

BOOK24R

5059 on bottom edge

Notes:

“secret” wrote on front cover

“Army Package Reactor” wrote on tape attached to spine

“secret” wrote in two spots on back cover

Blank pages: inside front cover opposite page 1, 1, 44-300, inside back sheet

-page 3 has paper glued to it

-page 4 has graph taped to it

-page 10 has graph taped to it

-page 12 has graph taped to it

-pages 14 & 15 had 2 graph sheets glued that came loose, now just in between pages

-page 18 had graph glued down - obvious where they went so I taped down

-page 20 had two glued down - obvious where they went so I taped down

-page 21 has graph glued down

-page 26 has graph taped to it

-page 27 has long graph sheet taped to it

-page 36 has graph taped down

-page 41 has graph taped down

Scanned by:

Sheila Finch

RSICC /Oak Ridge National Lab.

August 3, 1999

SECRET

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.

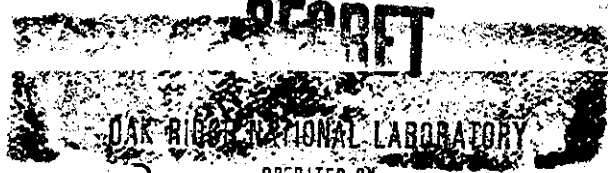
In cases where work is conducted in cooperation with others, it is often necessary to meet with them from time to time and discuss new developments. The occurrences of such conferences should always be entered in your notebook regardless of recording elsewhere, giving the date, who was present (if possible), 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.

SECRET

10-9-21

SECRET

C-6



75
AUT

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POST OFFICE BOX P
OAK RIDGE, TENNESSEE
NOTEBOOK NO. 50.59

Inv
58

Assigned to: A. P. Callihan
Department: Applied Nuclear Physics
Location: Bldg 9213, y-12
Date: Oct 19, 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.

Assignee is responsible for the safe-guarding of this notebook in accordance with security regulations.

Do not use scrap paper.

Be sure to record all personal conferences.

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Inv.
59

Subject Tower Shielding Reactor Mockup Page _____

CLASSIFICATION CANCELLED
DATE 6/3/60
For the Atomic Energy Commission
Jack H. Kahn for the
Chief, Declassification Branch

RESTRICTED DATA

contents of any matter for which a person is prohibited

Tower Shielding Reactor Mockup

Conf with Callahan Clifford Holland, Magnusson

- ① Use APPR critical experimental facility - plates, fuel, boxes, etc in a 5×5 array. Metal fraction $\sim 0.20\%$ (vol fraction).
- ② Four rods will be inserted in the center half of boxes 8, 12, 14, 18 (10 plates each) see p 3 for sketch of core.
- ③ Center box 13 should contain only half the fuel of the other boxes.

Experimental program desired

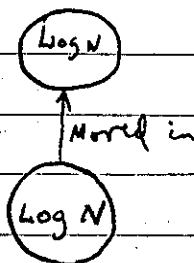
- 1) Crit Mass 5×5 with 4 voids and center box half loaded
- 2) Worth of fuel in center (all plates full)
- 3) Worth of one rod, Rod drop or period
- 4) Mass worth of one rod.
- 5) Effect of Homogeneity on Crit Mass??

5×5 clean critical will be run first.

SWM
2/15/56

DC-3

1	2	3	4	5		
⊗	✓	✓	⊗	✓		
6	7	8	9	10		
✓	⊗	VOID	✓	✓		
11	12	13	14	15		
✓	⊗ VOID	✓	VOID	⊗	⊗	
16	17	18	19	20		
✓	✓	VOID	✓	✓		
21	22	23	24	25		
✓	✓	✓	⊗	✓		



R-1

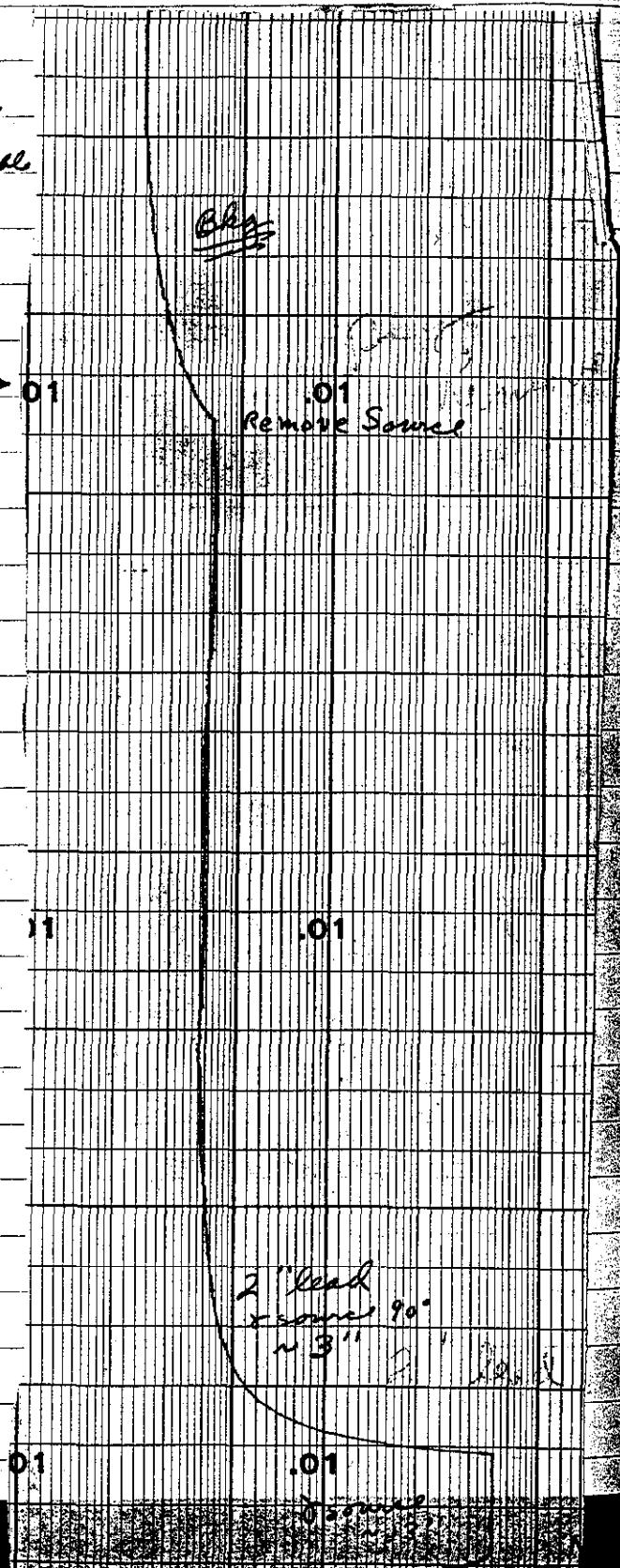
Previous Neg Period measurements showed that there is considerable gamma background, and the effect of 2" of lead on log N and the gamma source is noted on the chart paper →

$$.0040 - .0024 = .0016$$

$$.0360 - .0024 = .0336$$

$$\frac{.0016}{.0336} = .0476$$

∴ 2" atm gamma rays
approx X 20.



is noted on the chart paper → 01

$$.0040 - .0024 = .0016$$

$$.0360 - .0024 = .0336$$

$$\frac{.0016}{.0336} = .0476$$

∴ 2" atm gamma rays
approx X 20.

.01
Remove Source

01

.01

2" lead
x source 90°
~ 3" 2" 10"

01

.01

Bkg no H₂O

Bkg with
H₂O

5 x 5 Clean Critical Loadings

	31.13 gm U-235 per plate	
∴	25 plates = 778.25 kg	
1/2	plate per box = .389 kg	
1	plate per box = .778 kg	389
2	= 1.556	7.00
3	= 2.334	7.393
4	= 3.113	16
5	= 3.891	7.377
6	= 4.669	
7	= 5.447	
8	= 6.226	
9	= 7.004	
10	= 7.782	

APPR Book I (4424) p34

Previous data 5 x 5 (ross. plate) 4.65 kg 10.6% ^{metal} ~~steel~~ ^{rod} ~~rod~~
 Rod ^{Top half} ~~rod~~ drop worth 0.87 g
 p 42 Blade dropped 70.5 g

APPR

Plates

Type K U-235 - 22.46 ± 0.08 gm/plate
 B 0.210 ± 0.003 gm/plate

Type L U-235 11.66 ± 0.06 gm/plate

INSTRUMENT CHECK

Date 2-22 1956 Time 12¹⁰ ^{PM} Source No. ✓

Instrument	Value	Scale	Source Distance	Start-Up Note
DC-1				
DC-2				
DC-3	<u>70</u>	<u>10x20</u>	<u>10 cm</u>	
Log N	<u>7 sec</u>			
R-1	<u>6</u>	<u>1000x100</u>	<u>contact</u>	
R-2				
P. M.	<u>800 V</u>		<u>contact</u>	

Exp. 1-1 Time 12⁴⁵ PM Date 2-22 1956

Purpose 5x5 Critical

Personnel: D.M. J.H. DK

START-UP CHECK LIST

Equipment Checked by D.M. Check by DK

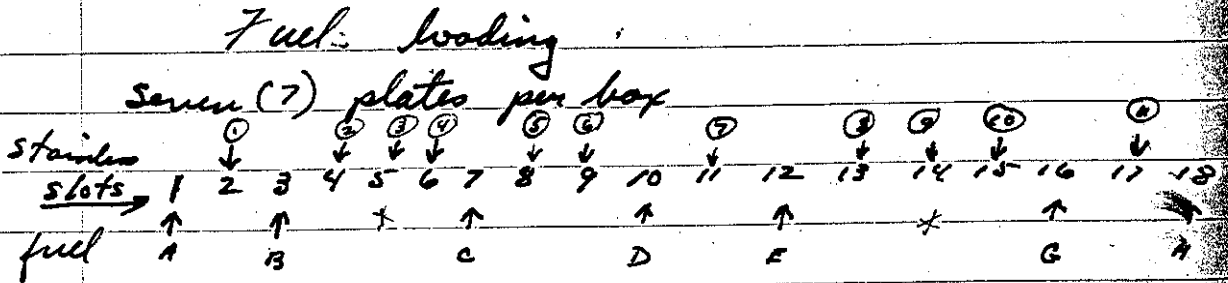
Instrument and Safeties Checked and DK

"Source In" Checked by D.M. Source No. ?

Emergency Equipment in Control Room checked by J.E.

Red Light On by DK

Start-Up OK'd by _____ Time 12⁴⁵ PM Date 2-22 1956



1⁰⁰ PM Water started in

1¹⁵ PM Blade Out 28.3 Water # 109.5

DC-3 = 33x10x2 109 N .00065 } Source IN

R-1 100 MV scale [2.5x200]

DC-2 - 9x1x10

Expr. 1-2 Time 30 PM Date 2-22 1956
 Purpose Fuel added to Orig loading
 Personnel: same

5 Steel plates removed from slot ⑤ and fuel (Irradiation) added. Loading 8 plates per box on 6.22 kg

START-UP CHECK LIST
 Equipment Checked by DM Personnel Check by DM
 Instrument and Safeties Checked and Reset by DM
 "Source In" Checked by DM Source No. _____
 Emergency Equipment in Control Room Checked by DM
 Red Light On by DM
 Start-Up OK'd by DM Time 1:45 PM Date 2-22 1956

2:02 PM } Blade - 28.30 water 109.5
 Sample } DC-3 32x10x2 log N .0045 (not moved)
 R-1 100mV 5.4x100 DC-2-7x1x10

Expr. 1-3 Time 2:30 PM Date 2-22 1956
 Purpose Fuel added Series J in slot 14
Steel removed from slot 14
 Personnel: same

START-UP CHECK LIST
 Equipment Checked by DM Personnel Check by DM
 Instrument and Safeties Checked and Reset by DM
 "Source In" Checked by DM Source No. _____
 Emergency Equipment in Control Room Checked by DM
 Red Light On by _____
 Start-Up OK'd by DM Time 2:30 PM Date 2-22 1956

2:42 PM } Blade 28.30 water 109.5
 R-1 2.8x200 (100mV) DC-3 40x2x10
 log N = .018 temp on #15 = 73°F
 Subcrit. Loading 9 plates per box on 7.00 kg

Expt. 1-4 Time 2:50 PM Date 2-22 1956
 Purpose adding half plate + removing half steel in position 9 (series L)
 Personnel: Same

Equipment Checked by DM
 Instrument DM
 "Source in" DM
 Emergency _____
 Red Light _____
 Start-Up OK'd by DM Time 2:50 PM Date 2-22 1956

3:10 PM Critical Same Out Water 109.5
 Blade at 15.4

Inst reading
 DC-3 72.5 x 10 x 10 R-1 4.1 x 100 x 1000
 log N = 0.4 temp 73°F
 DC2 22 x 1 x 10

Equipment Checked by DM
 Instrument _____
 "Source in" _____
 Emergency _____
 Red Light _____
 Start-Up OK'd by DM AM _____ M Date _____ 1956

Expt. 1-5 Time 3:50 PM Date 2-22 1956
 Purpose Removing 1/2 plate out of box 9 slit?
 Personnel: _____

log N 0.42 DC3 73 x 10 x 10
 R-1 4.34 100 x 1000
 3:52 PM Blade 18.15 Water 109.5
 Critical

3'5"

Rod out (28.30) on period [See log chart]

3 min Y6 on for factor x 4

Blade leveled off Rod at 18.17

with Rod at 15.41 factor is 3'5" (Neg Period)

Blade Rod bars out at 28.3 " " 2'5" (Pos Period)

An attempt to drop control blade resulted in safety dropping also.

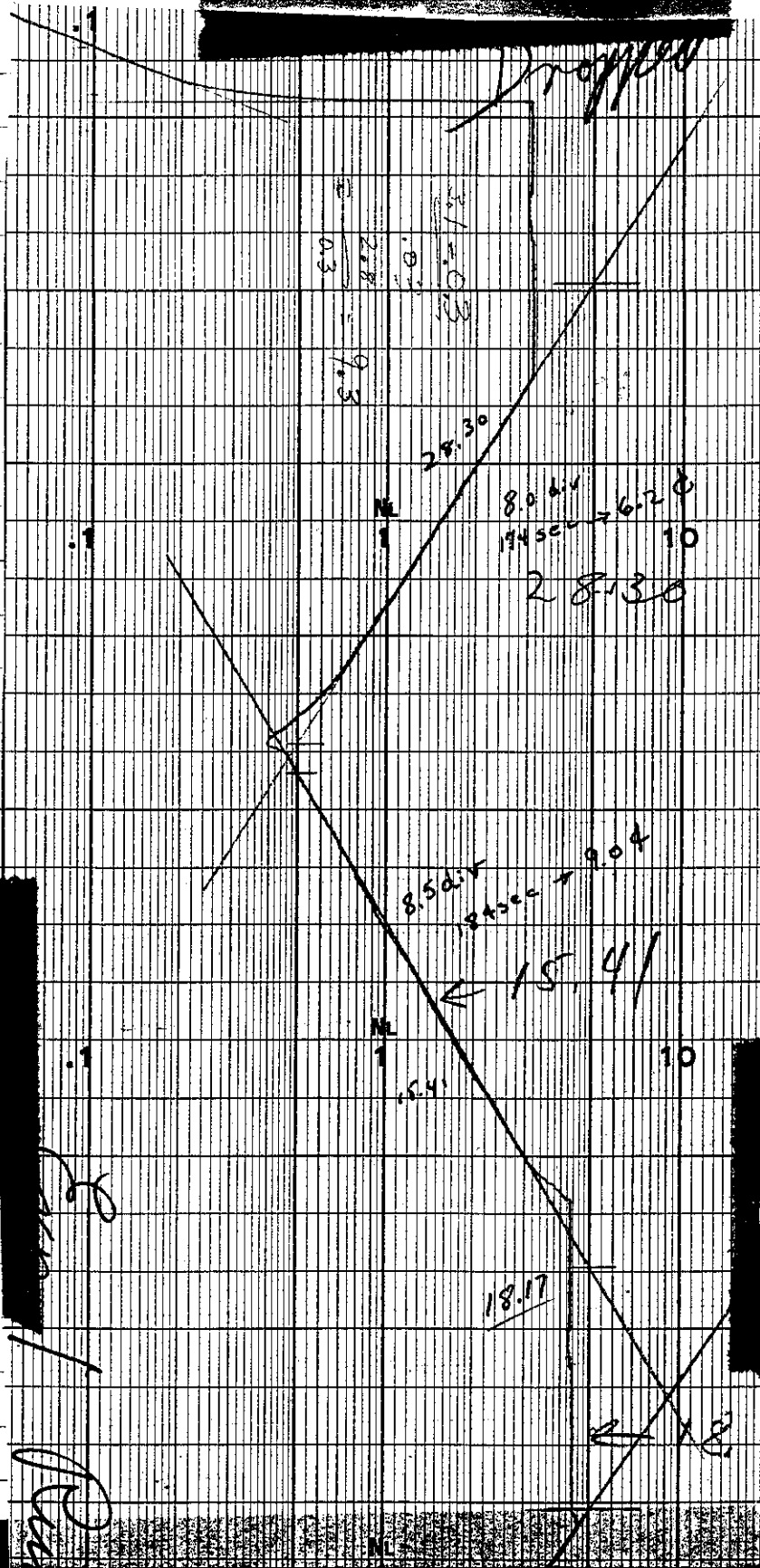
Feb 23, 1955	Blade		Δk
	18.13	CRIT.	XX
	28.30	+16/sec →	6.6¢
	18.17	CRIT	—
	15.41	-18¢ →	9.0¢
	28.30	+174 sec	6.2¢

Case K

1-4	1st	Critical Loading: $9\frac{1}{2}$ $\xrightarrow{311.3}$ 7.39 ₃	+15.4¢
1-5	2nd	" " $[9\frac{1}{2} - \frac{1}{2} \text{ plate in box 9}]$ 7.37 ₇	+16.4¢

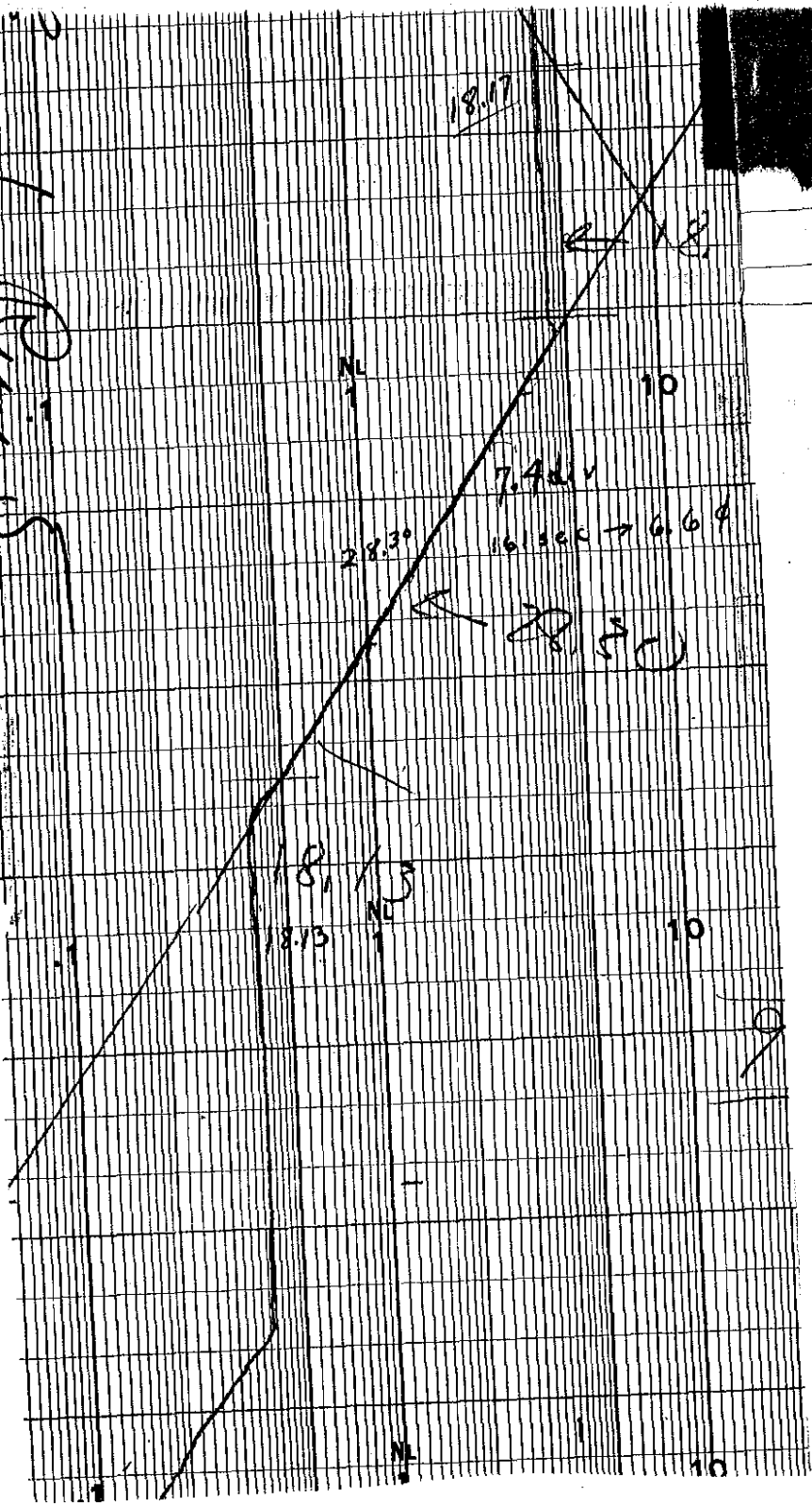
Fuel worth left plate removed from slot 9 box 9 $9.0¢ / 15.5$
 = 0.58¢/g

Corrected loading 5×5 $\xrightarrow{311.3}$ $7.377 - .011 = 7.366$ kg
 $311 \quad 7.386 - \frac{15.4 \times 279}{.58} = 7.36$
 7.39 - 0.3



10
10

Print S



Rod 4 moved to Box 14

When selwyn reads 22.54, poison section
of 1/4 rod is 1/2" above fuel, i.e. even with plate
edge.

Tower Rod n #2 Length = 26 1/2"

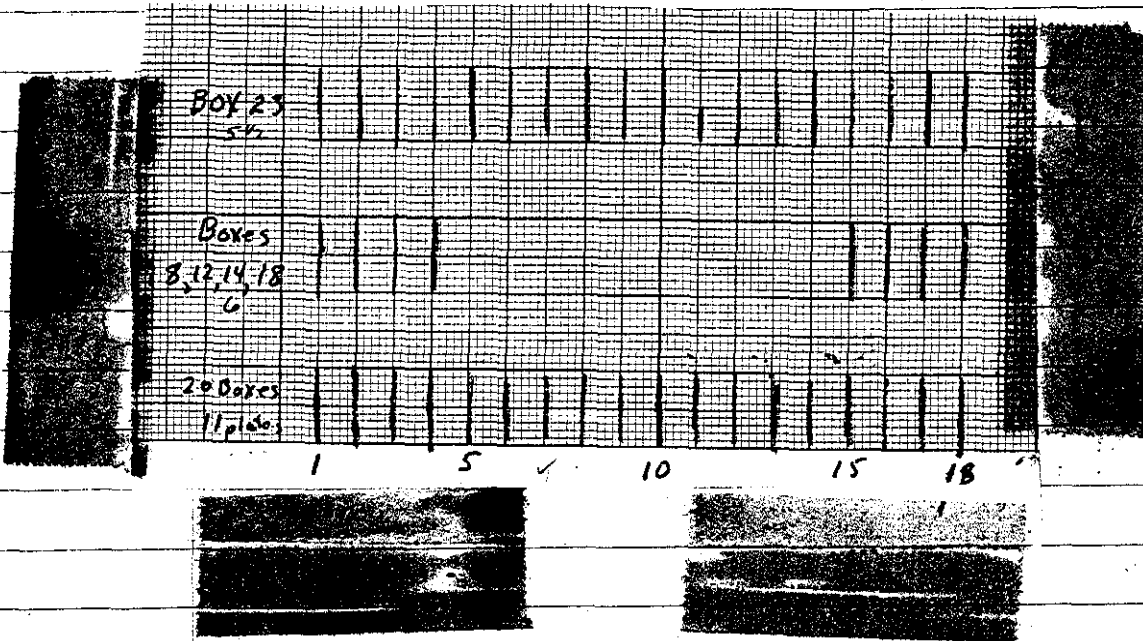
Out 24.63

In 999.98 End of Rod 1" above core

Blade broken

Core Loading:

Feb 27, 1956



$20 \times 11 = 220$

$4 \times 6 = 24$

$5\frac{1}{2} = \frac{5\frac{1}{2}}{249.5}$

$\times 31.13 = 7.767 \text{ kg}$

INSTRUMENT CHECK			
Date	2-27-1956	Time	9:00 AM
		Source	Radon
Instrument		Distance	Source to Scale
DC-1			
DC-2			
DC-3	60 X10X20	Near-Contact	
Log N	15 sec. Per job	Moving	
R-1	5X1000X100	Contact	
R-2			
P. M.	800V	200g alarm	also checked

Expt. 2-1 Time 11¹⁵ AM Date 2-27 1956
 Purpose M with voids in
Boxes 8, 12, 14, 18, Box 23 1/2 Lndcb
 Personnel: J.H. D.F.C. DWM

START-UP CHECK LIST
 Equipment Checked by DWM Personnel Check by DWM
 Instrument and Safeties Checked and Rec'd by DWM
 "Source In" Checked by D.F.C. Source No. ✓
 Emergency Equipment in Control Room Checked by DWM
 Red Light On by DWM
 Start-Up OK'd by D.F.C. Time 11¹⁵ AM Date 2-27 1956

loading: See p. 12.

Source In	Subcritical	Rod 2	24.63
Log N	0.017	Rod 9	22.53

Blade #3 Not working

14

Boxes ~~13~~
~~8, 12, 14, 18~~

BOXES
8, 12, 14, 18

Remaining
20 Boxes

Loading: $11\frac{1}{2} \times 20 = 230$
 $6 \times 4 = 24$
 $6 \times 1 = 6$

260 plates \rightarrow 8.094 kg U-235

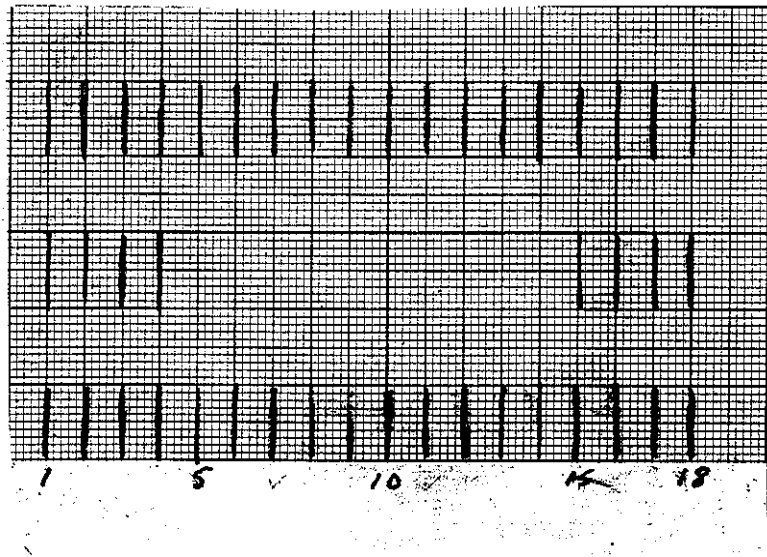
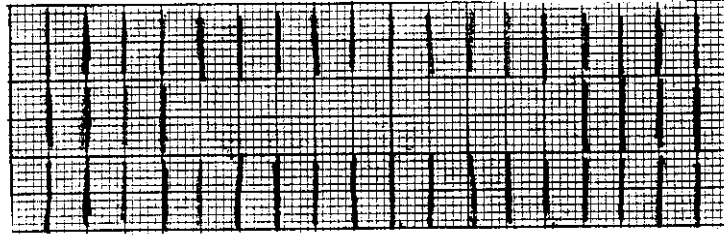
INSTRUMENT CHECK			
Date	2-28 1956	Time	8:10 AM
	Trip	Source No.	Return
Instrument	Model	Serial	Range
DC-1			Start-Up Scale
DC-2			
DC-3			
Log N	15sec	70x10x20	3"
R-1		7x100	Moving Contact
R-2			
P.M.	800V		1/2

Subcritical
Source In

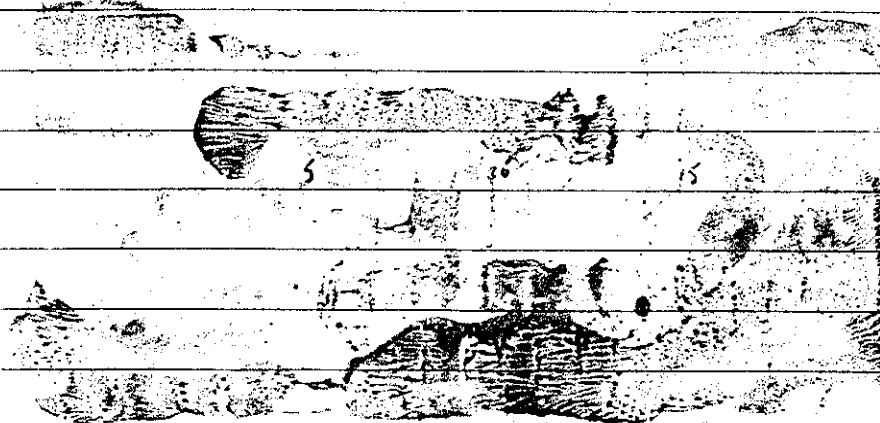
Expr.	2-2	8:10 AM	2-28 1956
Purpose	Same as 2-1		
Personnel	DWM	D.F.C.	

Log N 0.033
Rod 2 24.63
4 22.53

Equipment Checked by	DWM	by	DWM
Instrument		OWM	D.F.C.
"Source In"	DWM		
Emergency Eq.			D.F.C.
Red Light On by	DWM		
Start-Up OK'd by	DWM		2-28 1956



Loading: Added 12 1/2 plates by exchanging full plates for half plates in ²⁰ boxes ~~7, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25~~



Boxes 7, 3

Boxes 8, 12, 14, 18

Remaining 20 boxes

$$\begin{array}{l}
 1 \times 6 = 6 \\
 4 \times 6 = 24 \\
 \cancel{8 \times 11\frac{1}{2} = 92} \\
 20 \times 12 = 240
 \end{array}
 \left. \vphantom{\begin{array}{l} 1 \times 6 \\ 4 \times 6 \\ 8 \times 11\frac{1}{2} \\ 20 \times 12 \end{array}} \right\} = \begin{array}{l} 270 \\ \cancel{266} \end{array} \xrightarrow{\times 31.13} = \begin{array}{l} 8.405 \\ \cancel{8.277} \end{array} g$$

Control blade removed at 05 blade in out 29.515

INSTRUMENT CHECK				
Date	2-29	1956	Time	11 ⁰⁰ AM <input checked="" type="checkbox"/> Source No. <input checked="" type="checkbox"/>
Trip				
Instrument	Volts	Scale	Source Distance	Start-Up Scale
DC-1				
DC-2				
DC-3		10820	4"	
Log N. Period	15 Sec		Missing	
R-1		100000	Contact	
R-2				
P.M.	800 V			

16

Control Blade out 52

Expt. 2-3 Time 2-29 1956
 Purpose SAME AS 2-1
 Personnel: DWM DFC JAH

START-UP CHECK LIST
 Equipment Checked by DFC Person check by DFC
 Instrument and DFC
 "Source" checked by DWM No. +
 Emergency DFC
 Red Light DWM
 Start Up DWM 11:30 Date 2-29 1956

Crit Cond

DC-2	55 x 10 x 10	Rod 2 (oval)	24.68
3	60 x 10 x 10	3 (blade)	15.60
Log N	0.36	4 (Rod)	22.53
R-1	4.3 x 100 x 1000		

	Period	P
Moved Blade (3) to 17.19	+ 100	+ 9.64
Moved Rod (2) to 16.48 (24.68)	- 174	- 9.84
Moved Blade (3) to 29.51	+ 104	+ 9.34
Rod (2) to 15.26	level	
Total Blade		28.74

Rod ⁽³⁾ drop N.G. because Brake pen gain too high and pen on stop before drop DWM

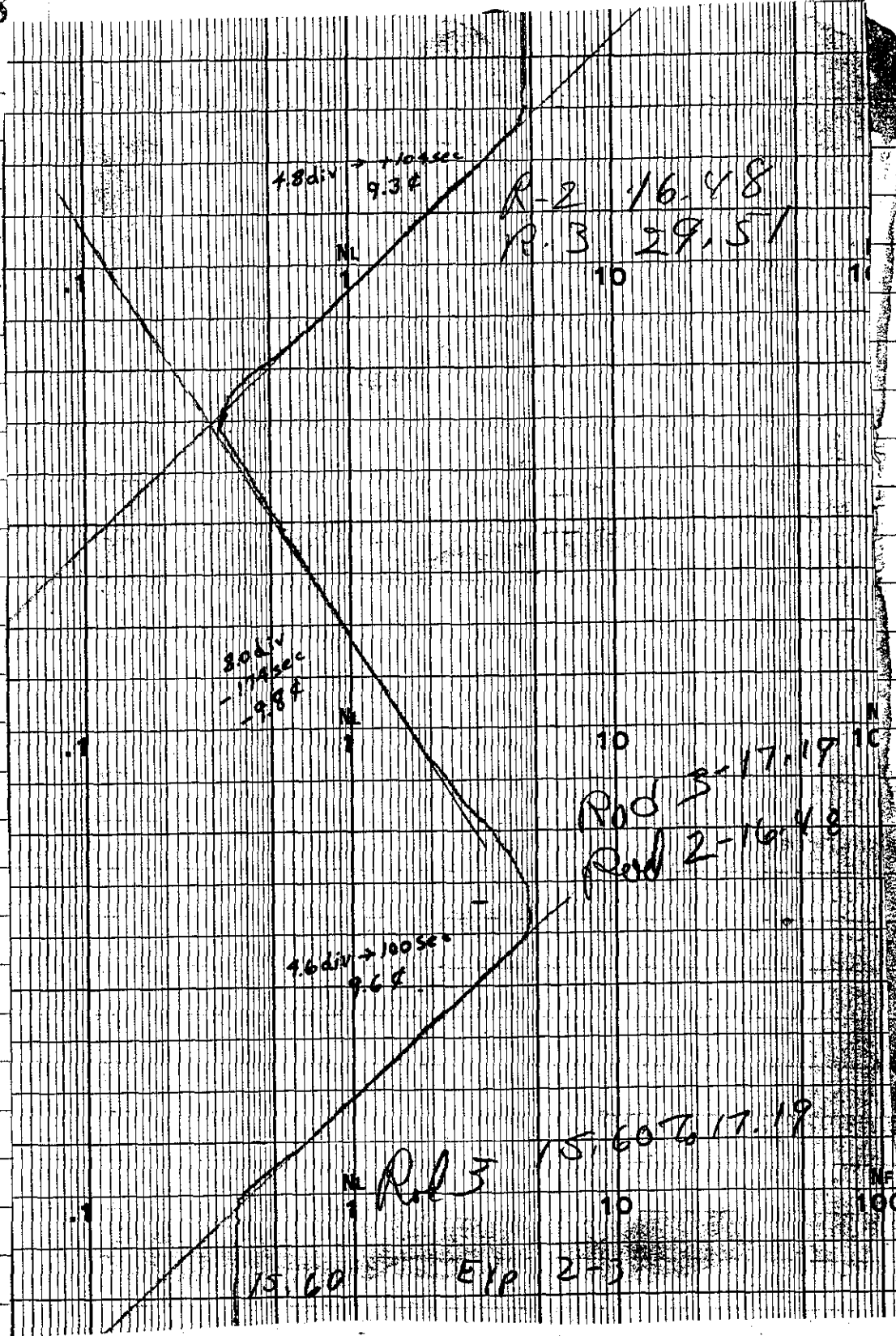
Checked Recorder and chart with balance voltage, and the above is false. DWM

Expr. <u>2-4</u>	Time <u>2:00</u> ^{AM} PM	Date <u>2-29</u>	195 <u>6</u>
Purpose: <u>SAME AS 2-1</u>			
Personnel: <u>DWM DEC JH</u>			

START-UP CHECK LIST		<u>CROSS</u>
Equipment Checked by <u>DEC</u>	Personnel Check by <u>DEC</u>	
Instrument and Safeties Checked and Tested by <u>DEC</u>	Source No. <u>✓</u>	
"Source In" Checked by <u>DWM</u>	Emergency Equipment in Control Room checked by <u>DWM</u>	
Red Light On by <u>DWM</u>	Start-Up OK'd by <u>DWM</u>	
Time <u>2:05</u> ^{AM}	PM	Date _____ 195 <u>6</u>

loading SAME AS EXP 2-3 EXCEPT
 Replaced Full Plates with HASE PLATES
 POS 9 IN BOXES 7, 9, 17, 19

Subcritical:



Expr. 2-5 Time 2:25 ^{AM} Date 2-29 1956
 Purpose SAME AS 2-1
 Personnel: D.W.M. D.F.C. J.G.H.

START-UP CHECK LIST
 Equipment Checked by D.W.M. Personnel Check by D.F.C.
 Instrument and Safety Checked and Tested by D.F.C.
 Source In Checked by D.W.M. Source No. 2
 Emergency Control Room Checked by D.F.C.
 Red Light Checked by D.W.M.
 Start Up OK'd by D.W.M. Time 2:25 ^{AM} Date 2-29 1956

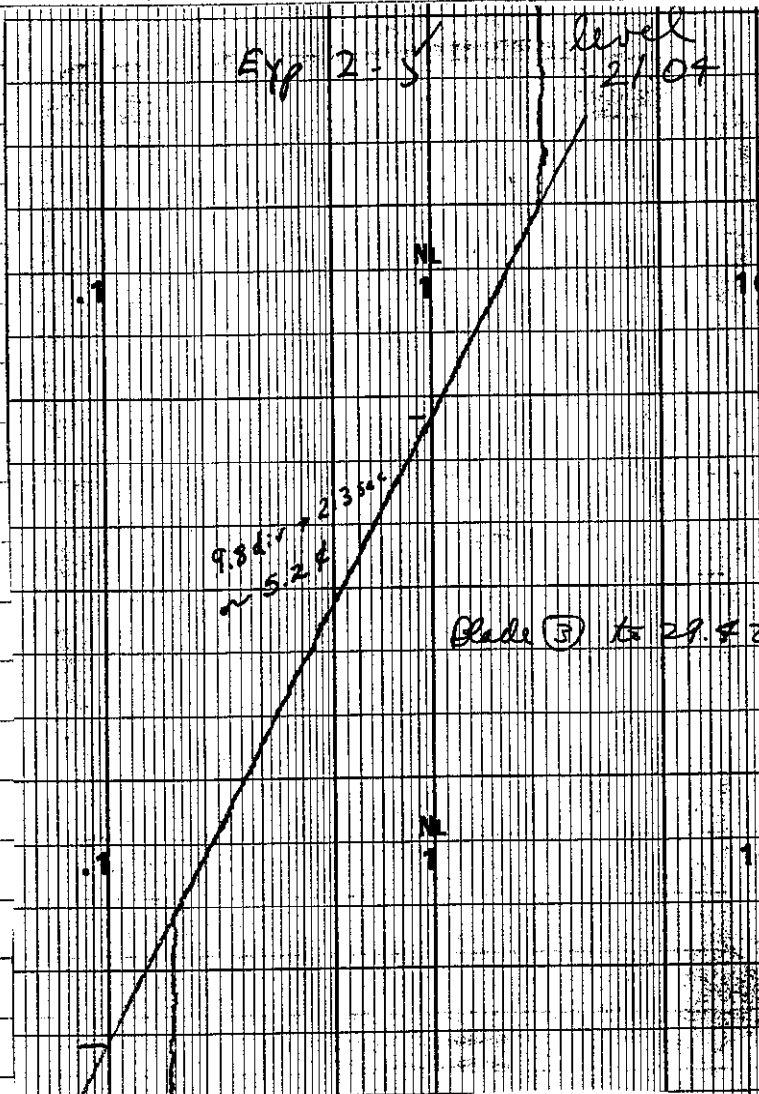
loading SAME AS 2-1 Except -
 Boxes 19, 17 pos 9 is vacant.
 Boxes 9, 17 contain half plates ^{plates} in pos. 9

LN = .165
 DC 3 53 X 10 X 5
 R1 3.4 X 50 X 1000

2 24.67 Positive Period 213 sec. 5.24
 # 3 29.42 90.5
 # 4 22.53

LN: = 2.2
 # 3 = 21.04
 # 2 = 24.67
 # 4 = 22.53

2 half plates worth 28.7 - 5.2
 = 23.5¢
 $\frac{23.5¢}{31.13} = 0.755 \text{ } \mu\text{g/mU-235}$



BRUSH ELECTRONICS COMPANY

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CHART NO. BL 908

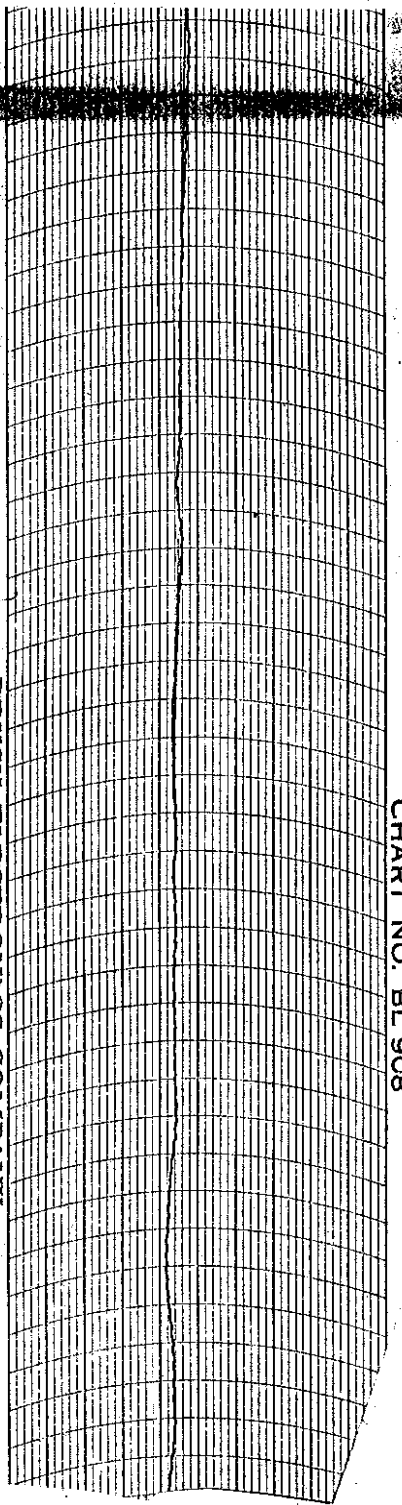
Exp 2 Run 5
 #3 Rod Dropped from 21.07
 #2 4 out

40-21
 21
 51 = 19.985

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CHART NO. BL 908



Decay curve with
lag in Tank

Using 80 sec extrapolation

$$\frac{N}{N_0} = \frac{1}{1 - k}$$

$$\frac{0.00025}{0.00025} = \frac{1}{1 - k}$$

$$\Delta k = \frac{0.00025}{N/N_0} = \frac{0.00025}{0.00025} = 0.001$$

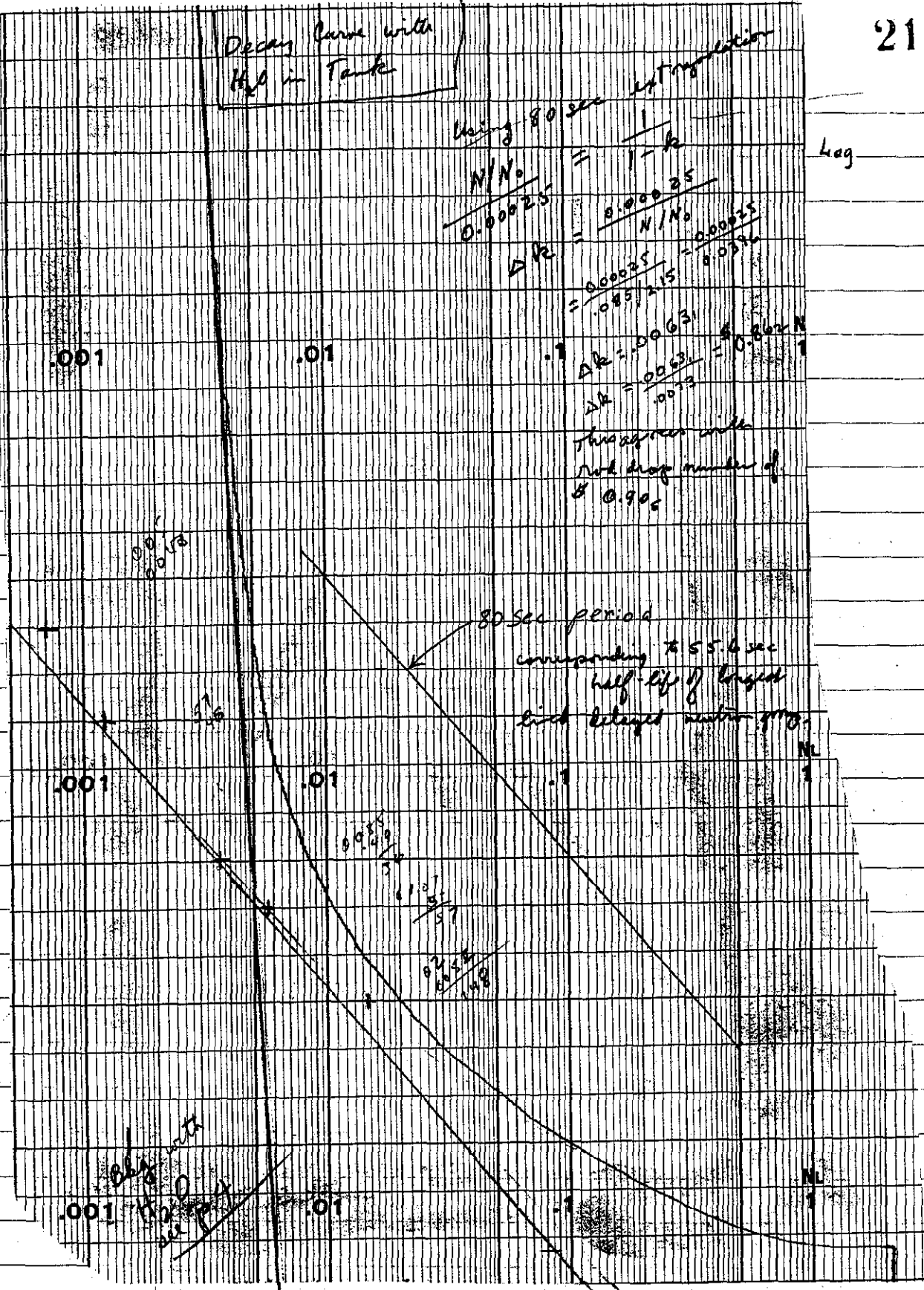
$$\Delta k = \frac{0.00025}{0.00025} = 0.001$$

$$\Delta k = \frac{0.00025}{0.00025} = 0.001$$

$$\Delta k = \frac{0.00025}{0.00025} = 0.001$$

Therefore with
not drag number of
0.90

Lag



80 sec period
corresponding to 55.6 sec
half-life of lagged
and delayed neutron group

0.001
0.01
0.1

Loading: Same as 2-3

20 boxes 12
 4 " 6
 1 " 6

INSTRUMENT CHECK						
Date	3-2	1956	Time	8 ⁴⁰	AM	Source No.
			Trip			
Instrument	Value	Scale	Source	Distance	Start-Up	Scale
DC-1						
DC-2	50	10x20				
DC-3	77	10x20		6"		
Log N	Period	12 sec				M.O.S
R-1	6	1000/1100				
R-2						
P. M.	800V			1"		

Exp:	2-6	Time	8 ²⁰	AM	Date	3-2	1956
Purpose	Fuel evaluation in Box 13						
Personnel:	DWM DFC						

START-UP CHECK LIST			
Equipment Checked by	DWM	Personnel Check by	DWM
Instrument and Safeties Checked and Reset by	DWM		
"Source In" Checked by	DWM	Source No.	
Emergency Equipment in Control Room Checked by	DFC		
Red Light On by	DWM	Time	8 ²⁰ AM
Start-Up OK'd by	DWM	Date	2-3 1956

Critical Cond.

Water #1 109.5

log N 0.50

Temp

DC-3 77 X 10 X 10

Rod #2 24.67

3 16.11

4 22.54

Add 1 1/2 plates to center box.

Fuel in slot 1, 3, 5, 8, 11, 14, 16 (1/2), 18

Exp. <u>2-7</u>	Time <u>9³⁰</u> AM	Date <u>3-2</u> 195 <u>6</u>
Purpose <u>addition fuel in center</u>		
Personnel: <u>D W M DFC</u>		

START-UP CHECK LIST	
Equipment Checked by <u>OWM</u>	Personnel Check by <u>OWM</u>
Instrument and Detector Checked and Bared by <u>Dr=C</u>	
'Source In' Checked by <u>Dr=C</u>	Source No. <u>✓</u>
Emergency Equipment in Control Room Checked by <u>OWM</u>	
Red Light On by <u>✓</u>	
Start-Up OK'd by <u>OWM</u>	Time <u>9³⁰</u> AM Date <u>3-2</u> 195 <u>6</u>

Crit Cond.

Water H ₀	109.5	log V ~ 0.48
temp	71.5° F	DC-3 78X10A10
2	16.48	
3	8.44	
4	22.54	

Blade Calib.	# 2	# 3	# 4	Level
vs # Rod	16.48	8.44	22.54	
	15.25	10.12	"	"
	13.98	12.05	"	"
	12.99	13.60		
	11.94	15.60		

Fuel Worth in Box 13	#3 8.44	69.6
	" 16.11	25.3
		<u>44.3</u>
$\frac{63.7¢}{46.7} = 1.364$ #/gm	#2 16.48	19.4
		<u>63.7¢</u>

Loading: Exchanged (7 1/2) G A P PR element for 7 1/2 plate Box 13.

Expt. <u>2-8</u>	Time <u>10⁵⁰</u> AM	Date <u>3-2</u> 195 <u>6</u>
Purpose <u>Evaluate submergence</u>		
Personnel: <u>DWM DH</u>		
START-UP CHECK LIST		
Equipment Checked by <u>D. W. M.</u>	Personnel Check by <u>D. W. M.</u>	
Instrument and Safeties Checked and <u>OK</u>	<u>D. W. M.</u>	
"Source In" Checked by <u>DH</u>	Micro No. _____	
Emergency Equipment in _____	Checked by <u>DH</u>	
Red Light On by <u>D. W. M.</u>	_____	
Start-Up OK'd by <u>D. W. M.</u>	Time <u>10⁵⁰</u> AM	Date <u>3-2</u> 195 <u>6</u>

Rod 2	11.84	} Waterhit 109.4 Temp ~ 72
Rod 3	13.11	
Rod 4	22.54	
DC-3	76 (10x10)	log N 0.5

	Rod 2	Rod 3	log N	(Period Extends from log N chart)
① 11 ¹⁴	11.01	14.92	11	level
11 ¹⁵	10.21	14.92	—	neg - period 154 sec
② 11 ²⁵	11.04	14.92	0.95	level
	11.04	15.60		+ 297 sec
③	11.95	13.11	0.85	level
	11.95	11.05		neg 156 sec
	13.82	11.05		+ 146 sec
12 ⁰⁰	13.82	7.76		neg 170 sec
	16.00	7.76		+ 108 sec
④	16.00	5.38	11	level

12¹² Rod 2 16.00 Rod 3 = 0.03
 12²² Rod 2 16.62 Rod 3 = 0.03
 (5) very 191 are level

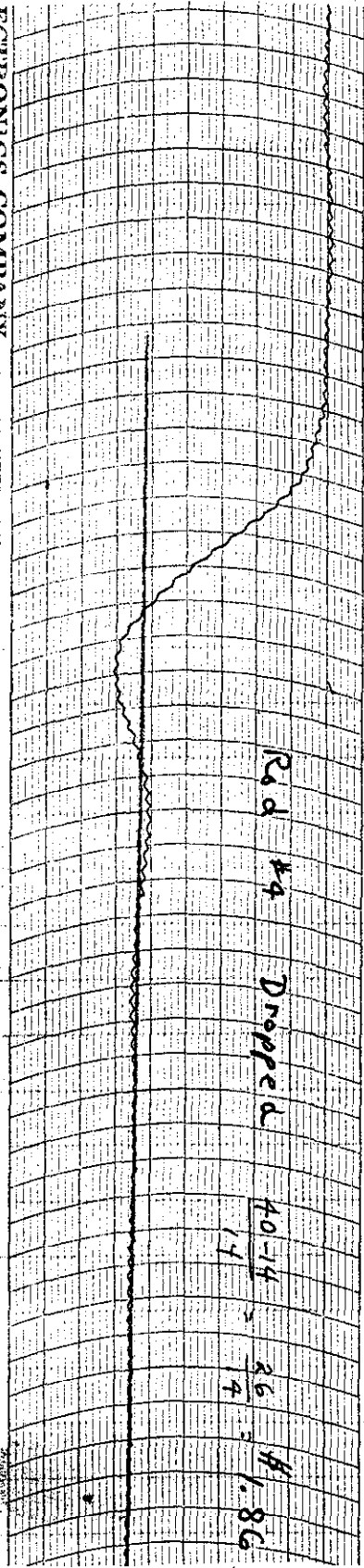
Rod 2 drop #1 from log N at 7

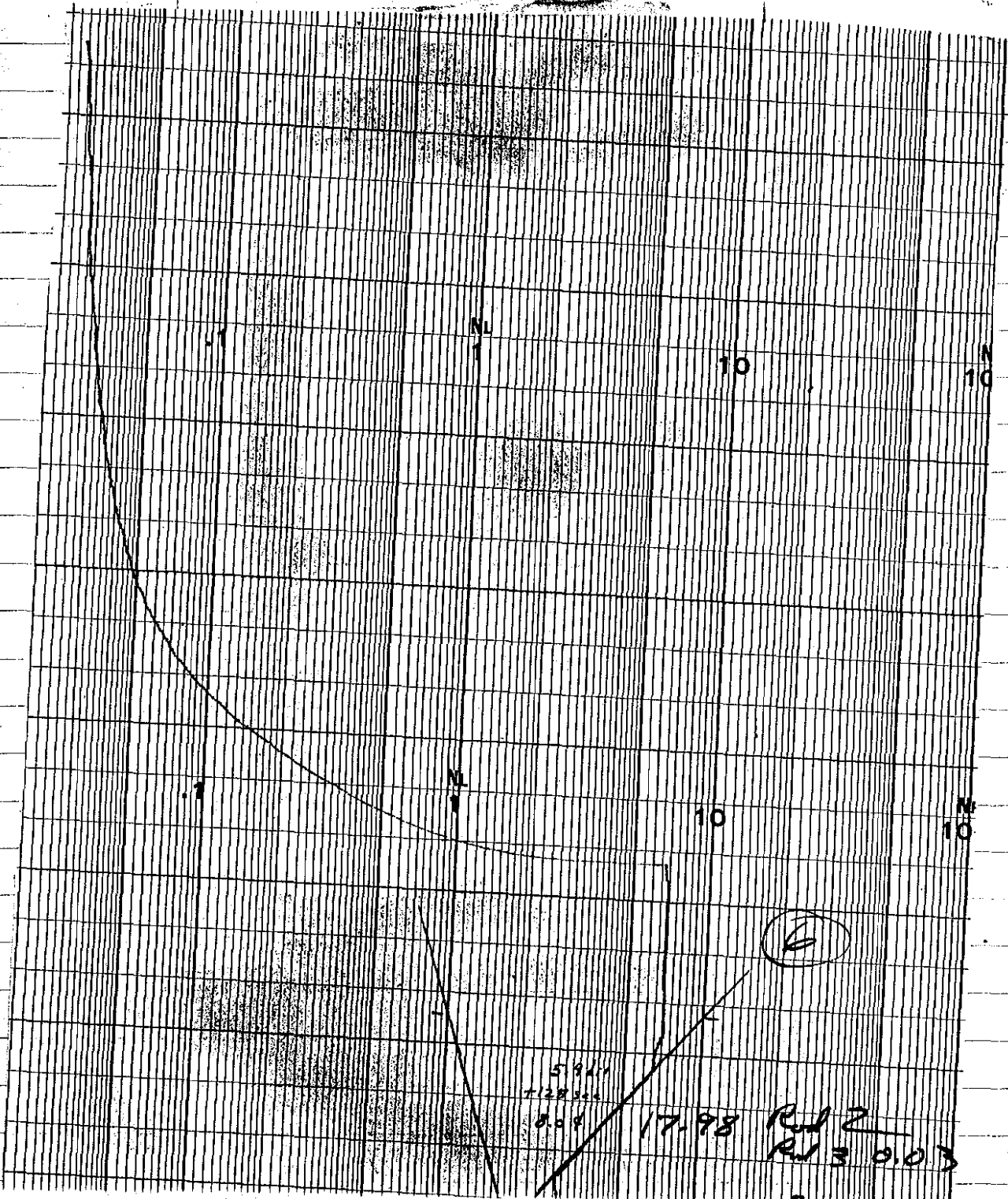
(6) 12²⁷ Rod 2 = 16.70 Rod 3 = 0.03 Rod 4 22.54 level
 #3 Blade value

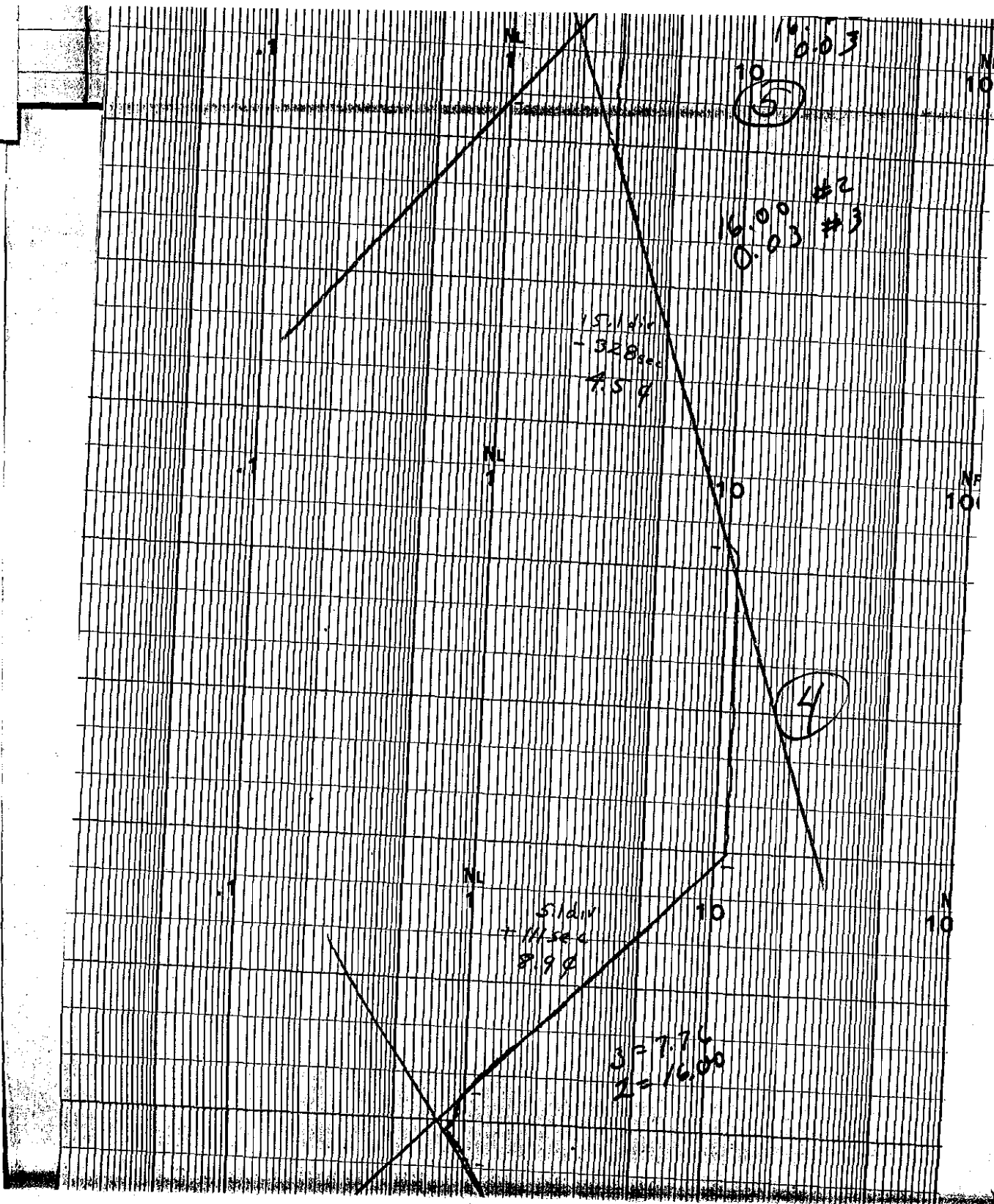
	#2	#3			
	11.94	13.11	level		
		14.92	+ 82.5	11.24	
71.2	11.01	14.92	Level		
30.6	10.21	"	- 180	9.44	13.11 43.7
	11.04	14.92	Level		14.92 32.5
	"	15.60	300 sec	3.84	15.60 29.7
	11.95	13.11	level		
60.0	11.95	11.05	- 154 sec	11.74	11.05 55.4
	13.82	"	+ 143 sec	7.34	7.76 93.2
41.9	"	7.76	- 165 sec	10.54	5.38 82.1
13	16.00	"	+ 111 sec	8.94	0.03 86.6
	"	5.38	level		
22.5	"	0.03	- 328	4.54	
18.0	16.62	0.03	Level		
10.0	17.98	.03	+ 128	8.04	
	16.70		Level for Rod #4 drop.		
28.7	15.26				
19.4	16.48				
0	24.68				

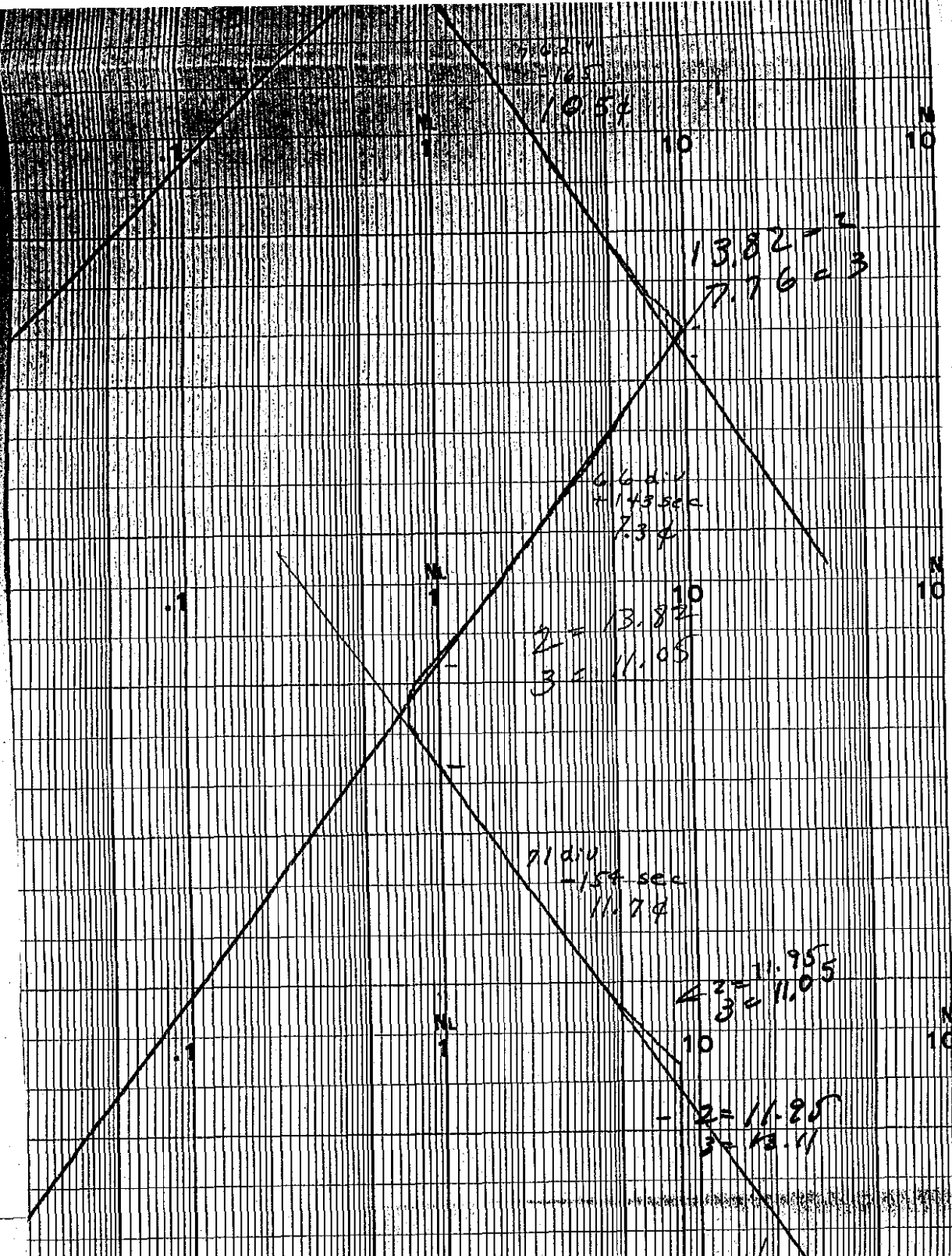
React change for APPR Element
 14.34 Δk for 9 rods

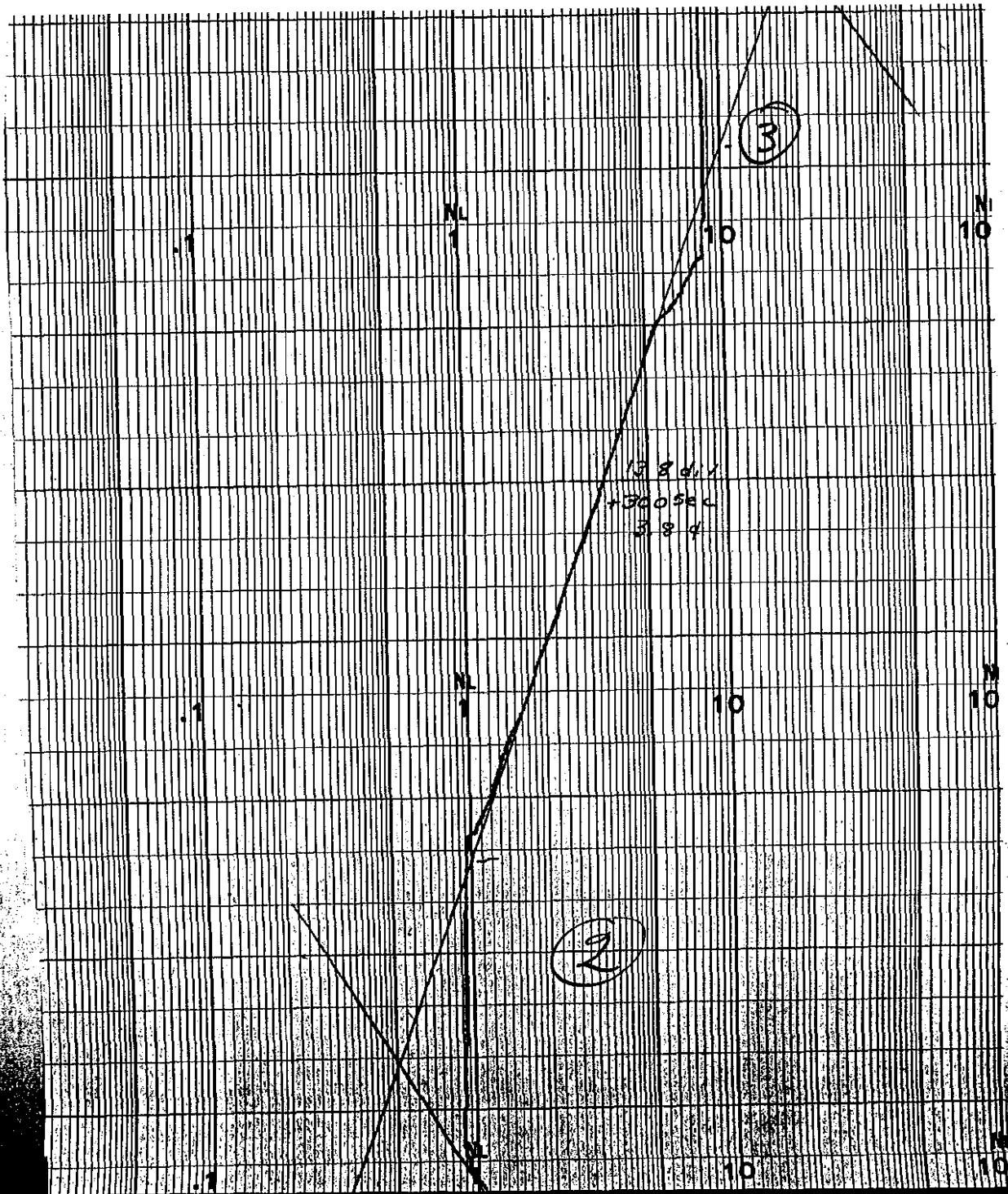
#3
 13.11 → 43.7
 15.60 28.7
 49.74
 15.0

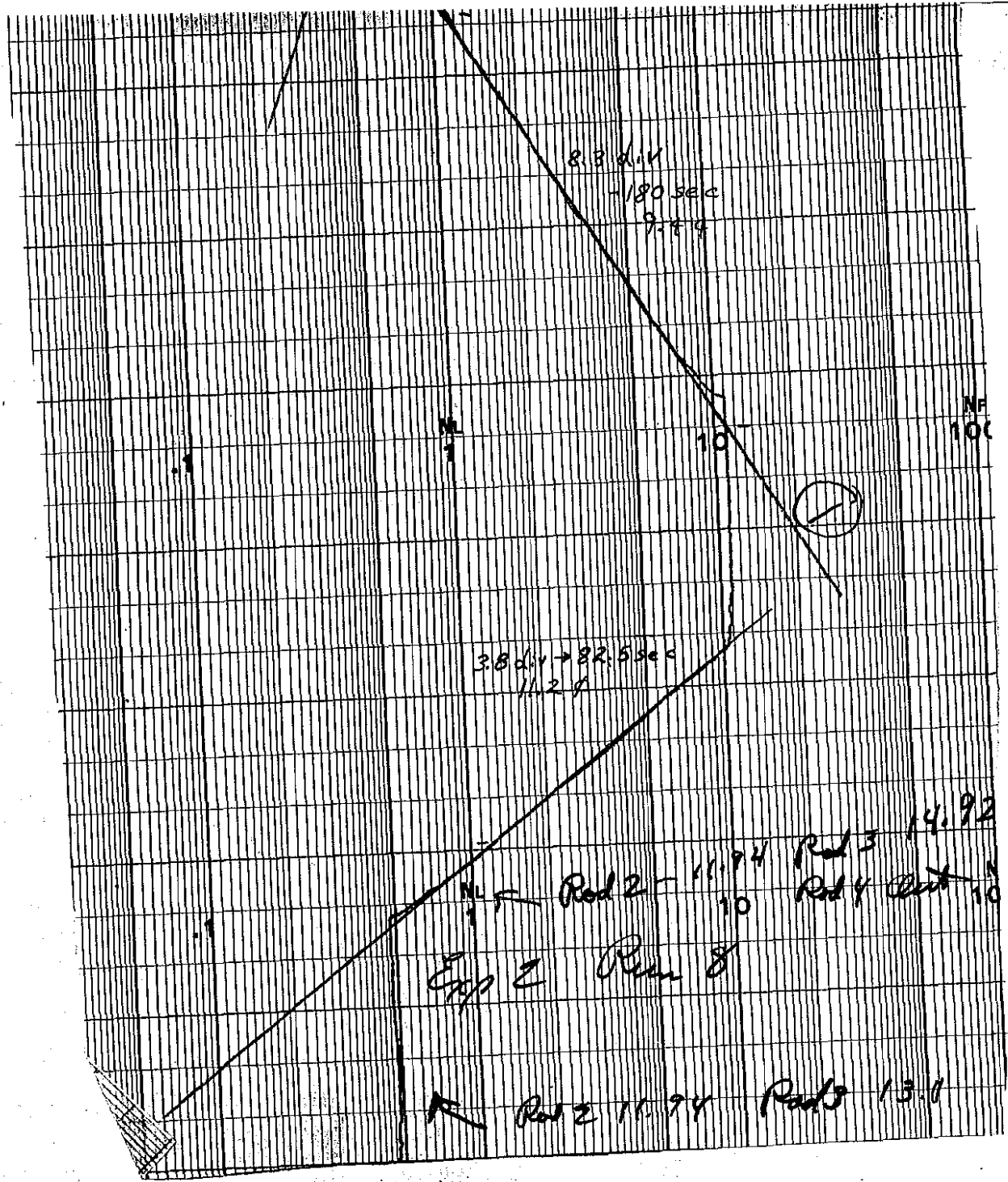












INSTRUMENT CHECK				
Date	Mar 5	1956	Time	5:00 PM
Instrument	DC-3	Scale	79 x 10 x 20	Start-Up Scale
DC-1				
DC-2				
Log N	Period	12 sec	Moving	
R-1	6.5 x 1000 x 100		Contact	
R-2				
P. M.	200 V		1"	

loading: 20 x 12 } same as Exp 2-7
 4 x 6
 1 x 7 1/2

Expr.	2-9x	Time	5:15 AM	PM Date	3-5	1956
Purpose	Fuel Evaluation + Rod Calibration (Zero Run)					
Personnel:						

START-UP CHECK LIST	
Equipment Checked by	Dwight Personnel Check by Dwight
Instrument and Safeties Checked and Reset by	Dwight
"Source In" Checked by	Dwight Source No.
Emergency Equipment in Control Room Checked by	
Red Light On by	Dwight
Start-Up OK'd by	Dwight Time 5:15 PM Date Mar 5 1956

Crit. conditions

Water Ht	109.5	Log N	0.52
" Temp	74 °F	DC-3	79 x 10 x 10
Rod # 2	(0) 10.21	R-1	4.3 x 100 x 1
" # 3	(blade) 21.44		
" # 4	(0) 22.54		

Expr. 2-10 Time 6¹⁰ PM Date 3-5 1956
 Purpose additional fuel Box 13
 Personnel: Sum DK JH

START-UP CHECK LIST
 Equipment Checked by DWM Personnel Check by DK
 Instrument and Safeties Checked and Reset by DK
 "Source In" Checked by DK Source No.
 Emergency Equipment in Control Room Checked by JH
 Red Light On by AM
 Start-Up OK'd by Time PM Date 195

1 3 5 7 10 12 14 16 18
 Box 13 9 Plates fuel 72 →

Critical Conditions:

① Water Ht 109.5 log A 0.51
 " Temp. 74" DC 3 75 x 10 x 10
 Rod #2 10.21 R-1 3.9 x 100 x 1000
 Rod #3 8.54
 Rod #4 22.54

② Rod #2 9.35 ③ Rod #2 8.49
 Rod #3 10.54 Rod #3 12.35
 Rod #4 22.54 Rod #4 22.54

④ Rod #2 7.71 ⑤ Rod #2 7.00
 Rod #3 13.975 Rod #3 15.49
 Rod #4 22.54 Rod #4 22.54

⑥ Rod #2 6.03
 Rod #3 17.53
 Rod #4 22.54

⑦ Rod #2 5.01
 Rod #3 20.14
 Rod #4 22.54

Expr. 2-71 Time 7¹⁵ PM Date 3-5 195
 Purpose added fuel to slot 8 Box 13
 Personnel: and

START-UP CHECK LIST
 Equipment Checked by DL Personnel Check by DL
 Instrument and Safeties Checked and Reset by DL
 "Source In" Checked by DL Source No. _____
 Emergency Equipment in Control Room Checked by DL
 Red Light On by _____ AM
 Start-Up OK'd by DL Time _____ PM Date _____ 195

Fuel plate added in slot 8 Box 13
 fuel now in slots 13 578 10 12 14 16 18

Critical Conditions: log N 0.52
 Rod # 2 5.01 IC-3 78 x 10 x 10
 Rod # 5 12.80 R-1 4 x 100 x 1000
 Rod # 4 22.54

② Rod #2 4.01
 Rod #3 14.08
 Rod #4 22.54

③ Rod #2² 3.01
 Rod #3³ 15.17
 Rod #4 22.54

④ Rod #2 2.01
 Rod #3 15.98
 Rod #4 22.54

⑤ Rod #2 1.01
 Rod #3 16.50
 Rod #4 22.54

(6) Rod #2 999.97
 Rod #3 16.83
 Rod #4 22.54

(7) Rod #2 = 2.00
 Rod #3 = 16.83
 Rod #4 = 19.90

(8) Rod 2 4.00
 Rod 3 ~~16.83~~
 Rod 4 17.15

(9) Rod 2 6.00
 Rod 3 16.83
 Rod 4 14.90

(10) Rod 2 9.00
 Rod 3 16.83
 Rod 4 11.75

(11) Rod 2 12.00
 Rod 3 16.83
 Rod 4 9.01

(12) Rod #2 14.50
 Rod #3 16.83
 Rod #4 7.13

(13) Rod 2 16.99
 Rod 3 16.83
 Rod 4 5.70

(14) Rod 2 19.01
 Rod 3 16.83
 Rod 4 4.82

(15) Rod 2 21.00
 Rod 3 16.83
 Rod 4 4.35

(16) Rod 2 27.65
 Rod 3 16.83
 Rod 4 4.26

Expr. 2-12 Time 8³⁵ Date 3-5 1956
 Purpose full loading 12 plates Box 13
 Personnel: same

Loading
 $21 \times 12 = 252$
 $4 \times 6 = 24$
 276

START CRIST
 Equipment Checked by P.M. check by OK
 Instrument and Safes OK OK
 "Source In" Checked by OK OK
 Emergency Equipment checked by OK
 Red Light On by — AM
 Start-Up OK'd by — PM Date 195

8.592 kg

Critical Conditions.

Water 109.5 temp 74°F

Rod 2 13.01 log N 0.54
 ① Rod 3 16.83 DC 3 78.8 x10x10
 Rod 4 4.26 R-1

Rod 2 15.84 23.5
 ② Rod 3 16.83 21.04
 Rod 4 998.35 195.1
239.6 4

Fuel worth (10 → 12)

$$\frac{50.4}{62.25g} = 0.803 \text{ } \$/g$$

Summary:

5x5 Clean Critical

Exp 1-4	9 1/2	or 7.39 ₃	+ 15.4 ¢	
1-5	- 1/2 plate Box 9	7.37 ₇	+ 6.4 ¢	> 0.58 ¢/gm

Tower Shielding Configuration:

2-3	20 x 12 1 x 6 1 x 6	8.405	+ 28.7 ¢	
2-5	Less 2 full + [Slot 9] 2 half [Box 9, 17]	8.37 ₄	+ 5.2 ¢	> 0.75 ¢/gm
			Blade drop 90.5 ¢	
2-6	Same as 2-3		+ 25.3	Reactor Δk = 34 ¢
2-7	Add 1/2 Box 13		+ 89.0	$\frac{63.7}{46.7} = 1.36 + \frac{5}{9}$
2-8	APPR Box 13		186	> 15.0 ¢
	Rod #4 Drop	186 ¢		
2-9	7 1/2 Box 13		+ 85.0	Reactor Δk = 4.0 ¢
2-10	9 Box 13		+ 64.9/46.7	= 1.39 ¢/gm
2-11	10 Box 13		37.9/31.1	= 1.22 ¢/gm
2-12	12 Box 13		50.0/62.26	= 0.80 ¢/gm

Center Element 6 - 12 Totals 216.5 g

$$\times 0.0073 = 1.58\%$$

APPR Homo-ELEMENT

327.5

$$209.88 \text{ g} \times Y = 15.0 + 1.38^{77} \text{ g/gm} \times 233.5$$

$$Y = \frac{337.5}{209.9} = 1.607 \text{ g/gm}$$

Fuel worth in APPR plates
at Box 13

$$\text{Dis. Factor} = \frac{1.38}{1.607} = 0.859$$

Dis. Factor for 12 plates Lin. extrapolation = 0.92

$$\frac{31.13 \times 12}{6^{216}} = 373.56 \text{ g} \quad \times 2.2 = 8.212$$

$$\times 8.212 \times 0.92 = 7.555 \text{ kg}$$

$$2744 (27\%) @ .364 \text{ g/g} = .753 \text{ kg}$$

$$2744 (27\%) @ .75 \text{ g/g} = .365 \text{ kg}$$

$$411 + 1390 @ .75 = 1.129$$

$$411 + 1390 @ .75 = .548$$

of 8.0 kg in loading

$$\frac{8.0}{2.2 \text{ boxes}} = 363.6 \text{ gm/box}$$

$$\frac{363.6}{18} = 20.2 \text{ gm/plate}$$

INSTRUMENT CHECK

Date 3-7 1956 Time 8³⁰ AM
 PM Source No. _____

Instrument	Trip Value	Scale	Source Distance	Start-Up Scale
DC-1				
DC-2				
DC-3	<u>62</u>	<u>10x20</u>	<u>4"</u>	
Log N	<u>1050</u>	<u>c</u>	<u>Moving</u>	
R-1	<u>5.5</u>	<u>X1000X100</u>	<u>Control</u>	
R-2				
P. M.	<u>800</u>		<u>1"</u>	

Loading: 21 x 12
6 x 4

Expr. 3-1 Time 8⁴⁰ AM
 PM Date 3-7 1956

Purpose: Fuel Evaluation zero Run

Personnel: D F C D W G M

START-UP CHECK LIST

Equipment Checked by D W G M Personnel Check by D W G M

Instrument and Safeties Checked and Reset by _____

"Source In" Checked by D F C Source No. L

Emergency Equipment in Control Room Checked by D W G M

Red Light On by D W G M

Start-Up OK'd by D F C Time 8⁴⁰ AM
 PM Date 3-7 1956

		H ₂ O Temp <u>74°F</u>
Time	Critical Conditions:	Water HT <u>109.5</u>
<u>~9⁴⁰</u>		Rod #2 <u>.01</u>
		#3 <u>7.20</u>
		#4 <u>22.53</u>
		Log N <u>.48</u>
		DC-3 <u>75X10X10</u>
		R-1 <u>3.7X100X100</u>
		DC-2 <u>85 X 1 X 10</u>

Remove Fuel plate from Slot 10 Boxes 1, 4, 15, 27, 24
and slot 2 Box ~~12~~¹²

Expr. 3-2	Time 9 ⁴⁰ AM	Date 3-7 1956
Purpose <u>Fuel Evaluation</u>		
Personnel: <u>Dwight D.F.C.</u>		

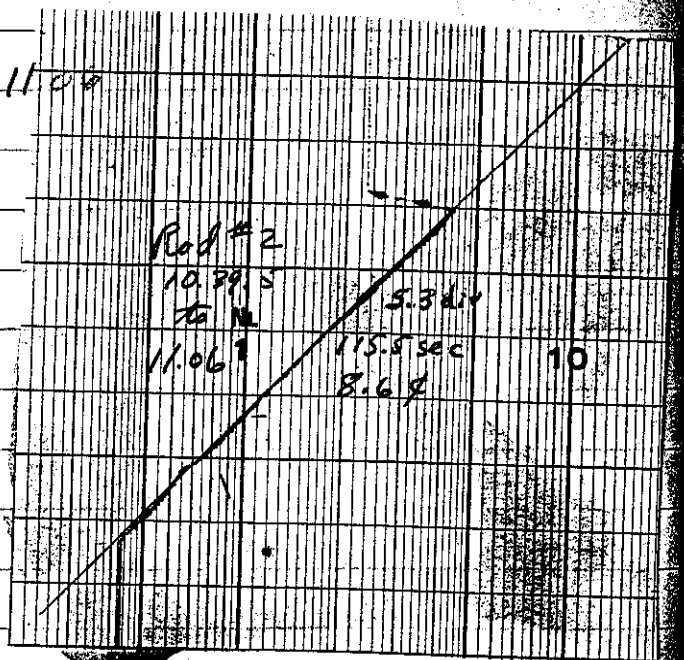
START-UP CHECK LIST	
Equipment Checked by <u>Dwight</u>	Personnel Check by <u>Dwight</u>
Instrument and Safeties Checked and Reset by <u>Dwight</u>	
"Source In" Checked by <u>D.F.C.</u>	Source No. _____
Emergency Equipment in Control Room Checked by <u>Dwight</u>	
Red Light On by <u>Dwight</u>	
Start-Up OK'd by <u>D.F.C.</u>	Time 9 ⁴⁰ AM Date 3-7 1956

Critical Conditions

rod # 2 (B.C.)	10.395
# 3 (Blade)	7.20
# 4 (Rd Cd)	22.54

Water HT 109.5
log N 43
DC-3 70x10x10
DC-2 85x1x10
R-1

PR Period ^{+112.5 sec}
#2 to ^{11.06} → 11.09



#2 10.395 = 68¢

∴ Average Fuel worth = $\frac{68¢}{6 \times 31.13} = \frac{68}{186.78} = 0.364 \text{ ¢/g}$

Assume fuel worth $\frac{12 \text{ plus}}{18 \text{ APPR}} = 0.92$

1.2¢ fuel worth = 0.364 ¢/g 24 boxes

APPR fuel worth = 0.396 ¢/g 24 boxes $\frac{.396 \times 24 + .802}{24.5} = .921$

Center box half loaded 1.377 ¢/g

APPR center box (half loaded) = 1.603 ¢/g .859

Average fuel worth $\frac{22 \times .364 + \frac{1.377}{2}}{22.5} = .386$

Critical Loading = $8.405 - \frac{20.7 \text{ ¢}}{.385} = 8.331 \text{ g}$

APPR 8.331 x .92 = 7.665

3% → 411 ¢ / .921 = 0.976

8.641 kg

March 27, 1955

Loading: 6 plates, boxes 8, 12, 13, 14 and 18
12 " , remaining boxes

Purpose to check out miniature fission chamber
Counter zeroed at top edge of Fuel box = 25.97 midplane = 12.00
Instruments were checked by FOX et al;
except log N, it responds OK.
Water gauge changed to Null. Source midplane east face

Expt. <u>4-1</u>	Date <u>Mar 27, 1956</u>
Purpose <u>Check Miniature Fission Counter</u>	
Personnel: _____	

START-UP CHECK LIST	
Equipment Checked by <u>Dum</u>	Personnel Check by <u>ERR</u>
Instrument and Safeties Checked and Reset by <u>Dum - ERR</u>	
"Source In" Checked by <u>Dum</u>	Source No. <u>(Not Out)</u> PN-57
Emergency Equipment in Control Room Checked by <u>ERR</u>	
Red Light On by <u>ERR</u>	
Start-Up OK'd by <u>Dum</u>	Time <u>12:00</u> Date <u>Mar 27, 1956</u>

Subcritical

Added 1 plate to box 13. Subcritical

Added 1 plate to box 13.

~~DC 3 Log N~~ ~~Selsyn Reading~~

(Applied Voltage N135V)

Level: Log N 1.1

Fission Counter: 4A Gain 16-1

DC 3 91-93 20x10

0.2µs, neg
PDL 10

counter position Selsyn Reading	Scaler x256	1 MIN Counting Time control blade	Scaler C4 DISC-25 x256
25.97	18 + 92 = 4900		
25.01	25 + 38 = 6438		
24.01	33 + 93 = 8541		
23.00	36 + 178 = 9394		
22.99	42 + 41 = 10793		
20.99	52 + 15 = 13327		
20.00	63 + 27 = 16155		
18.98	71 + 99 = 18275		
18.00	78 + 152 = 20120	16.68	
17.01	86 + 241 = 22257	16.69	
15.99	92 + 166 = 23718	16.66	
14.98	98 + 122 = 25210	16.72	
13.99	103 + 147 = 26515	16.72	(level slightly high) ^{92.5}
13.00	104 + 131 = 26755	16.70	
11.98	104 + 210 = 26834	16.69	
10.89	103 + 95 = 26443	16.70	
10.00	100 + 60 * = 25660	16.69	
9.00	98 + 24 = 25112	16.65	
7.99	93 + 90 = 23898	16.65	
7.00	85 + 186 = 21946	16.55	
6.00	81 + 38 = 20774	16.50	
5.00	67 + 171 = 17323	16.42	
4.02	67 + 172 = 15276	16.39	
2.98	50 + 41 = 12891	16.35	
2.01	38 + 166 = 9894	16.32	
0.99	35 + 3 = 8963	16.30	
-0.03	31 + 61 = 7997	16.30	
CKM 25.97		16.32	
CKM -0.03			

* extra register

40

Bkg: No contacts in 2' at 25.97 position



Miniature Count

EUGENE DIETZGEN CO.
MADE IN U. S. A.

NO. 3400-20 DIETZGEN GRAPH PAPER
20 X 20 PER INCH

28000

24000

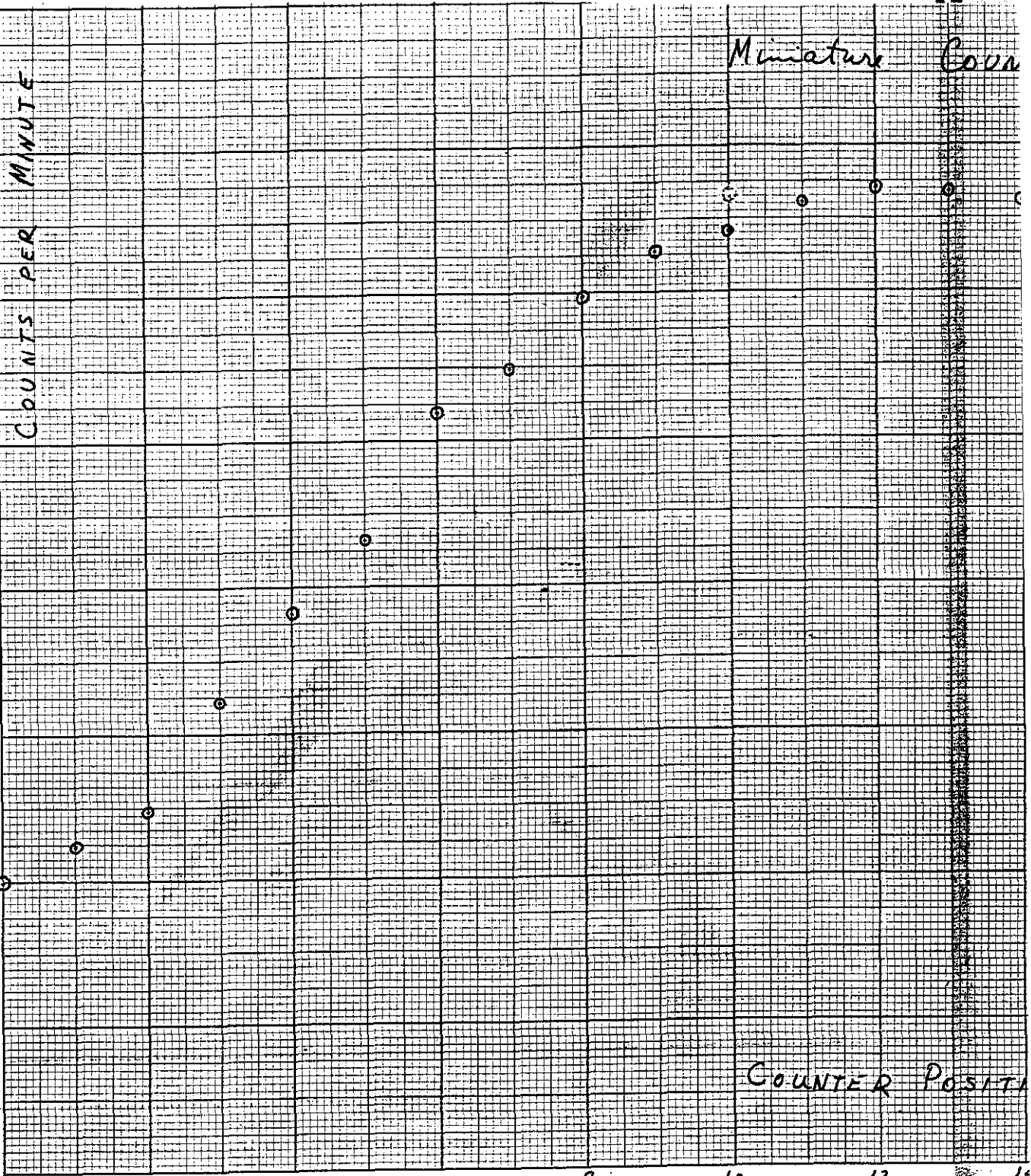
20,000

16,000

12,000

8000

4000



0

2

4

6

8

10

12

14

COUNTER POSITION

TER #1 in Tower Shielding Reactor Critical Experiment

$\log N = 1.1$

$DC-3 = 92 \times 10^4 \times 20$

Foil Runs on APPR

Made at $\log N = 2.0$ (max count) DC-3 off scale
and $R-1 \sim 6.6 \times 1000 \times 1000$

$\left\{ \begin{array}{l} \log N = 0.51 \\ DC-3 = 75 \times 10^4 \times 10 \\ R-1 = 3.9 \times 100 \times 1000 \end{array} \right.$

$\therefore \log N$ level for foil runs
would be $\frac{6.6 \times 1000 \times 1000}{3.9 \times 100 \times 1000} \times 0.51$
 $= 8.5$

$\frac{8.5}{1.1} = 7.7$

\therefore at foil run ^{power} max count would have been
207 000 c/min.

(Bkg 0 counts in 2 minutes)

ON (Selsyn Reading, Inches)

16 18 20 22 24 26

April 10, 1955

Fuel removed from core

A	25
B	24
C	25
D	20
E	25
G	24
H	25
I	22
J	25
K	25
L	0
M	25
O	1

266 plates

8 plates in Box 13

Steel removed

1
2
4
7
8
10

less 6 or 144 plates

Total plates $95 \times 18 - 10 \times 4 = 410$ $266 + 144 = 410$

} checks

Reactor drift calculations
at time of counter exp.

$$12 \times 20 = 240$$

$$6 \times 5 = 30$$

$$270$$

$$6 \text{ removed for fuel evaluation} = 264 \quad 6 \text{ removed} = 68 \text{ } \phi$$

$$2 \text{ added Box 13. Total critical} \quad 2 \times 1.3 \times 31.1 \quad +87 \text{ } \phi$$

$$\text{added } 13 \text{ } \phi$$

$$\text{Reactor excess} \quad \underline{22 \text{ } \phi}$$

$$35 \text{ } \phi$$

$$\text{Previous excess} \quad \underline{29 \text{ } \phi}$$

$$\text{Drift} \quad 6 \text{ } \phi$$

from 3-2 to 3-27 or 25 days

~~SECRET~~

~~SECRET~~

SECRET

Classification Change to *Deel.*
Authority of *J. H. Taha* *6/3/60*