sec ~ 10.8¢
 with rod at 17.906. Relevelled at 15.24¢

12:36 Rod reading at midplane 0.0298 Reactor level
 reduced for 3rd check of period.
 Reactor rising on with rod at 17.906
 Period 89.3 sec 11.0 ¢
 relevelled at 15.247

CRITICAL POSITIONS			
CA. 24	Expr. 8	Run 1	
Table Pos.	T	T	S
Control Rod	Channel		
Rod 15.247	A 91.3	1000/200	
Pressure 21.67 in. Hg	B .052		
3	C 44.3	5 x 10 ⁻⁹	
4	D 79.5	1000/1000	
	E 4.2	750	
Tim Crit. 11:00	AM	Duration	min.

13:09 Level reduced, rod at midplane 0.0298
 Reading Thermocouples

Couple	Temp	Couple	Temp
59A	1292	59D	1263
60A	1300	61D	1297
58A	1290	60D	1284
61A	1282	X 54 S ₁	1299
59B	1303	X 53 S ₁	1301
60B	1289	X 52	1303
61B	1309	X 56	1307
58B	1265	28	1291
		X 29 ₁	1295
		29 ₂	1290
		29 ₃	1296

couple	Temp
+57	1301
52S ₁	1301
54	1305
53	1304
60C	1299
61C	1286
58C	1255
28	1294

Variable probe 8" below fill probe 1300
 X Variable probe 4" below fill probe 1299

29 Aug 1955

INSTRUMENT CHECK					
Time	8:50 AM		Source		
	Channel				
	A	B	C	D	E
Range	$\frac{10}{1000}$	OK	10^{-10}	$\frac{10}{1000}$	756
Source Dist.	12"		18"	48"	21"
% F.S. Trip	90		100+	85	100+
Counters	1, 2, 3 - OK				

Rod at midplane at 000.313

C.A. 24	Expr. 9	Run 1
Sheet	Date 29 Aug 1955	Time 1420 ^{AM} PM
Purpose Differential Temp. Measurements between Fuel and Be vs change in reactivity		

Variable probe set 8" below fill probe.

Fuel (~1300°F) inserted into reactor (~1200°F)
 Reactor made critical at $B_1 = .05$ and then the level maintained by inserting rod.

CRITICAL POSITIONS

C.A. 24 Expr. 9 Run 1

Table Pos. _____

Control Rod	Channel
rod - <u>12.810</u>	A <u>99</u> <u>1000/200</u>
press. <u>21.90"</u> <u>11.1psi</u>	B <u>.05</u>
3 _____	C <u>4.4</u> <u>5 x 10⁻⁹</u>
4 _____	D <u>81.5</u> <u>1000/1000</u>
	E <u>6.9</u> <u>750 V</u>

Tim Crit. 2:35 Duration 70 min.

C.A. 24 Expr. 9 Run 2

Sheet _____ Date 29 Aug 1955 Time 2:30 PM

Purpose: Differential temperature measurements between fuel & Be vs change in reactivity.

CRITICAL POSITIONS

C.A. 24 Expr. 9 Run 2

Table Pos. _____

Control Rod	Channel
rod - <u>12.808</u>	A <u>35.5</u> <u>1000/500</u>
<u>21.87" Hg</u>	B <u>.05</u>
3 _____	C <u>6.8</u> <u>5 x 10⁻⁹</u>
4 _____	D <u>80.5</u> <u>1000/1000</u>
	E <u>7.5</u> <u>750</u>

Tim Crit. 2:45 ~~AM~~ PM Duration 76 min.

30 Aug 1955

C.A. 24 Expr. 10 Run 1
 Sheet _____ Date 30 Aug 1955 Time 11:10 ~~AM~~ ~~PM~~
 Purpose Raise Fuel to equilibrate
reflector & Island Temperature
Fuel reactor at 1250°F

- ~ 1135 On fill probe at 22.0" Hg
- 1132 Fuel Dumped.
- 1135 Fuel Raised to fill probe 22.0" Hg
- 1245 Fuel Dumped.
- 1340 Fuel & Reactor at approx. 1250°

INSTRUMENT CHECK

Time <u>1:41</u> AM PM	Source _____				
	Channel				
	A	B	C	D	E
Range	$\frac{10}{1000}$	OK	10^{-10}	$\frac{10}{1000}$	900V
Source Dist.	12"	↓	18"	30"	10"
% F.S. Trip Counter	100	↓	100+	100	100+

Counter 1, 2, 3 OK

Midplane position 000, 335

C.A. 24 Expr. 10 Run 2
 Sheet _____ Date 30 Aug 1955 Time 1:50 ~~AM~~ ~~PM~~
 Purpose Determination of Slow Temp
Coefficient,
1250°F

Variable probe $\frac{1}{2}$ " above fill probe?

- 1:54:30 P on fill probe & variable probe
- 1:58 P off fill probe.
- 2:00 P Dump - fuel too cold.

C.A. 24 Expr. 10 Run 3
 Sheet _____ Date 30 Aug 1955 Time 3:00 ~~AM~~ ~~PM~~
 Purpose Raise fuel to equilibrate
temperatures.
1250°F

Mixed at intervals

CA. 24	Expr. 10	Run 4
Sheet	Date 30 Aug 1955	Time 3:20 AM PM
Purpose Determination of Slow Temperature		
Coefficient		
1250°F		

Midplane pos. 000.335

3:23:00

on both probes 22.0" Hg 11.1 ps.ig. sung.
 Reactor up on 104 sec. period ~ 9.4 φ with
 rod at 14.573. leveled at 13.496

Midplane pos. 000.332

During the above run the variable
 probe was slightly ~~above~~ below the fill probe.

4:00 Adjusted variable probe so it is slightly
 higher than fill probe.

4:10 Reactor rising with rod at 14.574
 period 108.6 sec = 9.0 φ

4:16 variable probe on. 21.92" Hg

4:19 off V.P.

4:32 source full out

4:35 Rod at 13.530; ~~not change~~.

4:34:40 V.P. on

CRITICAL POSITIONS			
CA. 24	Expr. 10	Run 4	
<hr/>			
Rod Pos.			
1 14.574 gaul	A 84	$\frac{1000}{200}$	
2 108.6 sec period	B 0.05		
3 Leveled at 13.496 13.530	C 7.0		
4 21.92" Hg	D 75.5	$\frac{1000}{1000}$	
	E 6.0	750	
<hr/>			
Tim Crit. 4:05	AM PM	Duration	min.

C.A. 24 Expr. 10 Run 5
 Sheet _____ Date 30 Aug 1955 Time 1745 ^{AM} PM
 Purpose Repeat run #4.
Channel "c" out of circuit.
1250°F

1747 Control rod mid position 0.335
 1748 Source in
 1749 F.P. on
 1750 F.P. off
 1751 F.P. on source out
 1753:30 Rod at 14.574 period 130 sec = 7.9 #
 Levelled with rod at 13.633 $B_1 = .048$
 1755 22.01" Hg.
 1807 Rod at 13.62 $B_1 = .048$ 21.95" Hg.

CRITICAL POSITIONS

C.A. 24 Expr. 10 Run 5

Control Rod	Channel
1 14.574 gave 151 sec period leveled	A 81 $\frac{1000}{200}$
2 at 13.736	B .048
3 with 21.91" Hg.	C out
4	D 73.5 $\frac{1000}{1000}$
	E 5.8 750

Tim Crit. 1753 ^{PM} Duration 50 min.

C.A. 24 Expr. 10 Run 6
 Sheet _____ Date 30 Aug 1955 Time 2005 ^{PM} ~~182~~
 Purpose Repeat run #4.
Channel C out of circuit
1250°F

2000 ~~1800~~ Control rod mid position 0.332
 2005 21.77" Hg. source out
 2005 Rod 14.573 period 151 sec = 7.0 #
 2010 Start leveling.
 2027 Levelled at 13.736 $B_1 = .048$ 21.78" Hg.
 2033 source full out.

CRITICAL POSITIONS

C.A. 24 Expr. 10 Run 6

Control Rod	Channel
1 14.573 gave 151 sec period leveled	A 85 $\frac{1000}{200}$
2 at 13.736	B .048
3 with 21.78" Hg.	C out
4	D 76.5 $\frac{1000}{1000}$
	E 69 750

Tim Crit. 2005 ^{PM} Duration 35 min.

2036 Rod drop. Rod at 13.736 = 6.27

31 Aug 1955

INSTRUMENT CHECK *Y on E*

Time 9:00 ~~AM~~ ~~PM~~ Source PN 123

Range	Channel				
	A	B	C	D	E
	$\frac{10}{1000}$	OK	10	$\frac{10}{1000}$	950V
Source Dist.	18"	↓	24"	36"	5"
% F.S. Trip	80	↓	98	77	100+
Counters	1,2,3,	OK			

Midplane position of rod 000.340

C.A. 24 Expr. 11 Run 1

Sheet _____ Date 31 Aug 1955 Time 9:55 ~~AM~~ ~~PM~~

Purpose Check temp difference between Fuel & reactor.
approx 1200°F

C.A. 24 Expr. 11 Run 2

Sheet _____ Date 31 Aug 1955 Time 10:56 ~~AM~~ ~~PM~~

Purpose Check ability to maintain fuel level constant.
approx 1200°F

10:48 on ^{Variable} Fill probe & fill probe

10:57:00 off Fill probe 11.2 psig on sump.

10:57:30 off variable probe.

Variable probe adjusted $\frac{1}{32} - \frac{1}{16}$ " up.

C.A. 24 Expr. 12 Run 1

Sheet _____ Date 31 Aug 1955 Time 11:42 ~~AM~~ ~~PM~~

Purpose Check joint on Rod
Calibration at 1200°F

Went up on 10.9
86.86 second period ~ 70% ϕ with rod
at 13.202. Rerouted with rod at 12:218

CRITICAL POSITIONS

C.A. 24 Expr. 12 Run 1

Table Pos. _____ L _____ T _____ R _____

Control Rod	Channel
1 12:218	A 86.5 $\frac{1000}{200}$
Sump pressure 11.2 lbs	B .051
22.12" Hg	C 3.8 5×10^{-9}
	D 76.5 $\frac{1000}{1000}$
	E 7.3 750V

Tim Crit. 11:50 ~~AM~~ ~~PM~~ Duration 12 min.

Position of rod at midplane now 000.327

1200
Scott
Crosby
Lynn

C.A. 24 Expr. 12 Run 2
 Sheet _____ Date 31 Aug 1955 Time 1225 PM
 Purpose Check point on rod calibration
at 1200°F.

Screw tightened on yoke of control rod. May have changed rod position (readings) slightly.

1237

Source out

1237:30

Rod at 12.872 gave 124 sec period = 8.2 ϕ
 Levelled at 12.148 $B_1 = .05$ 22.13" Hg.

CRITICAL POSITIONS

C.A. 24 Expr. 12 Run 2

Control Rod	Channel
12.872 = 124 sec	A 85.5 $\frac{1000}{200}$
Levelled at 12.148	B .053
22.13" Hg.	C 7.8 2.5×10^{-9}
	D 77 $\frac{1000}{1000}$
	E 71 750

Tim Crit. 12:37 ^{AM}/_{PM} Duration 14 min.

C.A. 24 Expr. 12 Run 3
 Sheet _____ Date 31 Aug 1955 Time 1305 PM
 Purpose Repeat run 2
1200°F

mid. plane position - 0.315

1320

Source out

1320

Rod 12.870 115 sec = 8.7 ϕ
 Levelled ~~12.148~~ 12.136 $B_1 = .053$ 22.12" Hg
 11.2 # gage.

CRITICAL POSITIONS

C.A. 24 Expr. 12 Run 3

Control Rod	Channel
12.870 = sec	A 85 $\frac{1000}{200}$
12.148 level	B .053
22.12" Hg.	C 7.8 2.5×10^{-9}
	D 76 $\frac{1000}{1000}$
	E 72 750

Tim Crit. 13:20 ^{AM}/_{PM} Duration 18 min.

C.A. 24 Expr. 12 Run 4
 Sheet _____ Date 31 Aug 1955 Time 1400 ~~AM~~ PM
 Purpose Repeat run 2
1200 °F

rod mid position 0.315

Rod 12.870 sec = 106 9.24
 Levelled 12.132

CRITICAL POSITIONS			
C.A.	Expr.	Run	
24	12	4	
Control Rod		Channel	
1 12.870 = 196 Sec p.	A	82.5	$\frac{1000}{200}$
2 Levelled 12.132	E	.05	
3 $H_g = 22.12''$	C	7.5	2.5×10^{-9}
4	D	73.5	$\frac{1000}{1000}$
	E	6.7	750 V.
Tim Crit. <u>1410</u> AM PM	Duration	<u>16</u>	min.

C.A. 24 Expr. 12 Run 5
 Sheet _____ Date 31 Aug 1955 Time 1552 ~~AM~~ PM
 Purpose Repeat run 2
1200 °F

0.312 = Rod at midplane

Rod = 12.870 positive period = 113 Sec 8.84
 Levelled at = 12.086

Variable Probe 26.898 1197 °F

CRITICAL POSITIONS			
C.A.	Expr.	Run	
24	12	5	
Control Rod		Channel	
		84.5	$\frac{1000}{200}$
Level at <u>12.086</u>		.05	
$H_g = 22.15''$	C	7.9	2.5×10^{-9}
	D	74.5	$\frac{1000}{1000}$
	E	7.1	750 V.
Tim Crit. <u>1605</u> AM PM	Duration		min.

Fuel dumped and Raised V. Probe = 26.894
 1197 °F

C.A. 24 Expr. 7 Run 7
 Sheet Date 31 Aug 1955 Time 1730 PM
 Purpose Mixing cycle and rod calibration;
8th addition from enricher;
3rd 100 gm V addition, (?)
~~9th 100 gm V addition, (?)~~

run 6 on pg 84

Mixed 15 times. Max. sump pressure 8#. Variable probe about 1/32" above fill probe. Check ability to hold pressure constant.

1745

Rod at mid plane 0.312

1958

Withdraw rod

2007

F.P. on

2008

Source out

2009

Rod 12.102 - period too long ~ 1400 to 1600 sec.

CRITICAL POSITIONS		
A	Exp	Run
24	7	7
Control Rod		
1	12.028	85.5 $\frac{1000}{200}$
2		E .051
3		C 8.1 2.5×10^{-7}
4		D 78 $\frac{1000}{1500}$
		E 6.7 250
Time Crit.	2008 AM	Duration 40 min.

Difference in temp might account for the above period ~ 1/4

2045

Brought level to .05 and leveled with rod at 12.028

Do not believe fuel was added

V.P. 26.830

1194.2 °F

C.A. 24 Expr. 7 Run 8
 Sheet Date 31 Aug 1955 Time 2130 PM
 Purpose Mixing cycle + rod calibration
9th addition from enricher,
100 gm V addition (the hope)

Rod mid position 0.310

2247

Source out

2249

Rod 12.100 52.5 sec = 15.7 \$
 Leveled 10.998

CRITICAL POSITIONS		
CA 24	Expr 7	Run 8
Control Rod	Channel	
12,100 = 52,500	80.5	$\frac{1000}{200}$
Levelled at 10.99	.049	
Hg = 22.14"	C 7.7	2.5×10^{-9}
	D 72.5	$\frac{1000}{1000}$
	E 6.0	750
Tim Crit. 2247	AM	Duration 20 min.

1 Sept 1955

0020 Going up on 59.29 sec $\sim 14.4 \phi$ with rod at 12.028 relevelled with rod at 11.014.

Midplane position .310

0041 Going up on 59.29 sec period $\sim 14.4 \phi$ with rod at 12.027. Relevelled with rod at 11.007. $\beta_1 = .05$

01:15 Fuel addition from Enricher addition #10.

CA 24	Expr 7	Run 9
Sheet	Date 1 Sept 1955	Time 1:20 AM
Purpose <u>Mixing Cycle for 10th addition (100 gm U) & Rod calibration</u>		

Mixed 15 times
~~19th Sample extracted.~~
 gms in sampler
 gms in liner
 total extracted.

Midplane position of rod 000.310
 Going up on 17.55 sec period $\sim 9.9 \phi$
 with rod at 11.006. Relevelled at .05 with rod at 10.604.

CRITICAL POSITIONS		
CA 24	Expr 7	Run 9
Date Pos	L	T R
Control Rod	Channel	
10.604	A 86.5	$\frac{1000}{200}$
pressure in sump 11.3 lbs.	B .05	
22.27 in. Hg	C 3.9	5×10^{-9}
	D 78.3	$\frac{1000}{1000}$
	E 6.7	750V
Tim Crit. 02:18	AM	Duration 12 min.

02:00:00 on fill & variable probe @ 11.3 lbs.
 02:03:30 off variable probe

02:03:50 off fill probe.
 02:15:15 Fill probe on

C.A.	24	Expr.	7	Run	10
Sheet		Date	1 Sept 1955	Time	02:42 AM
Purpose	Mixing Cycle for 11 th addition for enricher & Rod Calibration				

Mixed 15 times

03:03:50 Midplane position of rod 000.308
 on fill probe
 03:03:50 on variable probe 22.29 in Hg 11.3 lbs

Going up on 126 sec period ~ 8.1 ϕ with rod at 10.604. Relevelled at .05 with rod at 10.116.

Coar. U 346.069 kg fuel 22.2177 kg U 20.7016 kg U²³⁵
 Con. fuel 349.364 " " 22.4292 " 20.8983 kg U²³⁵
 6.42% U 93.18% U²³⁵
 93.175%

Includes enricher additions 6 to 11 and 19th sample removal.

CRITICAL POSITIONS			
C.A.	24	Expr.	7
Run	10		
Control Rod		Chemical	
1	10.116	A	86 $\frac{1000}{200}$
2	pressure in sump 11.3 lbs	B	.05
3	22.13 in. Hg	C	3.8 5×10^{-9}
4		D	77.8 $\frac{1000}{1000}$
		E	6.8 750V
Tim Crit.	03:21 AM	Duration	12 min.

03:45 19th Sample removed
 630971
 2372.4 gms in sampler
 237 gms in liner
 2435.4971 total removed.
 6.42% wgt % U

C.A.	24	Expr.	7	Run	11
Sheet		Date	1 Sept 1955	Time	5:00 AM
Purpose	Rod Calibration				

Going up on 115 sec period ~ 8.25 ϕ with
rod at 10.604. Relevelled at .050 with rod
at 10.074

CRITICAL POSITIONS			
C.A. 24	Expr. 7	Run 11	
Table Pos.	L	T	R
Control Rod	Channel		
10.074	A 84.0	$\frac{1000}{200}$	
pressure in samp 11.2 lbs B .050			
22.19 in. Hg	C 3.8	5×10^{-9}	
	D 76	$\frac{1000}{1000}$	
	E 6.3	750V	
Tim Crit. 5:00	AM	Duration	min.

12th Rod drop from 10.074
addition

C.A. 24	Expr. 7	Run 12	
Sheet	Date 1 Sept 1955	Time 5:50	AM
Purpose Mixing Cycle after 12 th addition & Rod calibration			

Mixed 15 times

Midplane position of Rod 000.332

Went up on 112 sec period ~ 8.95 ϕ with
Rod at 10.075. Relevelled with
Rod at 9.561

CRITICAL POSITIONS			
C.A. 24	Expr. 7	Run 12	
Table Pos.	L	T	R
Control Rod	Channel		
9.561	A 85.5	$\frac{1000}{200}$	
pressure in samp 11.2 lbs B .050			
322.19 in Hg	C 3.4	5×10^{-5}	
	D 75	$\frac{1000}{1000}$	
	E 6.7	750	
Tim Crit. 5:20	AM	Duration	min.

C.A. 24 Expr. 7 Run 13
 Sheet _____ Date 1 Sept 1955 Time 0740 ^{AM}/_{PM}
 Purpose Repeat of 24.7.12
~ 1200°F

Reactor rising on 107 sec period ~ ϕ
 leveled 9.570

CRITICAL POSITIONS

C.A. 24 Expr. 7 Run 13
 Rod Pos. _____ L _____ T _____ P _____
 Control Rod Channel
 Rod 9.570 A 87 1000/200
 Press. 22.14 "Hg B .05
 C 4.0 5×10^{-9}
 D 78 1000/1000
 E 6.8 700 \checkmark
 Tim. Crt. 0750 ^{AM}/_{PM} Duration _____ min.

rod position 0.0325

C.A. 24 Expr. 7 Run 14
 Sheet _____ Date 1 Sept 1955 Time 8:22 ^{AM}/_{PM}
 Purpose Mixing Cycle for 13th
addition & Rod Calibration

Mixed 15 times
 no period, nothing added.

C.A. 24 Expr. 7 Run 15
 Sheet _____ Date 1 Sept 1955 Time 9:50 ^{AM}/_{PM}
 Purpose Mixing Cycle for 14th addition
& Rod calibration

Mixed Times
 Position of Rod at Midplane 0.0325

Going up on ^{45.6}~~59.7~~ sec period ~ ^{17.2}~~14.4~~ φ
 with rod at ^{9.572}~~15.72~~. Relevelled at .050
 with rod at ⁷⁴⁶ 8.476

CRITICAL POSITIONS			
C.A.	24	Expr.	17 7 Run 15
Table Pos.		L	T R
	Control Rod		Channel
1	⁷⁴⁶ 8.476	A	82.5 $\frac{1000}{200}$
	2 press. in sump 11.2 lbs	B	.047
	3 22.17 in. Hg	C	3.7 5×10^{-4}
4		D	74.5 $\frac{1000}{1000}$
		E	6.3 7500
Tim Crit.	10:15	AM	Duration 28 min.

Going up on 44.5 sec. period ~ 17.4 φ
 with rod at 9.570. Relevelled at .050
 with rod at 8.720

Rod at 8.735 now shut off regulator

C.A.	24	Expr.	7	Run	16
Sheet		Date	1 Sept 1955	Time	12:15 AM PM
Purpose	Mixing Cycle after 15 & 16 lb addition of Rod Calibration				

Mixed 15 times

1250 Rod mid-plane 0.322
 1259 source out

1300 Rod 8.746 gave 50.3 sec period = 16.0 φ
 Relevelled at B = .05 rod at 8.018 and 22.20" Hg

CRITICAL POSITIONS

C.A. 24 Expr. 7 Run 16

Table Pos. _____

Control Rod	Channel
1 <u>8.018</u>	A <u>83.5</u> $\frac{1000}{200}$
2 <u>22.18" Hg</u>	B <u>.05</u>
3 _____	C <u>7.9</u> $\frac{2.5 \times 10^{-9}}{1000}$
4 _____	D <u>70</u> $\frac{1000}{1000}$
	E <u>6.3</u> <u>750</u>

Tim Crit. 1259 ^{AM}/_{PM} Duration 30 min.

1325 Rod drop from 8.018"

Sept 1
1410

sample 20 62.2845 gm sampler
302.3 g liner
364.5845 total

6.57 ± .02 wt % U

Correct U 346.682 kg fuel 22.7771 kg U = 21.2226 kg U²³⁵
 correct sol. 349.985 " " 22.9942 kg U = 21.7245 kg U²³⁵
 6.57 wt % U 93.175 % U²³⁵

Includes enricher additions 12 to 16 and sample 20

INSTRUMENT CHECK

Time 1505 ^{AM}/_{PM} Source _____

Range	Channel				
	A	B	C	D	E
	$\frac{10}{1000}$		$\frac{10}{1000}$	$\frac{10}{1000}$	900.0
Source Dist.	18	OK 18	30	8"	
% FS Trip	75		100+ 80	100+	

cta, 12, + 3, OK.

C.A. 24 Expr. 7 Run 17

Sheet _____ Date Sept 5 1955 Time 1550 ^{AM}/_{PM}

Purp. Repeat run 16

1555 Roof 8.746 gave 58.6 sec per. = 14.5 ϕ
Labeled at 8.098 B = .048 22.19" Hg

CRITICAL POSITIONS		
C.A. 24	Expr. 7	Run 17
Control Rod	Channel	
1 8.098	A 79.5	$\frac{1000}{200}$
2 22.19" Hg	B .048	
3	C 7.3	2.5×10^{-9}
4	D 71.5	$\frac{1000}{1000}$
	E 6.0	750
Tim Crit. 1555 ^{AM} / _{PM} Duration 20 min.		

C.A. 24	Expr. 7	Run 18
Sheet	Date 1 Sept 95	Time 1635 ^{AM} / _{PM}
Purpose Repeat run 16		

V.P. approx $\frac{1}{16}$ " above F.P.

23.25 ϕ /in

1650 Roof 8.746 57.5 sec period = 15.3 ϕ
Labeled at 8.088 B = .048 22.16" Hg

CRITICAL POSITIONS		
C.A. 24	Expr. 7	Run 18
Control Rod	Channel	
1 8.088	A 82	$\frac{1000}{200}$
2 22.16" Hg	B .048	
3	C 7.4	2.5×10^{-9}
4	D 74	$\frac{1000}{1000}$
	E 6.1	750
Tim Crit. 1648 ^{AM} / _{PM} Duration 24 min.		

First $\frac{7}{8}$ " fuel worth about 7.5 ϕ

C.A.	24	Expr.	13	Run	1
Sheet		Date	Sept 1955	Time	1910 AM PM
Purpose	Check Evaluate reactivity as a function of fuel height.				
V.P.	$\frac{31}{32}$ " below fill probe at start of run				

1915 Rod mid position 0.325
 Positive period 20.58 ϕ /in
 21.93" Hg.
 1915 Rod 8.895 95.5 sec = 10 ϕ
 Levelled 8.409

VP 26.825 μ = 1194 $^{\circ}$ F

CRITICAL POSITIONS		
C.A.	24	Expr. 13 Run 1
Table Pos.		
Control Rod		Channel
1 8.409	A 80	$\frac{1000}{200}$
2 21.93" Hg	B .048	
3	C 7.4	2.5×10^9
4	D 72.5	$\frac{1000}{1000}$
	E 5.9	750
Tim Crit.	1915	AM PM Duration 25 min.

VP ~~at~~ Fuel level about $\frac{3}{8}$ " below F.P. at end of run.

Next $1\frac{17}{16}$ " fuel worth about 20.0 ϕ

C.A.	24	Expr.	13	Run	2
Sheet		Date	Sept 1955	Time	1955 AM PM
Purpose	Evaluate reactivity Vs fuel height.				
V.P.	$2\frac{9}{16}$ " below FP				

2050 Rod mid position 0.322 9.9 ϕ
 Rod at 9.951 111 sec. ~ 8.9 ϕ
 Levelled at 9.502 B = .05 21.34" Hg

CRITICAL POSITIONS		
C.A.	24	Expr. 13 Run 2
Table Pos.		
Control Rod		Channel
1 9.390	A 84.5	$\frac{1000}{200}$
2	B .05	
3 21.55" Hg	C 7.8	2.5×10^9
4	D 76.5	$\frac{1000}{1000}$
	E 6.1	750
Tim Crit.	2055	AM PM Duration 70 min.

V.P. on \rightarrow

VP 26.875 μ

Liquid Level $2\frac{3}{16}$ " below Fill probe 10 min after above readings.

$2\frac{3}{16}$ " approx. = 27.5 ϕ

C.A. 24 Expt. 13 Run 3
 Date 1 Sept 1955 Time 22:45 AM
 Sheet _____
 Purpose Reactivity vs fuel height.
 V.P. $4 \frac{3}{32}$ " below FP

Rod at midplane 0.322

7.2 $\frac{1}{\text{min}}$

2302 Rod at 13.65 106 sec 9.2 ϕ
 Levelled 12.38 $\beta_1 = .05$ 21.10 "Hg

CRITICAL POSITIONS
 C.A. 24 Expt. 13 Run 3

Control Rod	Channel	Value
12.205	A	81.5 $\frac{1000}{200}$
	B	.048
21.00 " Hg	C	7.5 2.5×10^{-9}
	D	74 $\frac{1000}{1000}$
	E	68 750

Tim Crit. 2302 AM PM Duration 68 min.

V.P. 26.855 mv. = 1195.2 °F
 2.2 V.P. $3 \frac{15}{16}$ " below FP

C.A. 24 Expt. 7 Run 19
 Date 2 Sept 1955 Time 00:50 AM
 Sheet _____
 Purpose Check joint on run 18.

Rod pos. at M.P. 0.000.32

Going up on 59 sec period ~~14.9 ϕ~~
 with rod at 8.745. Relevelled at .050
 with rod at 8.078

CRITICAL POSITIONS
 C.A. 24 Expt. 7 Run 19

Control Rod	Channel	Value
8.078	A	85 $\frac{1000}{200}$
pressure in comp 112516	B	.050
23.18 in. Hg	C	3.8 5×10^{-9}
	D	77 $\frac{1000}{1000}$
	E	7.3 750 ✓

Tim Crit. 00:52 AM PM Duration 12 min.

C.A. 24 Expr. 7 Run 20
 Sheet _____ Date 2 Sept 1955 Time 01:25 ~~PM~~ ^{AM}
 Purpose Mixing cycle after 17th
addition & Rod Calibration
1.2 turns

Mixed 15 Times

Going up on a 52.1 sec period ~ 15.7 ϕ
 with rod at 8.08. Relevelled at .050
 with rod at 7.403.

CRITICAL POSITIONS

C.A. 24 Expr. 7 Run 20
 Table Pos. _____ I _____ T _____ R _____
 Control Rod Channel

1	<u>7.403</u>	A	<u>84</u>	$\frac{1000}{200}$
2	<u>2218 in. Hg</u>	B	<u>0.49</u>	
3		C	<u>3.9</u>	5×10^{-9}
4		D	<u>76</u>	$\frac{1000}{1000}$
		E	<u>7</u>	<u>750V</u>

Tim Crit. 2:03 ~~PM~~ ^{AM} Duration 15 min.

Going up on 51.0 sec period ~ 15.9 ϕ
 with rod at 8.08. Relevelled at .050
 with rod at 7.387.

C.A. 24 Expr. 7 Run 21
 Sheet _____ Date 2 Sept 1955 Time 03:10 ~~PM~~ ^{AM}
 Purpose Mixing cycle after 18th
addition & Rod Calibration
.6 turns

Mixed 15 times

Going up on 182 sec period ~ 6.0 ϕ
 with rod at 7.39. Relevelled at .050
 with rod at 7.152.

CRITICAL POSITIONS			
C.A.	24	Expr.	7 Run 21
Table Pos.			
	Control Rod		Channel
1	7.152	A 84	$\frac{1000}{200}$
2	22.12 in. Hg	B .048	
3		C 3.9	5×10^{-9}
4		D 76	$\frac{1000}{1000}$
		E 7.3	750V
Tim Crit.	3:55	PM ^{AM}	Duration _____ min.

rod at midplane 0.313

Repeating period with rod at 7.40
 Period 193 sec $\sim 0.7 \phi$
 Released with rod at 7.162

C.A.	24	Expr.	7	Run	22
Sheet		Date	2 Sept 1955	Time	5:00 ^{AM} PM
Purpose	Mixing Cycle after 19 th addition & Rod Calibration				
	1 turn				

Mixed 15 times

Going up on 65 sec. period $\sim 13.7 \phi$
 with rod at 7.156 . Released at .050
 with rod at 6.621 .

CRITICAL POSITIONS			
C.A.	24	Expr.	7 Run 22
Table Pos.			
	Control Rod		Channel
1	6.621	A 83	$\frac{1000}{200}$
2	22.20 in. Hg	B .047	
3		C 3.8	5×10^{-9}
4		D 75.5	$\frac{1000}{1000}$
		E 7.3	750V
Tim Crit.	5:23	PM ^{AM}	Duration 10 min.

Rod Drop from 6.621 worth about 5.00

INSTRUMENT CHECK *Ion E*

Time 5:50 ^{AM} ~~PM~~ Source PN 123

	Channel				
	A	B	C	D	E
Range	$\frac{10}{1000}$	OK	10^{-10}	$\frac{10}{1000}$	750V
Source Dist.	14"	↓	12"	30"	3"
% F.S. Trip	75	↓	100+	80	100+
Counters	1, 2, 3	0, 1, 5			

0606 ^{21st} ~~20th~~ sample removed

66.3 gms in sampler

609.5 gms in liner

675.8 total removed gms.

6.69 ± .02 wt% U

C.A. 24 Expr. 7 Run 22 repeat

Sheet _____ Date 2 sept 95 Time 0640 ^{AM} ~~PM~~

Purpose Repeat of previous run

rod at 7.155
 Reactor rising on ~~63~~⁶³ sec period 13.8 ~ 4
 relevelled 6.553

CRITICAL POSITIONS

C.A. 24 Expr. 7 Run 22 R

Table Pos. _____ I _____ T _____ R _____

	Control Rod	Channel
Rod	<u>6.553</u>	A <u>81</u> $\frac{1000}{200}$
Press	<u>21.18</u>	B <u>.052</u>
3		C <u>3.8</u> 5×10^{-9}
4		D <u>73.8</u> $\frac{1000}{1000}$
		E <u>6.8</u> $750V$

Tim Crit. 0750 ^{AM} ~~PM~~ Duration _____ min.

Rod at 0.824

~~37%~~

Corr U - 346.792 kg fuel 23.2006 Kg U 21.617 Kg U²⁵

Corr fuel - 350.103 kg fuel 23.4221 Kg U 21.823 Kg U²⁵

6.69% U 93.174% U²⁵

U values include 19th addition and 21st sample

C.A.	24	Expr.	7	Run	23
Sheet		Date	2 Sept 1955	Time	0730 ^{AM}
Purpose	20 th Fuel Addition				
	1 turn				

Mixed 15 times

Reactor on 95 sec period (10.04) with rod at 6.555 relevelled 6.165

08:16 Vial probe 27.065 MV 1203

CRITICAL POSITIONS		
C.A.	24	Expr. 7 Run 23
Code Pos.		
Control Rod		Channel
Rod	6.165	A 78 1000/200
Press.	22.20 Hg"	B 105
3		C 3.6 5×10^{-9}
4		D 71.8 100%/1000
		E 6.7 250V
Tim Crit.		AM PM Duration 20 min.

Repeat of last run

reactor on 94.5 sec period (9.4) with rod at ~~6.172~~ ^{6.555} relevelled at 6.173 press. 22.19" Hg

rod in at 0.320

C.A.	24	Expr.	7	Run	24
Sheet		Date	2 Sept 1955	Time	0940 ^{AM}
Purpose	21 st Fuel Addition				
	0935 Added from curlicor				

Mixed 15 times

09:00 Reactor being filled

10:38 Reactor rising rod at 6.170 period 72 sec, 12.44. relevelled at 5.725

CRITICAL POSITIONS

C.A. 24 Expt. 7 Run 24

File Pos. _____

Control Rod	Channel
Rod <u>5.725</u>	A <u>79</u> $\frac{1000}{200}$
Press <u>22.18" Hg</u>	B <u>.052</u>
3 _____	C <u>3.6</u> 5×10^{-9}
4 _____	D <u>71.7</u> $\frac{1000}{1000}$
	E <u>6.3</u> <u>7500</u>

Tim Crit. _____ ^{AM}/_{PM} Duration _____ min.

Repeat of previous run reactor rising on 73 period (12.3 ϕ). Rod at 6.170. relevelled at 5.730.

C.A. 24 Expt. 7 Run 25

Sheet _____ Date 2 Sept 5 Time 1200 ^{AM}/_{PM}

Purpose 22nd Fuel Addition
~167 gms added from enricher (1 turn)

Mixed 15 times

Rod in at 0.318

1250 Reactor on 67.5 sec. period with 13.7 ϕ with rod at 5.725; leveled at 5.260. Hg = 22.23"

CRITICAL POSITIONS

C.A. 24 Expt. 7 Run 25

File Pos. _____

Control Rod	Channel
<u>5.260</u>	A <u>80.5</u> $\frac{1000}{200}$
<u>22.22" Hg</u>	B <u>.052</u>
3 _____	C <u>7.8</u> 2.5×10^{-9}
4 _____	D <u>73</u> $\frac{1000}{1000}$
	E <u>6.6</u> <u>75</u>

Tim Crit. 1245 ^{AM}/_{PM} Duration 20 min.

Repeat of run 25 = 25R
 132.5 Reactor on 70.5 sec. period with 12.7 ϕ with rod at 5.725; leveled at 5.274 Hg = 22.18" B₁ = .051
 Run 20 min. duration

C.A. 24 Expr. 7 Run 26
 Sheet _____ Date 2 Sept 1955 Time 1420 ^{PM}
 Purpose 23rd fuel addition -
1 turn of enricher.
Rod calibration + mixing cycle

Mixed 15 times

1530 22nd sample 63.3 sampler
 711.2 liner
 774.5 total

6.88 wt % U

1700 Complete temperatures taken
 1735 Started Reactor up Rod at 0.318

Reactor on ~~78~~⁹⁸ sec period worth ~~9.7~~ 9.7 %
 with rod at 5.274. Levelled at 4.918.

Corr. U 6.88% U 93.173%
 347.267 Kg fuel 23.8922 Kg U = 22.2611 Kg U²⁵
 Corr. fuel 350.590 Kg fuel 24.1208 Kg U = 22.4737 Kg U²⁵

Values include 23rd fuel addition
 and 22nd sample.

CRITICAL POSITIONS

C.A. 24 Expr. 7 Run 26

4.918 A 79 $\frac{1000}{200}$

22.18" Hg B .052

 C 7.6 2.5×10^9

 D 72 $\frac{1000}{1000}$

 E 6.1 758

Time Crit. 1745 AM
 PM Duration 20 min.

Rod period position .314

C.A. 24 Expr. 7 Run 26R

Sheet _____ Date 2 Sept 1955 Time 1815 ^{PM}

Purpose Repeat 24-7-26

1820 Reactor 94.5 sec period worth 10.0%
 with rod at 5.274. Levelled at 7.920

CRITICAL POSITIONS

CA 24 Expr 7 Run 26K

Control Rod 9.920 Channel 1000/200

A 78

B 1.051

C 7.5 2.5×10^{-9}

D 71.5 $\frac{1000}{1000}$

E 6.1 750

Tim Crit. 1820 ^{AM}/_{PM} Duration 18 min.

2305 Moderator pressure at about 5# set off
low level dump light.

3 Sept 55

INSTRUMENT CHECK

Time 1000 ^{AM}/_{PM} Source PN 123

Channel

	A	B	C	D	E
Range	<u>1000</u>	<u>10⁴⁰</u>	<u>1000</u>	<u>1000</u>	<u>1000</u>
Source Dist.	<u>8"</u>	<u>6"</u>	<u>18"</u>	<u>10"</u>	
% E.S. Trip	<u>95</u>	<u>95</u>	<u>100</u>	<u>100</u>	

Ch 3 Ch 2+3 on Nominal Buttons

CA. 24 Expr. 10 Run 7

Sheet _____ Date 3 Sept 1955 Time 10:15 ^{AM}/_{PM}

Purpose Slow temp Coeff

at nominal 1150°F

reactor rising with rod at 4.920
period 41 sec 18.3 ϕ relevelled 4.308

CRITICAL POSITIONS

C.A. 24 Expr. 10 Run 7

Table Pos. _____ I _____ T _____ R _____

Control Rod	Channel
Rod <u>4.308</u>	A <u>74.7</u> $\frac{1000}{200}$
Press. <u>22.51" Hg</u>	B <u>.047</u>
3 _____	C <u>3.5</u> 5×10^{-9}
4 _____	D <u>69.2</u> $\frac{1000}{1000}$
	E <u>6.2</u> 750 v

Tim Crit. 10:20 ^{AM} ~~PM~~ Duration 30 min.

C.A. 24 Expr. 10 Run 8

Sheet _____ Date 3 Sept 1955 Time 1:30 ^{AM} ~~PM~~

Purpose Slow Temp Coeff

@ ~ 1150°

Going up on 49 sec. period ~ 16.4 g
with rod at 4.920. Relevelled at .050
with rod at 4.355

CRITICAL POSITIONS

C.A. 24 Expr. 10 Run 8

Table Pos. _____ I _____ T _____ R _____

Control Rod	Channel
1 <u>4.355</u>	A <u>8.3</u> $\frac{1000}{200}$
<u>22.53 in Hg</u>	B <u>.052</u>
3 _____	C <u>3.9</u> 5×10^{-9}
4 _____	D <u>76.5</u> $\frac{1000}{1000}$
	E <u>6.6</u> 750 v

Tim Crit. 1:40 ^{AM} ~~PM~~ Duration 25 min.

C.A. 24 Expr. 10 Run 9

Sheet _____ Date 3 Sept 1955 Time 3:45 ^{AM} ~~PM~~

Purpose Slow Temp coeff @ ~1150°

Rod 4.920 period = 53 sec. 15.6 g
relevelled at 4.388

CRITICAL POSITIONS

C.A. 24 Expr. LD Run 9

Table Pos. _____ L _____ T _____ R _____

Control Rod	Channel
<u>Rod</u> 4.388	A 80 <u>1000/200</u>
<u>Press</u> 22.51 in. Hg.	B .050
_____	C 37 <u>9x10⁻⁵</u>
_____	D 74.5 <u>1000/1000</u>
_____	E 6.4 <u>750V</u>

Tim Crit. 3:52 ~~PM~~ Duration 15 min.

C.A. 24 Expr. 10 Run 10

Sheet _____ Date 3 Sept 1955 Time 5:25 ~~AM~~ ^{PM}

Purpose Slow Temp Coeff @ ~1150°F

Going up on 55 sec period ~ 15.2¢
with rod at 4.920. Relevelled at .050
with rod at 4.910.

CRITICAL POSITIONS

C.A. 24 Expr. 10 Run 10

Table Pos. _____ L _____ T _____ R _____

Control Rod	Channel
<u>4/410</u>	A 84.2 <u>1000/200</u>
<u>22.50 in Hg</u>	B .052
_____	C 3.9 <u>5x10⁻⁹</u>
_____	D 77.3 <u>1000/1000</u>
_____	E 6.6 <u>750V</u>

Tim Crit. 5:30 ~~PM~~ ^{AM} Duration _____ min.

C.A. 24 Expr. 14 Run 1
 Sheet _____ Date 3 Sept 1955 Time 7:25 AM
 Purpose Fast neutron escape

Rod Position Time
 4.510 9:35
 4.540 10:05
 4.580 10:30
 4.59.5 10:43

CRITICAL POSITIONS

C.A. 24 Expr. 4 Run 1

Control Rod	Class of
Rod 4.508	A 56 100/100
Pen 22.39 in Hg	B .0035
11.35 psi	C 6.8 2.55×10^{-10}
	D 54 1000/100
	E 0.6 750 V

Tim Crit. 9:00 2:00 AM Duration 4 min.

9-4-55

Scott
 Crudele
 Lynn

INSTRUMENT CHECK

Time 1:30 PM Source PN 123
run E

Range	A	B	C	D
	$\frac{10}{1000}$	10^{-10}	$\frac{10}{1000}$	900V
Source Dist.	10"	014"	30"	7"
% F.S. Trip	25	75	100+	25 100+

Counter LOK

C.A. 24 Expr. 14 Run 2
 Sheet _____ Date 4 Sept 1955 Time 1:05 PM
 Purpose Fast neutron escape
~~Flow temperature coeff.~~
~~at 1500 °F~~

Rod mid plane .318

11:10 PM. source out.

$B_1 = .0035$ Rod at 6.020 21.74" Hg
 Take 1/2 min. etc to check Hornyak Buttons

CRITICAL POSITIONS

C.A. 24 Expr. 14 Run 2

Tube Pos. _____

Control Rod	Channel
1. <u>6.020</u>	A. <u>55</u> $\frac{100}{200}$
2. _____	B. <u>.0036</u>
3. <u>21.74" Hg.</u>	C. <u>6.2</u> 2.5×10^{-10}
4. _____	D. <u>54</u> $\frac{1000}{100}$
	E. <u>4</u> <u>750</u>

Tim Crit. 12:10 PM Duration 90 min.

1140 P.M. $\frac{1}{2}$ min etc to check Hornyak Buttons
 B = .0034 Rod at 6.006 21.75 "Hg.

C.A. 24 Expr. 10 Run 11

Sheet _____ Date 5 Sept 1955 Time 12:30 AM

Purpose flow temperature coeff
at approx 1300 °F

CRITICAL POSITIONS

C.A. 24 Expr. 10 Run 11

Tube Pos. _____

Control Rod	Channel
1. <u>6.000</u>	A. <u>80</u> $\frac{1000}{200}$
2. _____	B. <u>.05</u>
3. <u>21.84" Hg.</u>	C. <u>8.0</u> 2.5×10^{-9}
4. _____	D. <u>72</u> $\frac{1000}{1000}$
	E. <u>6.8</u> <u>750</u>

Tim Crit. 12:30 AM Duration _____ min.

C.A. 24 Expr. 10 Run 3

Sheet _____ Date 5 Sept 1955 Time 1:03 AM

Purpose fast neutron escape

VERTICAL POSITIONS

C.A. 24 Exp: 17 Run 3

Table Pos. _____

Control Rod	Channel
<u>5.972</u>	<u>56</u> 100 200 300
<u>21.80" Hg</u>	<u>.0035</u>
	<u>7.0</u> 2.5×10^{-10}
	<u>54</u> 100 100
	<u>4</u> <u>750</u>

Tim Crit. 1:07 ~~AM~~ ~~PM~~ Duration 30 min.

C.A. 24 Exp: 10 Run 12

Sheet _____ Date 5 Sept 5 10 ~~AM~~ ~~PM~~

Purpose slow temp. coef
at approx 1300°F
Repeat of run 11

Rod = 5.98

INSTRUMENT CHECK

Time 1200 AM Source PN 123
2 on E

	Channel				
	A	B	C	D	E
Prices	10^{-1000}	α	10^{-10}	10^{-1000}	9000
Source Dist.	<u>10"</u>	<u>8"</u>	<u>30"</u>	<u>8"</u>	
% F.S. Trip	<u>100</u>	<u>100</u>	<u>95</u>	<u>100</u>	

Chs 243 on Horizontal Buttons
Scaler out on ch 1

C.A. 24 Exp: 10 Run 12

Sheet _____ Date 5 Sept 1955 Time 1653 ~~AM~~ ~~PM~~

Purpose Temp. coef ~ 1350°F

Rod at 0.320

Reactor rising with rod at 7.000
 period 89 sec. 10.6¢ relevelled at 6.530

First check of temp at 1350°F

Rod position changed
4th screw loose

CRITICAL POSITIONS			
C.A.	24	Expr	10
		Run	12
Pos.	_____ T _____		
Control Rod	Channel		
Rod 6.530	A	84	1000/200
Press 21.70" Hg	B	.051	
3	C	3.9	5x10 ⁻⁹
4	D	77	1000/1000
	E	6.5	750V
Tim Crit.	1700	Duration	_____ min.

3

C.A.	_____	Expr.	14	Run	4
Sheet	_____	Date	5 Sept 1955	Time	1820 ^{AM} PM
Purpose	Fast Neutron Escape				

Reactor rising on 54 sec period with rod at 7.000
relevelled at ~6.44 ^{15.3d}

CRITICAL POSITIONS			
C.A.	24	Expr	14
		Run	4
Pos.	_____ T _____		
Control Rod	Channel		
? Rod 6.44	A	55.5	100/200
Press 21.70" Hg	B	.0035	
	C	6.2	2.5x10 ⁻¹⁰
	D	55.5	1000/100
	E	0.4	750V
Tim Crit.	1822 ^{AM} PM	Duration	_____ min.

1822
A.

Reactor rising on 52 sec period with rod at 7.000
Levelled with rod at 6.438 B1 - 0035

CRITICAL POSITIONS		
C.A. 24	Expr. 14	Run 5
Control Rod	Channel	
Rod 6.438	A 56	100/200
Power 21.7" Hg	B 0.0035	
3	C 6.5	2.5 x 10 ⁻¹⁰
4	D 55.7	100/100
	E 0.4	7500
Tim Crit. 1912	AM	Duration _____ min.

~1940 Moved one of the Horgan chambers Rod at 6.438

Power level raised to .05. 59 Sec per. Rod-7.000
Rod position 6.459 14.4 φ

Rod dropped from 6.459

C.A. 24	Expr. 14	Run 6
Sheet _____	Date 5 Sept 1955	Time 10.27 PM
Purpose Fast neutron escape.		

Rod mid plane 0.320

~~Rod at 7.000~~ ~~gall~~ ~~rod period = 4~~
~~Levelled at 7.429~~ ~~B₁ = .0074~~ ~~Hg = 21.70"~~

CRITICAL POSITIONS		
C.A. 24	Expr 14	Run 6
Control Rod	Channel	
6.424	A 58	100/200
21.70" Hg	B .0034	
	C -	
	D 57	1000/100
	E .4	750
Tim Crit. 10.40	PM	Duration 25 min.

Fuel dumped and then reactor refilled.

CRITICAL POSITIONS			
C.A.	24	Expr.	14
		Run	7
Table Pos.			
Control Rod		Channel	
Rod	6.439	A	57 100/200
Press	21.52 " Hg	B	.0033
		C	6.9 2.5x10 ⁻¹⁰
		D	56.2 1000/100
		E	.4 750V
Tim Crit.	2400	AM PM	Duration min.

Sept. 6
12:30 AM
Scott
Crosby
Lynn
Changed from 1/8" annulus to 1/4" annulus control rod

C.A.	24	Expr.	15	Run	1
Sheet		Date	6 Sept 195	Time	2:00 AM
Purpose	Changed To evaluate the heavy wall (1/4" thick) control rod.				

Rod at 7.090 rec = ϕ
 Levelled at 6.774 B = .0038 Hg = 21.69"

$$A = \frac{\pi}{4} (D_2^2 - D_1^2)$$

A₂ = Heavy rod D₂ = 1.30 D₁ = .80 $\frac{A_2}{A_1} = 1.79$
 A₁ = Light rod D₂ = 1.30 D₁ = 1.05

Increasing volume of rod by about 80% increases lite value about 8% or less than 6% (5.3%)

Rod at 7.10 116 sec period = 8.68 ϕ
 Levelled at 6.780 $B_1 = .048$ $H_g = 21.69''$

CRITICAL POSITIONS		
C.A. 24	Expr 15	Run 1
Control Rod	Channel	
6.780	A 87.5	$\frac{1000}{200}$
$H_g = 21.69''$	B .048	2.5×10^{-9}
	C 8.0	$\frac{1000}{1000}$
	D 77.5	750
	E 6.9	
Tim Crit. 2:35	AM	Duration 35 min.

3:15A Moved Channel D chamber to west side of table. ~ 2x previous distance from reactor.

C.A. 24	Expr. 15	Run 2
Sheet	Date 6 Sept 1955	Time 3:10 AM
Purpose	Repeat run 1. Check value of heavy rod.	

3:32

Rod at 7.10 gave 120 sec period = 8.5 ϕ
 Levelled at 6.775 $B_1 = .048$

CRITICAL POSITIONS		
C.A. 24	Expr 15	Run 2
Control Rod	Channel	
6.778	A 82.5	$\frac{1000}{200}$
21.69" H_g	B .048	
	C 7.8	2.5×10^{-9}
6.784 at 4:12 AM	D 43.0	$\frac{1000}{500}$
	E 3.9	690
Tim Crit. 3:35	AM	Duration 37 min.

Moved channel "D" ~~two~~ ^{three} more feet away from reactor, and moved channel "E" about six feet away.

C.A. 24 Expr. 15 Run 3
 Sheet _____ Date 6 Sept 1955 Time 4:35 AM
 Purpose Repeat run 1.

4:40 P.M. Rod 7.10 on 117" sec period = 8.6.8 ϕ
 Levelled at $B_1 =$ $H_2 =$ "

CRITICAL POSITIONS

C.A. 24 Expr. 15 Run 3

Control Rod	Channel
1 <u>6.785</u>	A
2 <u>21.69" Hg</u>	B
3 _____	C
4 _____	D
	E

Tim Crit. 4:40 ~~AM~~ ^{PM} Duration 15 min.

C.A. 24 p. 16 Run 1 AM
 Sheet _____ Date 6 Sept 1955 Time 5:00 ~~PM~~
 Purp. Final exposure of U foils for power distribution.

5:02 ~~Rod at 7.10~~ ~~sec~~
~~Levelled at 6.787~~ ~~$B_1 = .02$~~ ~~$H_2 = 21.69" Hg$~~

CRITICAL POSITIONS

24 Expr. 16 Run 1

	A
	B <u>.2</u>
	C
	D
	E

Tim Crit. 5:07 ~~AM~~ ^{PM} Duration _____ min.
 $B_1 = .074$ rising period

Levelled at 0.2 on B₁

5:32 Power cut off of reactor.

TIME	ROD POSITION
5:27	6.787
5:32	6.787 Heat off of reactor
5:40	6.777
5:45	6.760
5:48	6.770
5:50	6.755
5:52	6.765
5:55	6.755
5:57	6.745
6:05	6.734
6:10	6.730
6:15	6.725
6:26	6.730
6:33	6.728
6:40	6.725
6:43	6.720
6:47	6.717
6:51	6.710
6:53	6.715
7:02	6.710
7:07	6.702
7:16	6.702

CRITICAL POSITIONS			
C.A.	24	Expt	16 Run 1
Table Ref.			
1	6.787 at 1343°F	70	$\frac{1000}{1000}$
2	21.6 "Hg.	0.2	10^{-9}
3		8.0	
4		D 56	$\frac{1000}{1000}$
		E 7.8	690
Tim Crit.	7:16 5:07	AM	Duration 129 min.
	2:09		

7:16 Rod drop from 6.702

Morning of 6 September.

Final sample removed from sump
for complete analysis.

Sample 23

64.2064 gm.	sampler
<u>478.0</u>	" liner
542.2064 gm.	total

6.88
~~6.83~~ wt. % V

CHARACTERISTICS OF SYSTEM

19 Aug Dumping time from fill probe to point 8" below - 2.23 sec for normal operation and 3.45 sec using VS-3 alone.

19 Aug Complete system dump time - 27.23 sec for normal operation and 31.1 sec using VS-3 alone.

20 Aug With the rod in the up position, the end is 0.6 in. below the top of the Be.

Time	Addition number	Enricher Position			Concentration			
		Found	Turned to	Backed to	U added	Calculated concentration $\pm .02$	analysis concentration	
1 Sept 55 01:15	10	0029.6	0031.2	0030.2	507			
02:38	11	0030.2	0031.8	0030.8				
05:35	12	0030.8	0032.4	0031.4			6.42 $\pm .02$	
08:20	13	0031.4	0033.0	0032.0			↑	
09:45	14	0032.0	0033.6	0032.6	583		427 ϕ	
12:00	15	0032.6	0034.8	0033.8				$\frac{\Delta H}{\Delta m} = .14$
	16	0033.8	0035.4	0034.4			6.57 $\pm .02$	↑
2 Sept 1955 01:20	17	0034.4	0036.0	not returned			↑	
		0036.0	0036.6	0035.6	469		35.2 $\frac{\Delta H}{\Delta m} = .14$	
03:05	18	0035.6	0037.2	0036.2				↓
04:55	19	0036.2	0038.2	0037.2			6.69 $\pm .02$	
07:25	20	0037.2	0039.2	0038.2				
09:35	21	0038.2	0040.2	0039.2	745		45.3 $\frac{\Delta H}{\Delta m} = .12$	
11:55	22	0039.2	0041.2	0040.2				
2:15	23	0040.2	0042.2	0041.2			6.88 $\pm .02$	

Analysis	office	
Paul W. [unclear]	7990	Knox 6-1716
Sam [unclear]	"	" 8-0912
Conroy	"	Oak Hills
Jim [unclear]	7242	Knox 8-3580

D. Callahan	102 Oak Ln	5-3432
J. Crudele	117 E. Vanderbilt	5-1929
J. Ellis		5-281
W. Harner		
J. J. Lynn	168 Hillside Rd.	5-4976
R. Parten	Oliver Springs	6174
R. Kohler	Clinton	1345
E. Sandin	315 Virginia Rd.	5-3630
D. Scott	Eff A-2 apt.	5-4642
J. Snyder	218 W. Vanderbilt Dr.	5-6570
R. Spencer	Knox	8-2045

Classification Change to Decl. 57
 Authority of E. J. Murphy Date 6/3/60

owl shift	Day shift	4-12 Richard
Spencer	Scott	12-8 Jim
Sandin	Lynn	8-4 Vic
Snyder	Crudele	