BOOK48R

Notes:

Blank pages: 4, 19, 33, 55, 172, 203-300, page opposite page 300

-page 89 has 1 long graph sheet
-page 129 has 1 (8.5x11) and 1 smaller sheet stapled together and to the page

Scanned by:
Sheila Finch
RSICC /Oak Ridge National Lab.
August 12, 1999

J. T. Thomas
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subjects discussed. This often will establish error in occasional claims
ther parties that you have appropriated information from them revealed durin
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3. This notebook must be returned to issuing office when completed or upon termi[nation] of assignee.

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10. The description of the invention or discovery should be complete enough to be und[er]stood by anyone skilled in the art.

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NOTEBOOK NO. 3272

Assigned to: ~~R. D. Callihan~~ E. T. Thomas

Department: Physics Div.

Location: 9213, 4-12

Date: Nov. 12, 1953

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Subject | Page

This document consists of 304 pages.
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5-25-46

A ≡ 9.1" Diameter Sphere

B ≡ 10.4" Diameter Sphere

C ≡ 11.0" " "

D ≡ 12.6" " "

E ≡ 6" Diameter Cylinder

at end of U^{235} appro.

	U^{233}	234	235	238
	98.72	0.50	0.06	0.72
to Los Al.	9865	53	06	72

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12/24/53 — EXPERIMENT 86

70% + Thorium 12.56" Diameter Sphere — H/U-235 = ~502

Fully Reflected — added ~300cc H_2O to Soln of Exp. 85

Time	Temp.	Safety	Source	Manifold height	Probe height	Volume in liters	$C_1 M_1^{-1}$	$C_2 M_2^{-2}$
9 50	24°	up.	in	33	2.7		.5 —	8.6 —
10 33	~24°	up	out	53.11	11.68		just critical	
10 50	24°	added 80 cc H_2O to soln.						
11 40	24°	up	out	53.15	11.85		just critical	
11 45	24°	up	out	55.28	9.19		slightly super critical.	
12/28/53		added 20 cc H_2O ; changed source from #222 to #307						
9 53	23°C	up	out	53.70	12.32	(Full) 17.02	just critical.	

1/7/54 — Analysis below not representative of soln used. See Exp. 92 JTT.

ANALYSIS

Reg. # 215348	G: 74.4083	.05208	gms U / gm Soln
Sample # 259	T: 21.3791		
(P-276)	N: 53.0292	1.0608	sp. gr. @ 24.4
	218 gms U.		
Sample # 2510	G: 84.0213	.05409	gms U / gm soln
(P-228)	T: 26.3978	~~1.0775~~	sp. gr. @ 25.0°
Reg. 215353	N: 57.6235	1.0652	
	3.1 gms U.		

CALCULATIONS

Volume of reactor at critical temperature:

let S_i be the change in volume per unit volume at temperature t_i

V_c = Volume at critical

V_R = Volume at room temperature

V_i = Volume at t_i

$$V_c = V_{32}\frac{S_{54}}{S_{32}} = 16.90 \cdot \frac{1.01050}{1.0020} = 17.0419$$

V_c from t_i vs V_i curve = 17.0415 } good check.

$$V_R = \frac{V_c}{S_c} = \frac{17.0415}{1.01050} = 16.864 \text{ l.}$$

$$\frac{H}{U\text{-}235} = 26.111\ \frac{.93105}{.04952} = 490.93$$ } error in gms H/gm soln due to 5000 ppm Al in soln correction factor = .98973

$H/U\text{-}235$ = .05319 gms H/gm soln × .98973 = .05259 gms H/gm soln.

$$H/U\text{-}235 = 26.111\ \frac{.93176}{.04900} = 496.52$$

Critical Mass:

(A) $M = (.05259)(1.0639)(16.864)(.9318)$ } @ 25°C

$M = 879.24$ gms.

(B) $M = (.05259)(1.0639)(.9318)(16.69)(1.00025)$

$M = 870.38$ gms. Void present = 330 cc.

EXPERIMENT 87

12/28/53 — 12.56" Diameter sphere — $^{Lt}/_{U\text{-}235}$ = 496.52

Fox, Thomas, Callihan — Fully reflected, at 54 °centigrade — added ~27 gms U-235 to Soln of Ex 86. 91 cc. of .22998 gms/gm soln.

(A)

Time	Temp	SAFETY	SOURCE	manifold height	Probe height	Volume in Liters	Remarks
2^{25}	46/45	up	out	52.27	11.34	16.87	Just critical
2^{38}	51/48	up	out	52.27	11.38	16.89	" subcritical
3^{00}	50/50	up	out	52.42	11.50	16.92	Just critical
5^{36}		up	out	53.15	12.32	Full	Just subcritical
5^{39}	54/54.5	up	out	53.15	12.39	Full	Just critical

12/29/53

(B)

8^{37}	(28)/32	down	out	00.00	11.40	16.90	measure of volume of expansion.
9^{18}	—	up	in	20.75	00.00	0	check probe reading with manifold
10^{25}	24/24	up	out	51.85	11.00	16.69	just critical

ANALYSIS

Sample 2511	G	49.2581	
Req. #	T	19.8000	
	N	29.4581	
Sample 2512	G	60.3827	.05314 gms U / gm soln $^{1/5}$
Req. # 215350	T	19.3719	.0640 ~~.0702~~ sp. gr. @ 25°C
	N	41.0108	

2.2 gms U.

Volume at critical temperature:

$$V_c = V_{28}\frac{S_{65}}{S_{28}} = 16.79 \cdot \frac{1.0164}{1.0010} = 17.0483$$

V_c from V_i vs t_i curve = 17.0488 } good check

$$V_R = \frac{V_c}{1.0164} = 16.774\ \ell.$$

" " .05403 x .98973 = .05348 gms u / gm soln } correction for 5000 ppm Al.

$$H/_{U\text{-}235} = 26.11 \frac{.93061}{.04983} = 487.6$$

CRITICAL MASS:

(A) $M = (.05348)(.9318)(1.0651)(16.774)$ @ 25°C

$M = 890.31$ gms U-235

(B) $M = (.05348)(.9318)(1.0651)(16.525)(.99975)$

$M = 876.87$ gms U-235 Void present = 495cc.

12/

for

Time

12 38

2 43

12/30

8 20

10 00

EXPERIMENT 88

12/29/53 — 12.56" DIAMETER SPHERE — $H/_{U-235}$ = 48782

Fully reflected — added ~14 gms U-235 to Soln of Ex. 87

for Thomas — at 65° centigrade — 46 cc. of .23949 gm U / gm soln.

(A)

Time	Temp	safety	source	manifold weight	probe height	volume in liters	Remarks
12 38	74°	up	out	52.92	12.42	Full	slightly subcritical
2 43	64/65*	up	out	52.92	12.39	Full	just critical

* it has been shown by previous experiments that the solution temp lags the reflector water during cooling by 5°C at the lower temperatures. It may be expected, therefore that the higher temp gradient at 65°C will cause as much as 9 1°C temp difference (at a maximum!).

12/30/53

8 30 — 28° — — — 11.16 — 16.78 — (for Expansion)

(B)

10 00 — 26/26° — up — out — 51.57 — 10.76 — 16.525 — just crit

ANALYSIS

Sample 2513 G 67.1139
Reg # 21535 1 T 19.6039
N 47.5100
2.6 gms U.

.05403 gm U / gm soln 1/5
1.0651
+.0774 sp. gr. @ 25.0°

Sample 2514 G 78.0576
T 19.8778
N 58.1798

Analysis for Exp. 89

Sample 2515 G 72.1629 .15616 gms U/gm Soln

Req. # 215352 T 20.0485 1.2189 sp. gr.

N 52.1144

8.1 gms U.

Sample 2516 G 82.4186 ~.19 gm U/cm³

T 19.8535

N 62.5631

Calculations

$$\frac{H}{U\text{-}235} = 26.111 \frac{.79737}{.14551} = 143.08$$

Critical Mass:

$M = (.15616)(.9318)(1.2189)(10.56)(1.00025)$ @ 25°C

$M = 1.8734$ Kg.

Void present 6.46 liters

EXPERIMENT 89

12/30/53 — 12.56" Diameter Sphere — H/U-235 = 143.08

For Thomas — Fully reflected @ 26°C

Time	Temp	safety	source	manifold height	Probe height	Volume in Liters	Remarks
12 36	26°	up	in	57.27	6.81	10.35	Slight multiplication
		10.35 liters is the complete volume at sp.gr. 1.1345					
12 57	26°	added 340 cc of .22449 gram/gram soln.					
1 26	26°	up	in	57.27	6.96	10.680	Slight multiplication
1 40	26°	added 348 cc of .22449 gram/gram soln					
2 15	26°	up	in	57.27	7.13	11.10	Still Slight multiplication
~3 30		added ~1.1 liters of sp.gr. = 1.5 after draining 5 liters.					
		added ~.9 liters of .22449 gram/gram soln.					
4 25	25°	up	in	52.00	5.69	7.95	No multiplication

12/31/53 for Thomas — added ~1 liter of unknown concentration.

8 05	24°	up	in	50.80	6.10		Slight Multiplication
9 25		added 1 liter @ 1.14 sp gravity.					
9 45	24°	up	in	50.60	6.57		slightly more multiplication
11 00		added 1 liter @ 1.14 sp. gr.					
11 45	24°	up	out	48.80	6.90"	10.56 liters	just Critical

1.87294 Kg

CALCULATIONS

$$H/U\text{-}235 = 26.111 \frac{.84817}{.10903} = 203.12$$

CRITICAL MASS:

$$m = (.11701)(.9318)(1.15015)(11.5)(1.00102)$$

@ 25°C

$$M = 1.4436 \text{ Kg.}$$

Void present 5.52 liters

EXPERIMENT 90

12/31/53 — 12.56" DIAMETER SPHERE — H/U-235 = 203.12

Fully Reflected @ 24°c — added 1 liter @ sp.gr. 1.14 to solution of Exp. 89

Fox Thomas

@ 25°C

Time	Temp	safety	source	Manifold height	Probe height	Volume in Liters	Remarks
1:42	24°	up	out	47.91	6.92	10.565	just critical
		Volume not much different from Exp 89.					
		added 500 cc of H_2O to Soln.					
2:28	24°	up	out	47.50	6.96	10.690	just critical
1-4-54		added 2 Liters of H_2O					
Fox Thomas							
9:10	21°	up	out	46.0	7.14	11.1 l.	slightly Super critical.
9:20		added 2 Liters of H_2O					
10:07	21°	up	out	49.21	7.36	11.5 l.	just critical

1/4/54

Sample #2517 G. 88.1435 — .11701 gmsU/gmsoln

Req. #215356 T. 19.9710

N. 68.1725 — 1.1554 sp. gr. @ 25°

8.0 gmsU.

14.4865 Kg

CALCULATIONS

$H/U\text{-}235 = 26.111 \dfrac{.66297}{.24202} = 71.53$

CRITICAL MASS ☢

$M = (.25973)(.9318)(1.4268)(9.55)(1.00102)$ @ 25°C

$M = 3.3011$ Kg.

Void present 7.47 liters

EXPERIMENT 91

1-5-53

Fox and Thomas

12.56" DIAMETER Sphere N_{U-235} = 71.53

Fully Reflected @ 21°C Using 9.5 Liters @ .256 gms U / gms Sol

25°C

Time	Temp	Safety	source	Manifold height	Probe height	Volume Liters	Remarks
10:30	21°	up	in	37.92	3.10	3.0	establish equilibrium
11:50	21°	up	out	50.00	6.38	9.39	sub critical
12:50				added ~2.5 liters of solution at ~.256 gms U / gm sol
1:35	21°	up	out	46.32	6.44	9.55	just critical
1:45	21°	up	out	Rod inserted to 6" below solution surface resulted in a period of approximately 200 sec when withdrawn.			
1:53	21°	up	out	— reactor scramed by R-1 to test the effect of cd blade. Scram set on R-1 set at ½ usual value, reactor allowed on positive period of ~200 sec until scram point. Result: Cd-Blade more effective than Boron rod — but power levels for comparison not the same; also it is doubtful that equilibrium had been established.			

Sample 2518 G. 60.4308 .259730 gms U / gm Sol

T. 19.7476

Reg.# 215357 N. 40.6832 1.4185 @ 23.6°

10.57 gms 1.41268 corr.

3.27842 Kg.

cont'd from page 17 →

1-11-54

For J. Thomas

added ~50 cc of soln @ sp. gr. 1.16

Time	Temp	safety	source	Manifold height	probe height	Volume liters	Remarks
857	21.5°	up	out	54.20	12.8+	17.020	subcritical full
915	21.5°	added ~100 cc of soln @ sp. gr. 1.16					
950	21.5°	up	out	52.90	11.73	17.000	critical

ANALYSIS

Sample # 2519 G. 80.3045 .051350 gms U/gm Soln

Req # 215359 T. 20.0702

N. 60.2343 1.0620 sp. gr.

—— " —— 3.09

CALCULATIONS

$.051350 \times .98973 = .05082$ gms U/gm Soln { correction for 5000 ppm Al

$H/U\text{-}235 = 26.111 \dfrac{.93406}{.04735} = 515.09$

CRITICAL MASS: $M = (.05082)(1.0620)(.9318)(17.0)(1.00102)$ { @ 25°C

$M = 855.8$ gms

EXPERIMENT 92

12.56" DIAMETER SPHERE H/U-235 = 515.09

1-7-54

FULLY REFLECTED AT 21°C REPEAT of EXPERIMENT 86

Fox & Thomas

Added 1.6 Liters of H_2O to 16 Liters of EXPERIMENT 88.

TIME	TEMP	SAFETY	SOURCE	MANIFOLD HEIGHT	PROBE HEIGHT	VOLUME in LITERS	REMARKS
4[23]	21°	up	in	53.75	12.5 ~	17.020	Subcritical full
010854 Fox and Thomas		added ~21 cc of solution with analysis					.15616 gmsU/gmSol; 1.2189 sp.gr.
9[40]	21°	up	in	53.75	12.5	17.020	subcritical full
10[00]	21°	added ~25 cc @ .15616 gmsU/gmSoln.					
10[45]	21°	up	in	53.71	12.00	17.020	subcritical full
11[10]	21°	added ~50 cc @ .15616 gmsU/gmSoln					
12[00]	21°	up	in	53.75	12.32	17020	subcritical full
12[15]	21°	added ~25 cc of .15616 gmsU/gmSoln					
12[55]	21°	up	in	53.64	12.11	17.020	subcritical full
1[20]	21	added ~25 cc @ .15616 gmsU/gmSoln					
1[59]	21°	up	in	53.71	12.35	17.020	subcritical full
2[10]	21	" added ~50 cc @ .15616 gmsU/gmSoln					
3[00]	21	up	in	53.70	12.38	17.020	subcritical full
3[09]		here we question the concentration figure .15616 gmsU/gmSoln - check indicates sp.g. of Soln is 1.1655 instead of 1.2189					
3[16]	21°	added 100 cc @ ~.117 gmsU/gmSoln					
3[50]	21°	up	in	53.57	12.30	17.020	subcritical full

Cont'd on page 16

in for A.L.

D 25°C

18

Date: 080654

UO_2F_2 Solution for series "A experiments

From S.C.W charge #1

Gross wt 16.27000 Kg

Tare wt 1.9131

Net wt. 14.3569 Kg.

ANAL. Reg 354667 → 0.33511 gmsU/gmSoln sp.gr. 1.6205 at 24°C

= 0.54305 gmsU/cc

.33511 × 14.3569 × 10^3 = 4.811 Kg U.

4.811 × .932 = 4.484 Kg U^{235}

9/28/54 Added 4.90 Kg of Soln at .5056 gmsU^{235}/cc

.5056 gmsU^{235}/cc

sp. gr. 1.6205
.33503 gmsU/gmSoln
93.15% U^{235}

4.9 × .33503 = 1.6415 Kg U

= 1.5292 Kg U^{235}

Total 6.013 Kg U^{235}

5/4/55 Inventory: Two bottles in vacuum contain ≈5.4 Kg U (.9 Kg in Soln H/X ≈524)

20 9.0" Diameter Sphere

Expr. A-1 Time 320 ~~AM~~ PM Date 8-6 1954
Purpose Preliminary critical test of 9.07" D sphere with UO_2F_2 and water reflector
Personnel: J. K. Fox and J. T. Thomas

INSTRUMENT CHECK

Date 8-6 1954 Time 320 ~~AM~~ PM Source No. _____

Instrument	Trip Value	Scale	Source Distance	Start-Up Scale
~~BC~~	~~5~~	~~200~~	~~Contact~~	~~5~~ ~~200~~
BF	9	100	"	10
~~D~~	~~1~~	~~200~~	—	~~20~~
Log N	6 sec.	✓		
R-1	8	200	Contact	200
R-2				
P. M.	✓		Contact	—

START-UP CHECK LIST

Equipment Checked by J.T.T. Check by J.T.T.
Instrument and Safeties Checked by J.K.F.
Source In" Checked by J.T.T.
Emergency Equipment in Co[illegible] J.T.T.
Red Light On by J.T.T.
Start-Up OK'd by J.T.T. Time 325 ~~AM~~ PM Date 8-6 1954

MULTIPLICATION

Expr. A - 1 Time 3:2C PM Date 8 - 6 1954

Settings

	Scaler	H. V.	Disc.	B. G. c/(2) min.
C(1)		1275	3.50	10
C(2)		"	"	7
C(3)		"	"	15

Time	Temperature Refl.	Sol'n	Height Refl.	Sol'n	C(1)	$M^{-1}_{(1)}$	C(2)	$M^{-1}_{(2)}$	C(3)	$M^{-1}_{(3)}$	or Remarks
											Manifold
3:37	28°C	Full	3.34"		12.25	1.0	7.0	1.0	15.0	1.0	226.1
3:52	"	"	5.75		12.0	0.833	8.5	0.824	17.25	0.87	231.0
4:10	"	"	6.91		16.5	.606	11.5	.608	24.0	.625	233.5
4:16	"	"	7.32		22.25	.449	15.5	.452	36.0	.484	234.4
4:21	"	"	7.69		39	.257	21.25	.324	49.0	.306	234.9
4:29	"	unable to withdraw source. Drained back in order to repair pulley on source drive.									

8/9/54

Replaced pig with assembly from S.C.W.

22 9.0" D. Sphere

Expr. A-1 Time 12:40 PM Date 8-9 1954

Purpose Preliminary criticality test of 9" D sphere with H$_2$O Reflector

Personnel: J. K. Fox, J. T. Thomas

START-UP CHECK LIST

Equipment Checked by _____ Personnel Check by _____

Instrument and Safeties Checked and Reset by _____

"Source In" Checked by _____ Source No. _____

Emergency Equipment in Control Room Checked by _____

Red Light On by _____

Start-Up OK'd by _____ Time _____ AM PM Date _____ 195__

INSTRUMENT CHECK

Date 8-9 1954 Time 12:40 AM PM Source No. Ra-Be.

Instrument	Value	Trip Scale	Source Distance	Start-Up Scale
DC-1	No Trip	100	contact	10
DC-2	9	100	Contact	10
DC-3				
Log N	6-sec		Cont.	
R-1	.8	1000	Contact	200
R-2				
P. M.	✓		Contact	

START-UP CHECK LIST

~~Equipment Checked by~~ J.T.T. Personnel Check by J.T.T.

Instrument and Safeties Checked and Reset by J.T.T.

~~"Source In" Checked by~~ J.T.T. Source No. ~~307~~ PM-15

Emergency Equipment in Control Room Checked by J.T.T.

Red Light On by J.T.T.

Start-Up OK'd by J.T.T. Time 12:40 ~~AM~~ PM Date 8/9 1954

Replaced source #307 with Source #PM-15 and observed notable change in M^{-1} curve.

MULTIPLICATION

Expr. A-1 Time 12⁵⁵ ~~AM~~ PM Date 8/9 1954

Settings — B. G.

	Scalar	H. V.	Disc.	c/(2) min.
C(1)		12.25	3-50	27.25
C(2)		1775	3-50	7.25
~~C(3)~~				17.00

Time	Temperature Refl.	Temperature Sol'n	Height Refl.	Height Sol'n	C(1)	$M^{-1}_{(1)}$	C(2)	$M^{-1}_{(2)}$	C(3)	$M^{-1}_{(3)}$	Remarks
1⁴³	25°C	=	Full	5.67"	71.0	.384	160	.453	35.0	.486	MANIFOLD HT. 231.0"
2⁰³	25°C	=	"	6.21	94.75	0.238	17.0	.442	43.25	.358	232.3
2¹⁸	25°C		"	6.60	124.0	0.220	19.0	.369	55.25	0.272	233.1
3⁰⁵	25°C		"	8.03"	slightly supercritical						2355
3¹⁰	25°C		"	8.01	slightly subcritical.						235.4
3²⁵	25°C		"	3.98"	33.5"	.812	8.0"	.873	20.	.830	

SUMMARY OF CRITICAL CONDITIONS

Expr. A-1 Reactor 9.0" D sphere

Solution UO_2F_2 Height 8.02" Volume 6320 l. Temp 25°C

Reflector H_2O Height Full Temp 25°C

Time Critical 30⁶ ~~AM~~ PM Duration 5 min. Log N .0075

Anal. Req. 354667 gms U/gm 0.33511 Sp. Gr. 1.6205

Critical Mass 3.1986 Kg Atomic Ratio 47.25

Expr. A-2a Time 130 ~~AM~~ PM Date 8-11 1954

Purpose Multiplication Tests 9" Dia Sphere with H_2O Reflector

Personnel: J. K. Fox J. T. Thomas

INSTRUMENT CHECK

Date 8-11 1954 Time 130 ~~AM~~ PM Source No. PN-15

Instrument	Trip Value	Scale	Source Distance	Sensitivity Scale
[illegible]	None - Response only			5
[illegible]	9	50:1	Contact	5
[illegible]	9	100:1	Response only	10
[illegible]	6 sec	response good		—
R-1	9	1000		200
R-2				
P. M.	✓		contact	

START-UP CHECK LIST

Equipment Checked by J.T.T. ~~Check~~ by J.T.T.

Instrument and Safeties J.T.T.

Source In ~~Checked~~ J.T.T. PN-15

Emergency Equipment [illegible] by J.T.T.

Red Light On by W.G.

Start-Up OK'd by J.T.T. Time 130 Date 8-11 1954

MULTIPLICATION

Expr. A-2a Time 145 ~~AM~~ PM Date 8/11 1954

Settings

Scalar	H. V.	Disc.	B. G. c/(2) min.
C(1)	1725	3-50	22
C(2)	1225	3-50	8.0
C(3)			15.5

Temperature Time	Refl.	Sol'n	Height Refl.	Sol'n	C(1)	$M^{-1}_{(1)}$	C(2)	$M^{-1}_{(2)}$	C(3)	$M^{-1}_{(3)}$ or Remarks	MANIFOLD
1 48			Full	0.17"			Background				33.59 "
2 09			"	2.02"	24.5	.83	7.5	1+	17.0	.912	36.70
2 23			"	3.14"	30.0	.733	9.0	.889	18.5	.838	39.21
2 37			"	3.99"	34.0	.647	10.0	.80	20.5	.756	41.00
2 50			"	5.06"	44.5	.444	12.5	.64	25.25	.614	43.60
3 05			"	6.09"	75.0	.293	16.5	.484	38.0	.408	45.80
3 21			"	6.69"	117	.188	23.5	.340	56.0	.277	47.20
3 30			"	6.80	131	.168	27.0	.296	63.0	.246	47.20
3 34			"	6.81	131	—	24.0	—	65.0	—	47.20
3 50			"	7.10	185	.119	34.0	.236	85.5	.181	47.71

Note; Start up scale on DC-1 should be 1.

INSTRUMENT CHECK

Date 8-12 195 4 Time 9 ~~PM~~ AM Source No. Ra 4.80

Instrument	Trip Value	Scale	Source Response	Start-Up Scale
DC-1	Responds only			1
DC-2	9	100 x 1	contact	5
DC-3	9	100 x 1	✓ Response only	10
Log N	6 sec.		contact	
I-1	8	1000		100
~~P-3~~				
P. M.	Responds		4"	✓

P.M. did not respond – necessary to repair; checked at 9:50

START-UP CHECK LIST

~~Equipment Checked by~~ J.T.T. ~~Personnel Check by~~ J.T.T.

Instrument and Safeties Checked and Reset by J.T.T.

~~"Source In" Checked by~~ J.T.T. ~~Source No.~~ 307

Emergency Equipment in Control Room Checked by J.T.T.

~~Red Light On by~~ J.T.T.

Start-Up OK'd by J.T.T. Time 10 ~~PM~~ AM Date 8/12 195 4

Exp A-2b : repeat of experiment A-2a; the only change is the source – from PW-15 to PW 307

Personnel : Edley + Thomas

MULTIPLICATION

Expr. A-26 Time 10¹⁵ AM ~~PM~~ Date 8-12 1964

Settings

Scalar	H. V.	Disc.	B. G. c/(2) min.
C(1)	1225	3-50	9.0
C(2)	1275	3-50	5.25
C(3)			7.5

Time	Temperature Refl.	Temperature Sol'n	Height Refl.	Height Sol'n	C(1)	$M^{-1}_{(1)}$	C(2)	$M^{-1}_{(2)}$	C(3)	$M^{-1}_{(3)}$	or Remarks
10¹⁵	23°	23°	Full	0.18"		Bdy.	-		-		MANIFOLD 33.50"
10³⁴	"	"	"	2.02"	10.75	.837	5.5	.955	7.75	.968	36.80
10⁵³	"	"	"	3.20	11.75	.782	5.75	.913	8.5	.882	39.21
11²⁰	"	"	"	3.99	12.5	.720	5.0	1.05	8.5	.882	41.00
11²⁶	"	"	"	3.99	13.0	.693	5.75	.913	8.75	.857	41.00
11⁴⁵	"	"	"	5.09	18.0	.500	20	.75	11.0	.682	43.60
11⁵⁶	"	"	"	6.09	27.0	.333	9.1	.577	14.0	.536	45.80
12²⁰	"	"	"	6.76	43.0	.209	11.0	.478	21.5	.349	47.20
12³⁷	"	"	"	7.08	60.25	.149	16.5	.318	29.0	.259	47.72
12⁵⁴	"	"	"	7.49	116.25	.0775	29.0	.181	57.0	.1315	48.45
1¹⁵				.801		slightly subcritical					~ 49.20
1²⁰				8⁰²		just critical					~ 49.21
1²²				803		slightly supercritical					~ 49.22

To obtain 100 sec period raise manifold to 49.30 then drain back to 49.22.

SUMMARY OF CRITICAL CONDITIONS

Expr. A 26 Reactor 9.0" Dia. Sphere

Solution UO_2F_2 Height 8.02 Volume 6.320 l. Temp 23°C

Reflector H_2O Height Full Temp 23°C

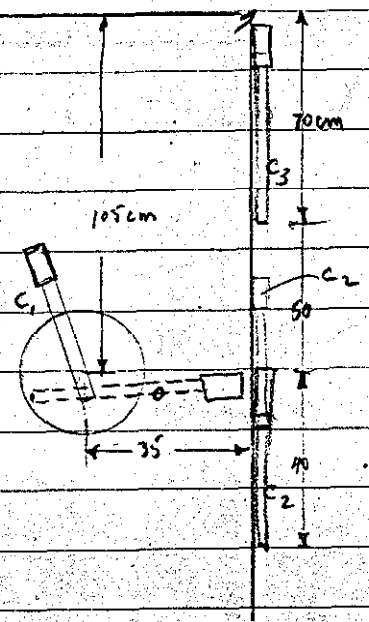
Time Critical 1.15 ~~PM~~ Duration 40 min. Log N 0.02

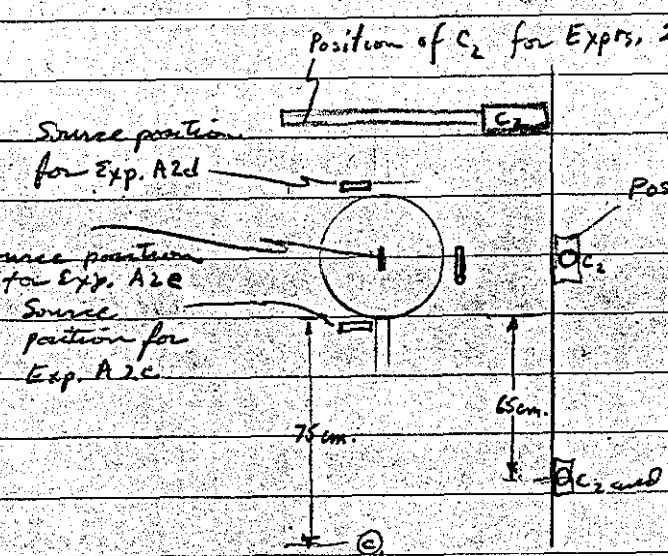
Anal. Req. 354.67 gms U/gm .33511 Sp. Gr. 1.6205

Critical Mass 3.1986 Kg Atomic Ratio 47.25

Exprs. 2a and 2b

Note: Throughout all these experiments Counters 1 and 3 are static. Counter 2 was moved only!





Instrument and source location for expts. A2a and A2b

Only difference between experiments a and b was a change in source strength.

Experiments A2a and A2b

The reciprocal multiplication ~~source strength~~ seems to be independent of the ~~th~~ source strength except for an observed statistical difference.

Experiments A2c and A2d

The location of counter 2 above the reactor seems to be a poor one. If the counter must be above the reactor, the source should be located as in 2c in preference to 2d; that is, in the lower hemisphere near the reactor vessel.

Experiment A2e

The location of the source in the center of the sphere improves statistics of all counters but does not improve the multiplication curves over other source positions.

General conclusions:

Locate the source near the sphere at the equatorial plane. The counters should be or are best placed to occupy positions in the region of the lower hemisphere.

The location of counter 1 is considered very good.

Expr. A-2c Time 9:10 AM ~~PM~~ Date 8-13 1954

Purpose Multiplication tests using 9" Dia. sphere H2O reflected

Personnel: W. Eilley & J.T. Thomas

Repeat of A-2b with source placed in reflector water tank just below sphere

INSTRUMENT CHECK

Date 8-13 1954 Time 5:10 AM ~~PM~~ Source No. RA 4.80

Instrument	Trip Value	Scale	Source Distance	Start-Up Scale
DC-1	Response check only			1
DC-2	9	100/1	Contact	10
DC-3	9	100/1	Response only	5
Log N	6 see			
R-1	8	1000	Response only	100
R-2				
P. M.	Trip check		~ 4"	

START-UP CHECK LIST

~~Equipment Checked by~~ J.T.T. ~~Personnel Check by~~ J.T.T.

Instrument and Safeties Checked and Reset by J.T.T.

~~"Source In" Checked by~~ J.T.T. Source No. PN-15

Emergency Equipment in Control Room Checked by J.T.T.

~~Red Light On by~~ J.T.T.

Start-Up OK'd by J.T.T. Time 9:15 AM ~~PM~~ Date 8-13 1954

MULTIPLICATION

Expr. A2c Time 9:15 AM ~~PM~~ Date 8-13 1954

Scalar	Settings H. V.	Disc.	B. G. c/(2) min.
C(1)	1275	3-50	87.0
C(2)	1275	3-50	42.5
C(3)			41.0

Time	Temperature Refl.	Sol'n	Height Refl.	Sol'n	C(1)	$M^{-1}_{(1)}$	C(2)	$M^{-1}_{(2)}$	C(3)	$M^{-1}_{(3)}$	or Remarks
9:20	21°	21°	Full	0.17"		Bldg.					MANIFOLD 33.50"
9:37	"	"	"	2.02	1025	.846	320	1.33	495	.891	36.75
9:55	"	"	"	3.20	118	.738	32.5	1.13	52.5	.778	39.20
10:10	"	"	"	3.99	124.5	.699	32.5	1.298	57.0	.719	41.00
10:30	"	"	"	5.09	146.5	.576	39.0	1.09	66.0	.621	43.60
10:50	"	"	"	6.10	1910	.455	84.5	.503	82.5	.498	45.80
11:05	"	"	"	7.08	323.5	.269	23.0	.178	14.0	.288	47.71
11:18	"	"	"	7.50	563.5	.154	50.0	.084	24.2	.166	48.45

Test on blade effectiveness proved satisfactory.

Also response of DC-1 much improved by this source position.

Expr. A-2d Time 12 50 ~~AM~~ PM Date 8-13 1954
Purpose Multiplication Tests with 9" Dia sphere H2O Reflector
Personnel: W Gilley and J. T. Thomas

START-UP CHECK LIST

Equipment Checked by J.T.T. Personnel Check by J.T.T.
Instrument and Safeties Checked and Reset by J.T.T.
"Source In" Checked by J.T.T. Source No. PU-15
Emergency Equipment in Control Room Checked by J.T.T.
Red Light On by J.T.T.
Start-Up OK'd by J.T.T. Time 12 50 ~~PM~~ Date 8-13 1954

Repeat Exp A-2c moved source from bottom to top of sphere

MULTIPLICATION

Expr. A-2d Time 2 50 ~~AM~~ PM Date 8-13 1954

Scalar	Settings H. V.	Disc.	B. G. c/(2) min.
C(1)	1225	3-50	18.0
C(2)	1775	3-50	200
C(3)			13.0

Time	Temperature Refl.	Sol'n	Height Refl.	Sol'n	C(1)	$M^{-1}_{(1)}$	C(2)	$M^{-1}_{(2)}$	C(3)	$M^{-1}_{(3)}$	or Remarks	
1255	21°	21°	Full	0.17"							Rdy.	Manifold 33.50
105	21°	21°	"	2.02	23.0	.783	162	1.23	13.75	.946		36.70
120	21°	21°	"	3.20	235	.766	222	.910	15.5	.839		39.21
140	21°	21°	"	3.99	28	.843	2310	.866	16.0	.765		41.00
155	21°	21°	"	5.09	410	.438	2660	.752	22.0	.591		43.60
215	21°	21°	"	6.09	66.0	.273	3185	.626	34.0	.383		45.80
227	21°	21°	"	7.09	178.5	.1007	4770	.419	89.0	.155		47.72
238	21°	21°	"	7.99	368.0	.0490	555	.360	165	.0781		48.45

Expr. A-2E Time 920 AM 8-16 1954
Purpose Multiplication Test - 9" Dia sphere with H_2O Reflector.
Personnel:

Source in center of sphere.

INSTRUMENT CHECK

Date 8/16 1954 Time 920 AM Source No. RA-A-80 PuBe

Instrument	Trip Value	Scale	Source Distance	Start-Up Scale
[illegible]	Responds			1
[illegible]	9	100×1	Contact	10
[illegible]	Responds		"	5
[illegible]	6 sec		responds	—
[illegible]	8	1000		50
[illegible]				
P. M.	Trips -		4"	—

P.M not by-passed during check, Bell alarm works fine!

START-UP CHECK LIST

Equipment Checked by J.T.T. Personnel Check by J.T.T.
Instrument and Safeties Checked and Reset by J.T.T.
"Source In" Checked by J.T.T. Source No. PU-15
Emergency Equipment in Control Room Checked by J.T.T.
Red Light On by J.T.T.
Start-Up OK'd by J.T.T. Time 920 ~~AM~~ PM Date 8- 1954

MULTIPLICATION

Expr. 1-2 e Time 9 20 AM ~~PM~~ Date 8/16 1954

Settings

Scalar	H. V.	Disc.	B. G. c/(2) min.
C(1)	1775	3-50	34.0
C(2)	1775	3-50	135.0
C(3)			21.0

Time	Temperature Refl.	Temperature Sol'n	Height Refl.	Height Sol'n	C(1)	$M^{-1}_{(1)}$	C(2)	$M^{-1}_{(2)}$	C(3)	$M^{-1}_{(3)}$	M^{-1} or Remarks
9+5			Full	0.17"		Bdg.					Manifold 33.50"
10^{05}	25°C	25°	Full	2.02	32.0	.944	149.0	.906	21.5	.977	36.74
10^{27}	"	"	"	3.20	39.25	.867	162.0	.831	22.75	.923	39.21
10^{56}	"	"	"	3.99	46.5	.731	195.0	.692	25.25	.832	41.00
11^{20}	"	"	"	5.09	80.0	.425	281.5	.474	38.0	.553	43.60
11^{37}	"	"	"	6.09	1680	.202	5160	.262	78.5	.286	45.80
12^{07}	"	"	"	7.49	1052	.0323	1004	.134	44.0	.569	78.45

Counter #2 missing counts; Results of last count taken —

C_1	C_2	C_3
948	1004	329
	838	403
1019		
1052	806	419

Counter 2 is suspect.

Expr. A-3a Time 925 AM PM Date 8-17 1954
Purpose To establish power develop in 9.0" Dia sphere necessary for foil exposures.
Personnel: W. Gilley, J. T. Thomas

Exposing foil B-20 at center of sphere
Probe setting 4.25"

INSTRUMENT CHECK

Date 8-17 1954 Time 925 AM PM Source No. RA 4.80

Instrument	Trip Value	Scale	Source Distance	Start-Up Scale
DC-1	none	Responds		5
DC-2	9	100/1	contact	10
DC-3	9	100/1	Response ok	5
Log N	6 sec			
R-1	8	1000		50/sec c
R-2				
P. M.	✓			

START-UP CHECK-LIST

Equipment Checked by J.T.T. Personnel Check by J.T.T.
Instrument and Safeties Checked and Reset by J.T.T.
"Source In" Checked by J.T.T. Source No. PN-15
Emergency Equipment in Control Room Checked by J.T.T.
Red Light On by J.T.T.
Start-Up OK'd by J.T.T. Time 930 AM PM Date 8-17 1954

10^{30} critical, manifold at 49.21"
drained back inserted probe to 4.25"
10^{40} critical manifold at 49.20
10^{53} raised manifold to 49.35 to obtain 100 sec period.
returned manifold to 49.21 to level power at .15

SUMMARY OF CRITICAL CONDITIONS

Expr. A 3a Reactor 9" Dia Sphere

Solution UO_2F_2 Height 8.02 Volume 6.32ℓ Temp 25°

Reflector H_2O Height FULL Temp 25°

Time Critical 10^{53} AM ~~PM~~ Duration 20 min. Log N ~.13

Anal. Req. 354667 gms U/gm .33501 Sp. Gr. 1.4205

Critical Mass 3.1986 Kg Atomic Ratio 47.25

Expr. A 36 Time 1 30 PM Date 8-17 1954
Purpose Establish Power Level for foil exposures
Personnel: W. Gilley & J. T. Thomas

START-UP CHECK LIST
Equipment Checked by J.T.T. Personnel Check by J.T.T.
Instrument and Safeties Checked and Reset by J.T.T.
Source In" Checked by J.T.T. Source No. PN-15
Emergency Equipment in Control Room Checked by J.T.T.
Red Light On by J.T.T.
Start-Up OK'd by J.T.T. Time 1 35 PM Date 8-17 1954

Foil B-19 placed at center (Number toward center)
Foil B-29 placed at 4 4/16" from foil B-19.
Foil holder position 4.25"
2 30 Critical manifold height 49.20"
2 46 PM leveled off at 0.66 on log N
Time up started at 1/2 up from final level
R-1 off scale at 1000 x 1000 appx 0.6 on log N
R-2 " " " 100
R-3 reads 70 at 0.66 on log N
Surface of Manifold at 3 00 PM = 400 MR/hr/centipoise

SUMMARY
Expr.
Solution
Reflector
Time Critical
Anal. Req.
Critical Mass

SUMMARY
Expr.
Solution
Reflector
Time Critical
Anal. Req.
Critical Mass

SUMMARY OF CRITICAL CONDITIONS

Expr. A-36 Reactor 9" Sphere manifold reading.

Solution UO_2F_2 Height 49.22 Volume 6.32 l Temp 25°C

Reflector ~~Fuel~~ H_2O Height Full Temp 25°C

Time Critical 1^{30} PM Duration 20 min. Log N 0.66

Anal. Req. 354667 gms U/gm .33511 Sp. Gr. 1.6205

Critical Mass 3.198 Kg Atomic Ratio 47.25

Expr. A 3 c Time 12 ~~AM~~ PM Date 8-18 1954

Purpose Expose In-Al foils in 9" sphere

Personnel: Gilley + Thomas

INSTRUMENT CHECK

Date 8-18 1954 Time 12 ~~AM~~ PM Source No. RA-4-80

Instrument	Trip Value	Scale	Source Distance	Start-Up Scale
[illegible] 1	None		response only	10
2	9	100 x 1	contact	10
3	9	100 x 1	Response only	10
[illegible]	6 see		response only	+
R-1	.95	1000/1000	contact	100
R-2				
P. M.	Trips		4"	—

START-UP CHECK LIST

Equipment Checked by J.T.T. Personnel Check by J.T.T.

Instrument and Safeties Checked and Reset by J.T.T. - W.G.

Source In" Checked by J.T.T. Source No. PN-15

Emergency Equipment in Control Room Checked by J.T.T.

Red Light On by J.T.T.

Start-Up OK'd by J.T.T. Time 12 ~~AM~~ PM Date 8-18 1954

1 PM Critical, manifold height 49.20"

dummy exposure of foils manifold setting 49.22"

1 shutdown.

SUMMARY OF CRITICAL CONDITIONS

Expr. A 3c Reactor 9" Sphere

Solution UO_2F_2 Height ~8.02" Volume 6.320 ℓ Temp 24.5°

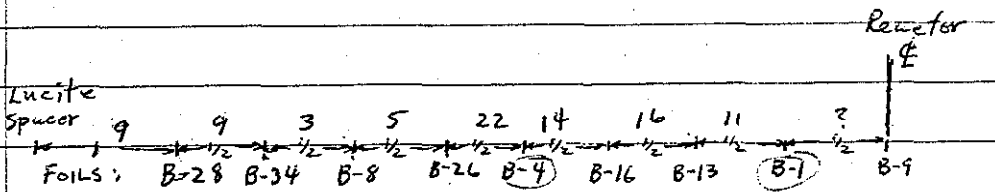
Reflector H_2O Height Full Temp 24.5°

Time Critical 1⁰⁰ PM Duration 2-0" min. Log N .65

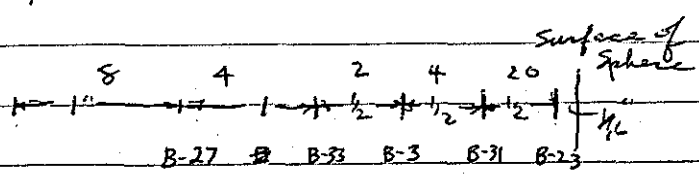
Anal. Req. 354667 gms U / gm .33511 Sp. Gr. 1.6205

Critical Mass 3.1986 Kg Atomic Ratio 47.25

Foil Positions in Core; Probe setting 4.25"



Foil Positions in Reflector



Power normalizing foil: F-1

Expr. A-3-d Time 12 45 ~~AM~~ PM Date 8-20 1954

Purpose Expose Cd covered In foils in same locations as in Exp. A3c.

Personnel: W. Gilley + J. T. Thomas

INSTRUMENT CHECK

Date 8-20 1954 Time 12 45 ~~AM~~ PM Source No. PA 4.80

Trib

Instrument	Value	Scale	Source Distance	Start-Up Scale
[illegible]	none	Response		10
[illegible]	4	100x1	contact	10
[illegible]	4	100x1	responsively	10
[illegible]	6 sec			
[illegible]	9.5	1000/1000		50
[illegible]				
P. M.	ok.			

START-UP CHECK LIST

~~Equipment Checked by~~ J. T. T. ~~Personnel Check by~~ J. T. T.

Instrument and Safeties Checked and Reset by W. G.

~~Source (a) Checked by~~ J. T. T. ~~Source No.~~ PN-15

Emergency Equipment in Control Room Checked by J. T. T.

~~Red Light On~~ by J. T. T.

Start Up O.K'd by J. T. T. Time 12 50 ~~AM~~ PM Date 8-20 1954

1 50 PM Critical manifold set at 49.41"

SUMMARY OF CRITICAL CONDITIONS

Expr. A 3 d Reactor 9" Dia sphere

Solution UO_2F_2 Height ____ Volume ____ Temp 25°

~~Reflector~~ H_2O ~~Height~~ Full Temp 25°

Time Critical 150 ~~AM~~ PM Duration 20 min. Log N ~.60

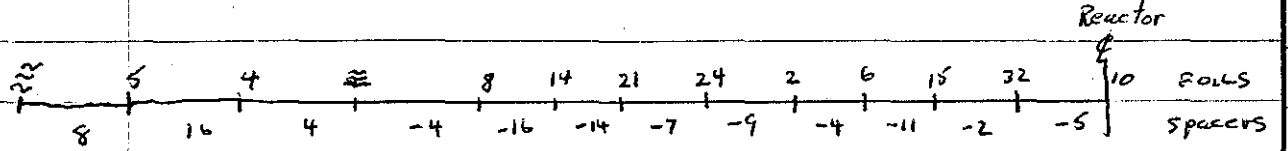
Anal. Req. 354667 gms U/gm .335 11 Sp. Gr. 1.6205

Critical Mass ____ Atomic Ratio ____

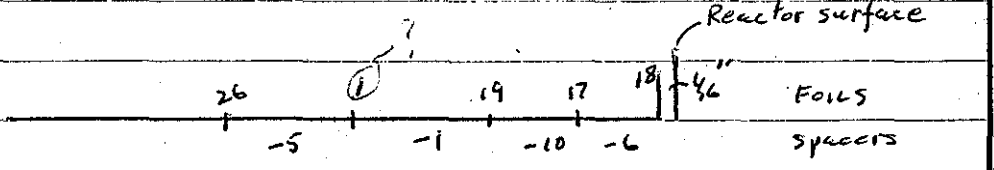
Foil Positions:

B-Series of Foils

CORE:



Reflector:



Expr. A-3e Time 935 AM ~~PM~~ Date 9/20 1954

Purpose Check critical pt and test sight glass

Personnel: E. Creamer, J. T. Thomas

INSTRUMENT CHECK

Date 9/20 1954 Time 935 AM ~~PM~~ Source No. Ra-Be

Train

Instrument	Value	Scale	Source Distance	Start-Up Scale
[illegible]	X	Response good		5
[illegible]	9	1 x 100	Contact	10
[illegible]	9	1 x 100	ca 2"	10
[illegible]	15 sec		2"	
R-2	9	1000		50/1000
R-1				
P. M.	✓			

START-UP CHECK LIST

Equipment Checked by J.T.T. Personnel Check by J.T.T.

Instrument and Safeties Checked and Reset by J.T.T.

Source In Checked by J.T.T. Source No. PN-15

Emergency Equipment in Control Room Checked by J.T.T.

Red Light On by J.T.T.

Start-Up OK'd by J.T. Time 935 AM ~~PM~~ Date 9/20 1954

10^{10} AM Manifold set at 49.00"

10^{16} moved manifold down. System period increasing as fast

10^{20} Reset manifold to 47.7

10^{28} Reset to 47.5 equiv at 10^{34} 51.8 cm or S.G.

10^{53} AM 47.85 Manifold 52.4 S.G. slightly Sub-Critical

10^{56} AM 47.9 " 52.48 SG Slightly Super

11^{05} 47.87" Manifold 52.4+ Slight Plus - just Critical

SUMMARY OF CRITICAL CONDITIONS

Expr. A 3 e Reactor 9.0" Dia. sphere

Solution UO_2F_2 Height 8.02" Volume 6.320 l Temp 26.2°C

Reflector H_2O Height Full Temp 26.2°C

Time Critical 10^{50} AM PM Duration 20 min. Log N 0.05

Anal. Req. 354667 gms U/gm .33511 Sp. Gr. 1.6205

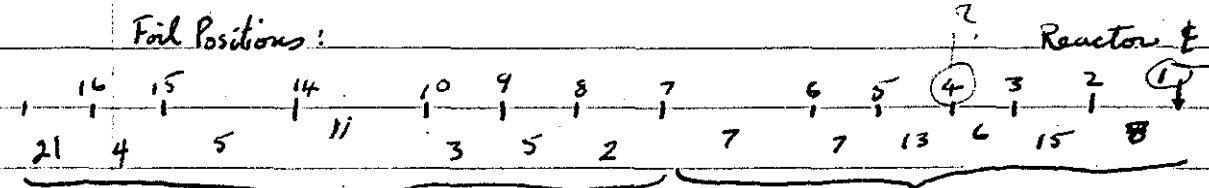
Critical Mass 3.2 Kg Atomic Ratio 47

Expr. A 13f Time 1⁰⁰ ~~AM~~ PM Date 9/20 1954
Purpose Expose In foils with UO_2F_2 Spacers
Personnel: F. Cavanian T.T. Thomas

START-UP CHECK LIST

~~Equipment Checked by~~ J.T.T. ~~Personnel Check by~~ J.T.T.
Instrument and Safetron Checked and Reset by J.T.T.
Source In" Checked by J.T.T. Source No. PN-15
Emergency Equipment in Control Room Checked by J.T.T.
Red Light On by J.T.T.
Start-Up OK'd by J.T.T. Time 1⁰⁰ ~~AM~~ PM Date 9/20 1954

Foil Positions:



20⁰
2⁰⁴ PM Critical Manifold ht. 47.86"; Sight glass = 52.9.
X100 sec period " " 47.99"; sight glass = 53.1
Probe set at 4.25"

SUMMARY OF CRITICAL CONDITIONS

Expr. A 13f Reactor 9.0" Dia.
Solution UO_2F_2 Height 8.02 Volume 6.320 l. Temp 27°C
Reflector H_2O Void Full Temp 27°C
Time Critical 1⁴⁰ ~~AM~~ PM Duration 20 min. Log N 0.65
Anal. Req. 354667 gms U/gm .33511 Sp. Gr. 1.6205
Critical Mass 3.2 Kg Atomic Ratio 47

Expr. A 3g Time 9⁰⁰ AM ~~PM~~ Date 9/21 195 4

Purpose Expose Cd covered In foils with UO_2F_2 Spheres

Personnel: Colby, Comin, Thomas

INSTRUMENT CHECK

Date 9/21 195 4 Time 9⁰⁰ AM ~~PM~~ Source No. Ra 4.4

Instrument	Trip Value	Scale	Source Distance	Start-Up Scale
DCL-1	Response	good		2
DCL-2	9	1×100	2"	10
DCL-3	9	1×100	2"	10
Log N	15 sec		—	—
R-1	9.5	1000/1000		50/1000
R-2				
P. M.	ok.			

START-UP CHECK LIST

Equipment Checked by J.T.T. Personnel Check by J.T.T.

Instrument and Safeties Checked and Reset by E.C.

"Source In" Checked by J.T.T. Source No. PN-15

Emergency Equipment in Control Room Checked by J.T.T.

Red Light On by J.T.T.

Start-Up OK'd by J.T.T. Time 9¹⁰ AM ~~PM~~ Date 9/21 195 4

9⁴⁰ critical; Manifold Ht. 48.02", Sight glass 53.3 cm.

<80 sec period " " 48.18 Sight glass 53.6 cm.

Probe set at 4.185"

SUMMARY OF CRITICAL CONDITIONS

Expr. A 3g Reactor 9.0" Pu Sphere

Solution UO_2F_2 Height ____ Volume ____ Temp 23°C

Reflector H_2O Height Full Temp 23°

Time Critical 10 AM ~~PM~~ Duration 20 min. Log N 0.625

Anal. Req. 357667 gms U/gm .33571 Sp. Gr. 1.6205

Critical Mass 3.2 Kg Atomic Ratio 47

Expr. D-1 Time 11:00 AM ~~PM~~ Date 9/27 195 4

Purpose Check critical point in 12.6" Dia sphere with fuel concentration .33511 gms U²³⁵/gm

Personnel: J. Fox; Cross; Thomas

INSTRUMENT CHECK

Date 9/27 195 4 Time 11:00 AM ~~PM~~ Source No. 204.80

Instrument	Trip Value	Scale	Source Distance	Start-Up Scale
NC-1	response only			2
NC-2	9.0	1X100	2"	5
NC-3	9.0	1X100	2"	5
Log N	15 sec			
R-1	✓			
R-2				
P. M.	ok			

11:00 R-1 not operating. Repaired by R.R. 12:25 PM.

START-UP CHECK LIST

~~Equipment Checked by~~ J. T. T. ~~Personnel Check by~~ J

Instrument and Safeties Checked and Reset by J. T. T.

"Source In" Checked by J. K. Fox Position No. PN-15

Emergency Equipment in Control Room Checked by J. K. Fox

Red Light On by J. T. T.

Start-Up OK'd by J. T. T. Time 12:25 ~~AM~~ PM Date 9/27 195 4

MULTIPLICATION

Expr. D-1 Time 11⁰⁰ AM ~~PM~~ Date 9/27 1954

Settings

Scalar	H. V.	Disc.	B. G. c/(2) min.
C(1)	1275	3-50	10.5
C(2)	1275	3-50	66.5
C(3)			16.5

Time	Temperature Refl.	Temperature Sol'n	Height Refl.	Height Sol'n	C(1)	$M^{-1}_{(1)}$	C(2)	$M^{-1}_{(2)}$	C(3)	$M^{-1}_{(3)}$	M^{-1} or Remarks
11⁰⁰ AM	23	23°C	Full								MANIFOLD - S.G.
11³⁵ AM	23°	23°c	Full 0.07"		Background						33.05" - 35.6 cm
12⁵² PM	23°	23°c	Full	3.02"	13.0	.508	69.5	.957	19.9	.630	39.51 — 43.2
1³⁵ PM	23°	23°c	Full	4.50"	16.0	.656	62.0	(1.07)	23.0	.718	44.25 — 46.8
2⁰⁶ PM	23°	23°	Full	5.52"	36.0	.292	156.0	.425	36.5	.425	48.00 — 49.55
2²⁶ PM	23°	23°	Full	5.91"	72.0	.146	270.	.246	68.0	.243	60.2 — 50.40

insufficient Solution!

2³⁶ PM. Extrapolated critical ~10 liters.

9/28/54 added ~810 cc of soln at ~.505 gms U^{235}/cc

~~Expr.~~ ~~Time~~ ~~AM PM~~ ~~Date~~

~~Purpose~~

Personnel:

Expr. D-1a Time 10 AM PM Date 9/28 1954

Purpose Obtain criticality in Hemi-sphere fully reflected -

Personnel: Gilley + Thomas

INSTRUMENT CHECK

Date 9/28 1954 Time 10 AM PM Source No. Ra-Be 6

Instrument	Trip Value	Scale	Source Distance	Start-Up Scale
	response only			2
	9.0	1x100	2"	10
	9.0	1x100	2"	10
	15 sec			
	9	100%/1000		
P. M.	ok			

START-UP CHECK LIST

~~Equipment Checked by~~ J. T. T. ~~Personnel Check by~~ J. T. T.

Instrument and Safeties Checked and Reset by J. T. T. / W. G.

~~Source Inserted~~ Locked by J. T. T. / SKE ~~Source No.~~ PN-15

Emergency Equipment in Control Room Checked by J. T. T.

Rod Light On by J. T. T.

Start-Up O.K'd by J. T. Time 10 ~~PM~~ AM Date 9/28 1954

MULTIPLICATION

Expr. D-1a Time 10 AM ~~PM~~ Date 9/28 195 4

Settings D. G.

Scaler	H. V.	Disc.	c/(2) min.
C(1)	1775	3-50	10
C(2)	1775	3-50	65
C(3)			17

Time	Temperature Refl.	Sol'n	Height Refl.	Sol'n	C(1)	$M^{-1}_{(1)}$	C(2)	$M^{-1}_{(2)}$	C(3)	$M^{-1}_{(3)}$	M^{-1} or Remarks	Manifold S.G.
~~9~~25 AM	23°C	Full	.88"								Background	34.8cm
10[10] AM	23°C	Full	4.14"		15.0	.667	86.5	.750	21.0	.810	41.21"	45.70
10[38] AM	22°C	Full	5.58		35.0	.236	195.5	.338	36.5	.466	46.32"	49.50
11[03] AM	23°C	Full	6.183"		217.	.0461	914	.0712	173.	.0983	48.30"	50.80
11[38] AM	23°C	Full	6.28"				Critical				48.58"	51.0

SUMMARY OF CRITICAL CONDITIONS

Expr. D 1a Reactor 12.6" Dia Sphere

Solution UO_2F_2 Height 6.28" Volume 9.400l Temp 23°C

Reflector H_2O Height Full Temp 23°C

Time Critical 11[38] AM ~~PM~~ Duration ~15 min. Log N .025

Anal. Req. 354676 gms U/gm .33587 Sp. Gr. 1.6225

Critical Mass 4.77 Kg U^{235} Atomic Ratio 47

9/29/54 Sample D-1a

G: 47.6676

T: 26.6683

N: 20.9993 gms soln

20.9993 × .33587 = 7.05 gms U.

Expt. D-2 Time 8:40 AM PM Date 9/30 1954
Purpose Check criticality in 12.6" Dia. sphere at Room temp. full sphere and full reflector
Personnel: Gilby + Thomas

START-UP CHECK LIST

Equipment Checked by J.T.T. Personnel Check by J.T.T.
Instrument and Safeties Checked and Reset by J.T.T.
Source Unit Checked by J.T.T. Source No. PN-15
Emergency Equipment in Control Room Checked by J.T.T.
Red Light On by J.T.T.
Start-Up OK'd by J.T.T. Time 8:40 AM PM Date 9/30 1954

INSTRUMENT CHECK

Date 9/30 1954 Time 8:30 AM PM Source No. RA 4.80

Instrument	Value	Scale	Source Distance	Start-Up Scale
DC-1	Response okay			7
DC-2	9	1×100	2"	5
DC-3	9	1×100	2"	5
Log N	15 sec		2"	
R-1	9	1000/1000	2"	50/1000
R-2				
P. M.	✓			

MULTIPLICATION

Expr. D-2 Time 840 AM Date 8/30 1954

Settings

Scaler	H. V.	Disc.	c / (2) min.
C(1)	1275	3-50	11.0
C(2)	1275	3-50	234.0
C(3)			15.25

Time	Temperature Refl.	Temperature Sol'n	Height Refl.	Height Sol'n	C(1)	$M^{-1}_{(1)}$	C(2)	$M^{-1}_{(2)}$	C(3)	$M^{-1}_{(3)}$	M^{-1} or Remarks	
											MANIFOLD	S.G.
850 A	24.5°C		Full	0.95"	Background						23.54"	37.4 cm.
935 A	24.5°C		Full	7.19	170,647	335,699	21,726				42.82	53.7
1006 A	24.5°C		Full	9.27	267,412	491,477	28,545				49.71	58.6
1025 A	24.5°C		Full	10.55	365,218	875,267	44.8.34				53.11	61.8
1043 A	24.5°C		Full	11.50	142,0775	1116,21	108,142				limit	64.2

Reactor lacks ~10 cc being full but is not critical.

Extrapolated critical volume = 66.4 l.

Expr. D-2a Time 105 PM Date 9/30 1954
Purpose ck 12.6" Dia sphere at R.T.

Personnel: Gilley & Thomas

Removed uranyl nitrate solution. Used calibration reflector. Full corresponds to 17.06 Liters

Mass → 843 g.

START-UP CHECK LIST

Equipment Checked by J.T.T. Personnel Check by J.T.T.
Instrument and Safeties Checked and Reset by J.T.T.
"Source In" Checked by J.T.T. W6 Source No. PN-15
Emergency Equipment in Control Room Checked by J.T.T.
Red Light [illegible] by J.T.T.
Start Up O.K'd by J.T.T. Time 105 PM Date 9/30 1954

Note: added ~34 grams of U to Solution of Exp D-2

Critical reading of S.G. = 64.1cm, of Manifold = 54.44"

SUMMARY OF CRITICAL CONDITIONS

Expr. D-2a Reactor 12.6" Dia. sphere
Solution UO_2F_2 Height 11.36" Volume 17.026l Temp 24.5°C
Reflector H_2O Height Full Temp 24.5°C
Time Critical 225 PM Duration 10 min. Log N 0.02
Anal. Req. 354677 gms U/gm 0.05003 Sp. Gr. 1.0587
Critical Mass 841 gms Atomic Ratio 523.6

Sample D-2a

G = 74.0398

T = 25.9513

N = 48.0885 gms.

C 1340 54

Expr. D-3 Time 930 AM PM Date 10/19 1954

Purpose Expose beeswax foils in 12.6" Dia sphere

Personnel: Gilley & Thomas

INSTRUMENT CHECK

Date 10/19 1954 Time 930 AM PM Source No. RA 1.80

Instrument	Volts	Scale	Source Distance	Start-Up Scale
	None	1×100	2"	10
	9	1×100	2"	10
	8	1×100	2"	10
	15 sec	10^3	2"	—
R-1	9	10×1000	9"	50
P. M.	✓			

START-UP CHECK LIST

~~Equipment Checked by~~ J.T.T. Personnel Check by J.T.T.

Instrument and Safeties Checked and Reset by J.T.T.

~~Source In~~ Checked by J.T.T. Control No. PN-15

Emergency Equipment in Control Room Checked by J.T.T.

Red Light On by J.T.T.

Start-Up OK'd by ~~J.T.T.~~ Time 930 AM ~~PM~~ Date 10/19 1954

Did not bypass D03 - Scrammed at log N of .5.

Necessary to replace foils!

foils	Spacer
34	18 w
	5 w
33	
	21 w
32	
	5 w
31	
	4 w
30	
	3 w
29	
	2 w
28	
	15 s
27	
	13 s
26	
	8 s
25	
	3 s
24	
	7 s
23	
	6 s
22	
	7 s
20	

START-UP CHECK LIST

~~Equipment Checked by~~ J.T.T. Personnel Check by J.T.T.

Instrument and Safeties Checked and Reset by J.T.T.

"Source In" Checked by J.T. Source No. PN-15

Emergency Equipment in Control Room Checked by J.T.T.

Red Light On by J.T.

Start-Up OK'd by J.T.T. Time 12^20 ~~AM~~ PM Date 12/19 1954

Critical position: Manifold 53.71" S.G. 63.1 cm.

Temp of H_2O = 20°C

SUMMARY OF CRITICAL CONDITIONS

Expr. D3 Reactor 12-6" Dia sphere

Solution UO_2F_2 Height _____ Volume _____ Temp 20°C

Reflector H_2O Height Full Temp 20°C

Time Critical 1^10 ~~AM~~ PM Duration 20 min. Log N 0.65

Anal. Req. _____ gms U / gm _____ Sp. Gr. _____

Critical Mass _____ Atomic Ratio _____

cont'd Reactor probe set at 5.76"

Expr. D-4 Time 945 ~~PM~~ Date 10/20 1954

Purpose Expose Cd-covered In foils in 12.6" Dia sphere

Personnel: Gilley + Thomas

INSTRUMENT CHECK

Date 10/20 1954 Time 945 AM Source No. RA 4.80

Instrument	Voltage	Scale	Source Distance	Start-Up Scale
Period	response only		4"	2.0
	9	1×100	2"	10
	9	1×100	2"	10
	15 sec	—		
Rate	8	1000/1000	2"	50/1000
Rate				
P. M.	✓			

START-UP CHECK LIST

~~Equipment Checked by~~ J.T.T. Personnel Check by J.T.T.

Instrument and Safeties Checked and Reset by J.T.T.

Source In" Checked by J.T.T. Source No. PN-15

Emergency Equipment in Control Room Checked by J.T.T.

Red Light On by J.T.T.

Start-Up OK'd by J.T.T. Time 945 AM Date 10/20 1954

Critical settings: Manifold 54.00"; S.G. 63.6 cm.

foils	Spacers
B-34	18w
B-33	?
B-32	7w
31	6w
30	5w
29	4w
28	2w
27	15s
26	13s
25	8s
	3s
24	
23	7s
21	6s
20	7s (probe setting 5.75")

SUMMARY OF CRITICAL CONDITIONS

Expr. D-4 Reactor 12.6" Dia sphere

Solution UO_2F_2 Height _____ Volume _____ Temp 20°C

Reflector H_2O Height Full Temp 20°C

Time Critical 10^{45} AM ~~PM~~ Duration 20 min. Log N 0.60

Anal. Eeq. _____ gms U/gm _____ Sp. Gr. _____

Critical Mass _____ Atomic Ratio _____

Expr. D-5 Time 1240 ~~PM~~ Date 10/21 1954

Purpose fuel expanders in 12.6" Spheres to obtain fission rate distribution

Personnel: Fox + Thomas

INSTRUMENT CHECK

Date 10/21 1954 Time 1240 ~~PM~~ Source No. RA 4.8

Instrument	Trip Value	Scale	Source Distance	Start-Up Scale
D-1	response only		14"	2
	9	1x10	3"	10
	9	1x100	4"	10
	10 sec			
R-1	9	1000/1000	4"	50/1000
R-2				
P. M.	✓			

START-UP CHECK LIST

Equipment Checked by J.T.T. Personnel Check by J.T.T.

Instrument and Safeties Checked and Tested by J.T.T.

Source in Core and by J.T.T. Source No. PN-1S

Emergency Equipment in Control Room Checked by J.T.T.

Rod Drive Tested by J.T.T.

Start-Up Cleared by D.T.T. Time 1245 Fal Date 10/21 1954

Critical positions: Manifold 53.71" S.G. 63.1 cm.

Expr. D-5 Time 935 AM ~~PM~~ Date 10/28 1954

Purpose Fission rate distribution in 12.6" Sphere
Expose Bare U-Lucite capsules

Personnel:

INSTRUMENT CHECK

Date 10/28 1954 Time 935 AM ~~PM~~ Source No: RA4.80

Instrument	Value	Scale	Source Distance	Start-Up Scale
DRT	response		4"	2
[illegible]	9	1/100	4"	10
	9	1/100	4"	10
Log N	10 sec		4"	25/1000
N-1	9	1000/1000		
N-2				
P. M.	ck.			

START-UP CHECK LIST

Equipment Checked by J.T.T. Personnel Check by J.T.T.
Instrument and Safeties Checked and Reset by J.T.T.
"Source In" Checked by J.T.T. Source No. PU-75
Emergency Equipment in Control Room Checked by J.T.T.
Red Light On by J.T.T.
Start-Up OK'd by J.T.T. Time 935 AM ~~PM~~ Date 10/28 1954

35
155
cup 20
135
cup 15
85
cup 10
75
Critical settings: Manifold 53.83"; S.6. 63.1 cm
Setting for ~100 sec period: 53.95" 63.25
cup 6
65
cup 1 — ℓ reactor probe set at 5.45"

SUMMARY OF CRITICAL CONDITIONS

Expr. D-5 Reactor 12.6" Sphere
Solution UO_2F_2 Height ____ Volume ____ Temp 21°C
Reflector H_2O Height Full Temp 21°C
Time Critical 10^30 AM ~~PM~~ Duration 20 min. Log N .50
Anal. Req. ____ gms U / gm ____ Sp. Gr. ____
Critical Mass ____ Atomic Ratio ____

Expr. D-6 Time 12[15] PM Date 11/3 1954

Purpose Cd-covered Oklo cube in 12.6" Dia Sphere

Personnel Fox & Thomas

INSTRUMENT CHECK

Date 11/3 1954 Time 12[15] PM Source No. RA-480

Instrument	Value	Scale	Source Distance	Start-Up Scale
	9.0	1/100	4"	10
	9.0	1/100	4"	10
	10 sec		4"	
	9	100/1000	4"	50/1000
P. M.	✓			

START-UP CHECK LIST

~~Equipment Checked by~~ J.T.T. ~~Personnel Check by~~ J.T.T.

Instrument and Safeties Checked and Reset by J.T.T.

~~"Source In" Checked by~~ J.T.T. Source No. PN-15

Emergency Equipment in Control Room Checked by J.T.T.

Red Light On by J.T.T.

Start-Up OK'd by [illegible] Time 12[14] PM Date 11/3 1954

Critical Settings: Manifold 54.54" S.G. 64.2 cm.

Period 54.70 64.3 cm.

3s

15s

20f

13s

15f

8

10f

7s

6f

S = Spacers 6s

Fe foils 1f

SUMMARY OF CRITICAL CONDITIONS

Expr. D-6 Reactor 12.6" Sphere

Solution UO_2F_2 Height _____ Volume _____ Temp 20.5°C

Reflector H_2O Height Full Temp 20°C

Time Critical 130 ~~PM~~ Duration 20 min. Log N .55

Anal. Enc. _____ gms U / gm _____ Sp. Gr. _____

Critical Mass _____ Atomic Ratio _____

Expr. D-7 Time 9 AM ~~PM~~ Date 11/5 1954

Purpose Expose ~~Ta~~ Teflon covered Ta foils

Personnel: Gilley & Thomas

INSTRUMENT CHECK

Date 11/5 1954 Time 9 AM Source No. RA 480

Instrument	Volts	Range	Range Tolerance	Start-Up Scale
out				
9		1K100	4"	10
9		1X100	4"	10
10 sec		100/1000	4"	10/1000
9				
P. M.		✓		

START-UP CHECK LIST

Equipment Checked by J.T.T. Personnel Check by J.T.T.

Instrument and Safeties Checked and Reset by J.T.T.

Source Id. Checked by J.T.T. Source No.

Emergency Equipment to Control Room Checked by J.T.T.

Red Light On by J.T.T.

Start-Up O.K'd by J.T.T. Time 900 AM ~~PM~~ Date 11/5 1954

Critical Positions ; Manifold 53.83" S.6. 63.1 cm.

Teflon coated In foils

-25

1"

-24

1⅛"

-23

1"

-21?

1"

-20 ℄ of Reactor

SUMMARY OF CRITICAL CONDITIONS

Expr. D-7 Reactor 12.6" Sphere

Solution UO_2F_2 Height 63.1 cm Volume _____ Temp 20.5°C

Reflector H_2O Height Full Temp 20.5°C

Time Critical 9:55 A.M. Duration 20 min. Log N .55

Anal. Req. _____ gms U / gm _____ Sp. Gr. _____

Critical Mass _____ Atomic Ratio _____

Expr. D-8 Time 1 ~~AM~~ PM Date 11/9 1954

Purpose Check Teflon covered I— foil exposure

Personnel: Gilley + Thomas

INSTRUMENT CHECK

Date 11/9 1954 Trip Time 1 ~~AM~~ PM Source No. RA-480

Instrument	Value	Scale	Source Distance	Start-Up Scale
DC-1		not used		
DC-3	✓	9	1/100	9"	10
DC-8	✓	9	1/100	4"	10
Log N	✓	10 ma		4"	
R-1	✓	9	1000/1000	7"	50/1000
R-2					
P. M.	✓	ck.			

START-UP CHECK LIST

~~Equipment Checked by~~ J.T.T. ~~Personnel Check by~~ J.T.T.

Instrument and Safeties Checked and Reset by J.T.T.

~~"Source In" Checked by~~ J.T.T. Source No. 2

Emergency Equipment in Control Room Checked by J.T.T.

Red Light On by J.T.T.

Start Up O.K.'d by J.T.T. Time 1 ~~AM~~ PM Date 11/9 1954

Critical Positions: Manifold 53.88 S.G. 63.1+

period. 54.03 63.3

10

9

7

6

5 ℄ of Reactor

(4) ?

2

(1) ? 2.76"

SUMMARY OF CRITICAL CONDITIONS

Expr. D-8 Reactor 12.6" Dia. Sphere

Solution UO_2F_2 Height _____ Volume _____ Temp 21°C

Reflector H_2O Height Full Temp 21°C

Time Critical 200 ≡ Duration 20 min. Log N .50

Anal. Eq. _____ gms U / gm _____ Sp. Gr. _____

Critical Mass _____ Atomic Ratio _____

UO_2F_2 Inventory

2/1/55

Received from Storage manifold in Room 102 37.210 Kg of Solution.

Analytical Req # 354702 : 0.44278 $\frac{\text{gms U}}{\text{gm soln}}$, sp. gr. = 2.01360 at 25°C

Volume of Soln = $\frac{37.210}{2.0136}$ = 18.480 liters

Kilograms of U = 37.210 × .44278 = 16.476 } H/U^{235} = 26.9

" of U^{235} = 16.476 × .9315 = 15.347

3/1/55 Returned 17.0178 Kg of Solution of H/x ~ 27 7.135 Kg U. 7.0189 Kg U^{235}

Received 7.100 liters of Solution of H/x ~ 74

3/8/55

Material Sampled on Req. # 354706 Req. # 354707

D-1/ Gross = 78.1686 D-1a 67.8567 } Exps. D-17 p. 96

Tare = 26.1698 24.1298

51.9988 gms 43.8269

3/23/55

Two samples taken:

Req #					
354709	G. 97.2380	1.70000	G. 106.6496		Exps. on p. 110
	T. 26.1706	.35799	T 25.5252		
	N. 71.0674		N. 81.1244		

3/16/55 Returned 11.1740 Kg of Solution H/x ~ 36

Received 8.2850 Kg of Solution H/x ~ 74

Dept 3410 Charge 7410-31 Retained 1937 Code 27

3/30 Removed 1.22 liters at H/U=35 = 42

Added 1.37 liters of H_2O. (distilled)

3/31 Returned all solution to Fox + Gilley.

	Sample D-3a	Sample D-3b
	G. 105.8983	G. 125.8963
Reg# 354710	T. 27.1028	T. 28.5500
	N 78.7955	N. 97.3463

Exps. on p. 122

1.6449 .34085

11/8/55 Removed 4 Kg UO_2F_2 solution of concentration specified on page 54. for transfer to E.C. Campbell at X-10.

Sample Ax

G. 53.1338

Reg. # 354729 T. 20.7234

N. 32.4104

gm U/gm = 0.05218

sp gr. = 1.0648

11/18/55 Removed 4.01 Kg. UO_2F_2 solution same as 11/8/55 above.

Sample Bx

G 66.5697

Reg. # 354734 T 19.7442

N 46.8255

Kg U.
Kg U^{235}

Exps. D-17
p. 96

on
10

Expr. D-9 Time _____ AM PM Date 2/7 1955

Purpose check critical pt. in 12.6" Dia sphere with UO$_2$F$_2$ solution $\bar{\nu}$ H/U^{235} = 27

Personnel: Fox & Thomas

INSTRUMENT CHECK

Date 2/7 1955 Time 11 35 AM Source No. RA-4-8

Instrument	Trip Value	Scale	Source Distance	Start-Up Scale
DC1	no	—	—	
DC2	yes	9 x 1/10	4'	10 1/10
DC3	yes	9 x 1/100	"	10 1/10
log N	yes	5 cc	"	—
R-1	yes	1 1000/1000	"	25/1000
R-2	no	—	—	—
P. M.	yes	✓	2"	—

START-UP CHECK LIST

Equipment Checked by J.T.T. Personnel Check by _____

Instrument and Safeties Checked and Reset by J.T.T. - JKF

"Source In" Checked by J.T.T. Source No. PN-15

Emergency Equipment in Control Room Checked by J.T.T.

Red Light On by J.T.T.

Start-Up OK'd by J.T.T. Time 12 45 AM PM Date 2/7 1955

MULTIPLICATION

Expr. D-9 Time 12:30 ~~PM~~ Date 2/7 1955

Settings B. G.

	H. V.	Dia.	c/(2) min.
C(4)	1950	45	8.5 scale 64
C(5)	1990	45	20.25 " "
C( )			

Time	Temperature Refl.	Temperature Sol'n	Height Refl.	Height Sol'n	C( )	$M^{-1}_{(\ )}$	C(4)	$M^{-1}_{(4)}$	C(5)	$M^{-1}_{(5)}$	Remarks.
12:45	~~Bare~~ 79.5°F		BARE 30.0 cm								Zero height - Background
1:20 PM.	Solution very slow in entering apheresis - suspect valve defective - draining back in order to remove and check valve.										
3:15	Replace valve										
3:17	79.0°F		Bare 30.0 cm								28.76" Manifold
4:20	Solution flow still very slow - Change of stainless steel tubing is necessary.										

Expr. D-9 Time 930 AM Date 2/8 1955

Purpose Obtain critical pt. in 19.6" Dia sphere unreflected at H/U235 ≈ 27

Personnel: Fox + Thomas

INSTRUMENT CHECK

Date 2/8 1955 Time 930 AM Source No. RA-8

Instrument	Trip Value	Scale	Source Distance	Start-Up Scale
DC-1	No			
DC-2	yes	9	50/10	4" 10/1
DC-3	yes	95	100/1	4" 10/1
Log N	yes	5 arc	—	4" —
R-1	yes	1	1000/1000	4" 25/1000
R-2	No			
P. M.	yes	trip ck.		3" —

START-UP CHECK LIST

~~Equipment Checked by~~ J.T.T. ~~Personnel Check by~~ J.T.T.

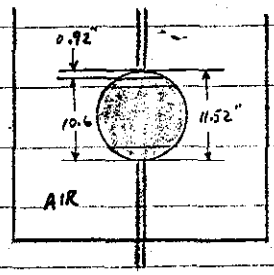
Instrument and Safeties Checked and Reset by J.T.T.

~~Source In~~ ~~Checked by~~ J.T.T. ~~Source No.~~ PN-15

Emergency Equipment in Control Room Checked by J.T.T.

~~Red Light On by~~ J.T.T.

Start-Up OK'd by J.T.T. Time 930 AM ~~PM~~ Date 2/8 1955



MULTIPLICATION

Expr. D-9 Time 930 AM ~~PM~~ Date 2/8 1955

Settings

Scalar	H. V.	Disc.	B. G. c/(2) min.	
C(4)	1950	45	8.25	scale of 64
C(5)	1980	45	20.5	
C( )				

Time	Temperature Refl.	Temperature Sol'n	Height Refl.	Height Sol'n	C( )	$M^{-1}_{(\ )}$	C(4)	$M^{-1}_{(4)}$	C(4)	$M^{-1}_{(4)}$	Remarks or M^{-1}
935 A	—		Bare	30.0 cm							Remarks manifold reading 20.65" Zero reading on S.G. 30.0 cm

1330 PM Removed 3/16" S.S. tube from bottom of reactor and replaced flange and Tubing.

1550 Begin again!

400 PM. Reactor subcritical at 56.8 - 3.0 = 26.8 cm.

Reactor slightly supercritical at 57.0 - 3.0 = 27 cm.

Reactor just critical at ~56.95 - 3.0 = 26.9 cm.

SUMMARY OF CRITICAL CONDITIONS

Expr. D-9 Reactor 12.6" dia sphere.

Solution UO_2F_2 Height 10.6" Volume 16.550 l. Temp 76°F

Reflector AIR Height — Temp —

Time Critical 400 ~~AM~~ PM Duration ~20 min. Log N 0.07

Anal. Req. 354702 gms U / gm 0.44278 Sp. Gr. 2.01360

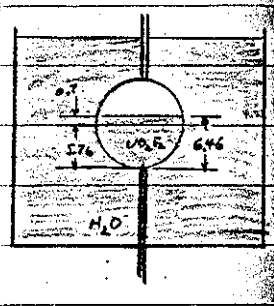
Critical Mass 13.7449 Kg^{25} Atomic Ratio 26.9

Expr: D-10 Time 845 AM ~~PM~~ Date 2/9 1955
Purpose Check Critical pt. in 12.6" Dia. sphere with water reflector at H/U235 ~27
Personnel: Fox, Grilley, Cowan & Thomas

INSTRUMENT CHECK

Date 2/9 1955 Time 845 AM ~~PM~~ Source No. RA 4.80

Instrument	Trip	Value	Scale	Source Distance	Start-Up Scale
DC-1	90	—			
DC-2	Yes	out	10/10	4"	10/1
DC-3	Yes	95	1/100	4"	10/1
Log N	Yes	5 ARS		4"	
R-1	Yes	1	1000/1000	4"	25/1000
~~R-2~~	No	—			
P. M.	Yes	ok.	—	2"	



START-UP CHECK LIST

Equipment Checked by J.T.T. Personnel Check by J.T.T.
Instrument and Safeties Checked and Reset by J.T.T.
"Source In" Checked by J.K.F. Source No. PN-15
Emergency Equipment in Control Room Checked by J.T.T.
Red Light On by J.T.T.
Start-Up OK'd by J.T.T. Time 845 AM ~~PM~~ Date 2/9 1955

10[45] A Slightly supercritical at 465-30 = 26.5 cm. Manifold reading 38.60"
11[00] A just critical 464-30 = 26.4cm. (38.45) manifold height 38.95 in.

SUMMARY OF CRITICAL CONDITIONS

Expr. D-10 Reactor 12.6" Dia. Sphere
Solution UO_2F_2 Height 16.4cm Volume 9.700 l. Temp 76°F or 23°C
Reflector H_2O Height Full Temp 76°F
Time Critical 10:45 AM ~~PM~~ Duration 35 min. Log N. Variable
Anal. Req. 359702 gms U / gm .44278 Sp. Gr. 2.01360
Critical Mass 8.056 Kg. U^{235} Atomic Ratio 26.9

Expr. C-1 Time 10⁵⁰ AM ~~PM~~ Date 2/9 1955

Purpose Check critical point in 11" D. Sphere at an $H/U^{235} \approx 27$ without reflector

Personnel: Fox & Thomas

INSTRUMENT CHECK

Date 2/9 1955 Time 10⁵⁰ AM ~~PM~~ Source No. RA 4.80

Instrument	Trip Value	Scale	Source Distance	Start-Up Scale
~~DC-1~~	No	—	—	—
DC-2	yes	No.	Response only - 4"	10/1
DC-3	yes	9.5	100/1 4"	10/1
Log N	yes	Safe	4"	—
R-1	yes	1	1000/1000 2"	25/1000
~~R-2~~	No	—	—	—
P. M.	yes	O/K	—	—

START-UP CHECK LIST

Equipment Checked by J.T.T. Personnel Check by J.T.T.

Instrument and Safeties Checked and Reset by J.T.T.

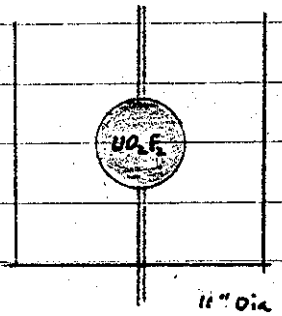
"Source In" Checked by J.T.T. Source No. PN-15

Emergency Equipment in Control Room Checked by J.T.T.

~~Red Light On~~ by J.T.T.

Start-Up OK'd by J.T.T. Time 10⁵⁵ AM ~~PM~~ Date 2/9 1955

Not Critical!



11" Dia

MULTIPLICATION

Expr. C-1 Time 10⁵⁵ AM ~~PM~~ Date 2/9 1955

	Settings H. V.	Disc.	B. G. c/(2) min.
Scalar C(4)	1950	43	8.5 scale of
C(5)	1990	45	21.5 " "
C( )			

Time	Temperature Refl.	Sol'n	Height Refl.	Sol'n	C( )	M^{-1} or Remarks $M^{-1}_{(\ )}$	C(4)	$M^{-1}_{(4)}$	C(5)	$M^{-1}_{(5)}$
11⁰⁵	—		Bare	0.0		Background.				
12⁰⁵	69.5°		Full			23.8	.357	21.5		

Remarks

Zero on S.G. = 27.5 cm.

SUMMARY OF ~~CRITICAL~~ CONDITIONS

Expr. C-1 Reactor 11.0" Dia. Sphere

Solution UO_2F_2 Height 11.04" Volume 12.920 l Temp 68.5

Reflector AIR Height — Temp 68.5

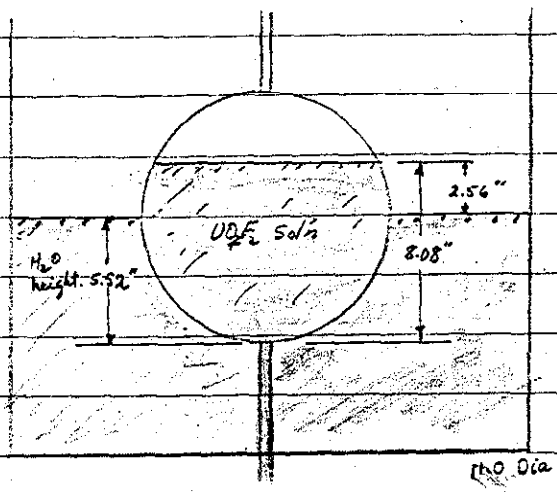
Time ~~Critical~~ 12.2 ~~AM~~ PM Duration 0 min. Log N .008

Anal. Req. 354702 gms U/gm 44278 Sp. Gr. 2.01360

~~Critical~~ Mass Present 10.730 Kg U^{235} Atomic Ratio 26.9

Expr. C-2 Time 1^10 PM Date 2/9 1955
Purpose Check Critical point in 11.0" Dia Sphere
of U^{235} ~27 - Half water reflected
Personnel: Fox + Thomas

START-UP CHECK LIST
Equipment Checked by J.T.T. Personnel Check by J.T.T.
Instrument and Safetics Checked and Reset by J.T.T.
Source In" Checked by J.T.T. Source No. PN-15
Emergency Equipment in Control Room Checked by J.T.T.
Red Light On by J.T.T.
Start Up OK'd by J.T.T. Time 1^10 PM Date 2/9 1955



SUMMARY OF CRITICAL CONDITIONS
Expr. C-2 Reactor 11.0" Dia Sphere
Solution UO_2F_2 Height 8.08" Volume 10.350 l. Temp 72°F
Reflector H_2O Height 1/2 H. Temp ~72°F
Time Critical 2^30 PM Duration ~5 min. Log N 0.618
Anal. Req. 354702 gms U/gm A4278 Sp. Gr. 2.01360
Critical Mass 8.596 Kg U^{235} Atomic Ratio ~26.9

Expr. C-3 Time 3:15 ~~AM~~ PM Date 2/19 1955

Purpose Check critical point in 11.0" Dia Sphere with UO_2F_2 at H/U^{235} - 27 full water reflector

Personnel: Fox + Thomas

START-UP CHECK LIST

Equipment Checked by J.T.T. Personnel Check by J.T.T.

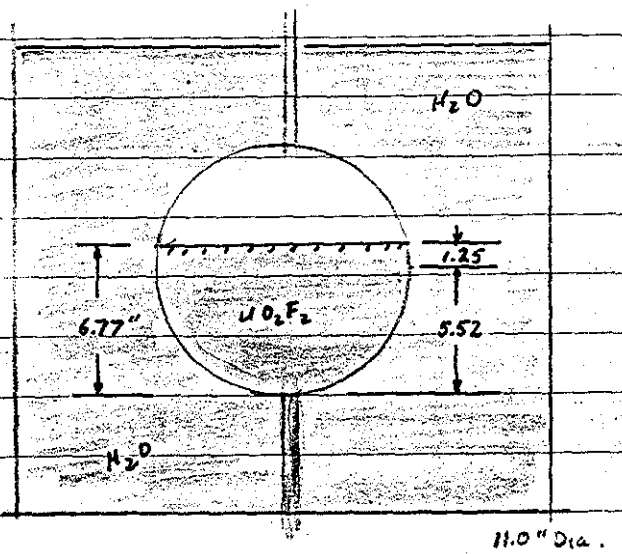
Instrument and Safeties Checked and Reset by J.T.T.

~~Source In~~ Checked by J.T.T Source No. PW-15

Emergency Equipment in Control Room Checked by J.T.T.

Red Light On by J.T.T.

Start-Up OK'd by J.T.T. Time 3:15 ~~AM~~ PM Date 2/19 1955



SUMMARY OF CRITICAL CONDITIONS

Expr. C-3 Reactor 11.0" Dia Sphere

Solution UO_2F_2 Height 6.77 Volume 8.40 ℓ Temp 74°F

Reflector H_2O Height Full Temp 74°F

Time Critical 3:40 ~~PM~~ Duration 20 min. Log N 0.008

Anal. Req. 35702 gms U/gm .44278 Sp. Gr. 2.0136

Critical Mass 6.976 Kg U^{235} Atomic Ratio 26.9

Expr. B-1 Time 1000 AM ~~PM~~ Date 2/10 1955

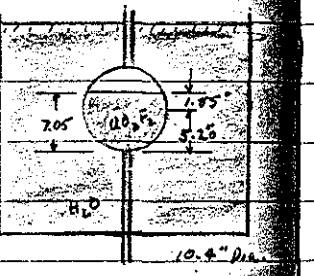
Purpose Check Critical point in 10.4" Dia Sphere with UO_2F_2 at Molarity 27 with water reflector.

Personnel: _____

INSTRUMENT CHECK

Date 2/10 1955 Time 1000 AM ~~PM~~ Source No. RA 4.80

Instrument	Trip Value	Scale	Source Distance	Start-Up Scale
DC-1	No			
DC-2	Yes	—	4"	10/1
DC-3	Yes	95	100/1 4"	10/1
Log N	Yes	5 sec	— 4"	—
R-1	Yes	1	1000/1000 4"	25/1000
R-2	No			
P. M.	Yes	Trip check	—	—



START-UP CHECK LIST

~~Equipment Checked by~~ J.T.T. ~~Personnel Check by~~ J.T.T.

Instrument and Safeties Checked and Reset by J.T.T.

~~"Source In" Checked by~~ J.T.T. ~~Source No.~~ PN-15

Emergency Equipment in Control Room Checked by J.T.T.

~~Red Light On by~~ J.T.T.

Start-Up OK'd by J.F.T. Time 1002 AM ~~PM~~ Date 2/10 1955

Zero reading on sight Glass 28.1 cm.

Critical height 46.0 cm − 28.1 = 17.9 cm Vol = 7.520 l.

J

SUMMARY OF CRITICAL CONDITIONS

Expr. B-1 Reactor 10.4" Dia. Sphere 7.05"

Solution UO_2F_2 Height 17.9 cm Volume 7.520 l. Temp 75.5°F

~~Reflector~~ H_2O ~~Height~~ Full Temp 75.5°F

Time Critical 1113 AM ~~PM~~ Duration 16 min. Log N ~102

Anal. Req. 354.702 gms U/gm .44278 Sp. Gr. 2.01360

Critical Mass 6.2483 Kg U^{235} Atomic Ratio 26.9

Expr. A-4 Time 9:15 ~~PM~~ AM Date 2/14 1955

Purpose Check critical point in 9.0" Dia sphere with UO_2F_2 at H/U^{235} ~ 27, with water reflector.

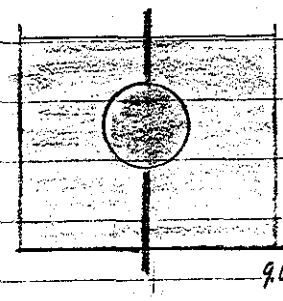
Personnel: J.K. Fox and N.J. Thomas

INSTRUMENT CHECK

Date 2/14 1955 Time 9:15 ~~PM~~ AM Source No. RA-4.80

Instrument	Value	Trip Scale	Source Distance	Start-Up Scale
DC-1	No	—	—	—
DC-2	Yes	9.5	10/1.0	4" 10/1
DC-3	Yes	9.5	100/1	4" 10/1
Log N	Yes	5 sec.	4"	
R-1	Yes	1.0	1000/1000	25/1000
R-2	No			
P. M.	Yes	Trip check	~4"	—

Not CRITICAL!



START-UP CHECK LIST

~~Equipment Checked by~~ J.T.T. Personnel Check by J.T.T.

Instrument and Safeties Checked and Reset by J.T.T.

"Source In" Checked by J.T.T. Source No. PN-15

Emergency Equipment in Control Room Checked by J.T.T.

~~Red Light On by~~ J.T.T.

Start-Up OK'd by J.T.T. Time 9:35 ~~PM~~ AM Date 2/14 1955

Zero reading on sight glass 27.7 cm.

System not critical Extrapolated critical volume = ~6.9 liters

SUMMARY OF NOT CRITICAL CONDITIONS

~~Expt~~ A-4 Reactor 9.0" Dia Sphere

Solution UO_2F_2 Height Full Volume 6.900 l. Temp 74°F

Reflector H_2O + Uranium Height Full Temp 74°F

Time Not Critical 10:50 ~~PM~~ AM Duration — min. Log N —

Anal. Req. 354702 gms U/gm .44278 Sp. Gr. 2.0130

~~Critical~~ Mass present 5.315 Kg U^{235} Atomic Ratio 26.9

Expr. A-4a Time 12 50 ~~AM~~ PM Date 2/14 1955

Purpose Obtain critical point in 9.0 lit Sphere by extrapolation.

Personnel: J. K. Fox + J. T. Thomas

START-UP CHECK LIST

Equipment Checked by J.T.T. Personnel Check by J.T.T.

Instrument and Safeties Checked and Reset by J.T.T.

"Source In" Checked by J.T.T. Source No. PN-15

Emergency Equipment in Control Room Checked by J.T.T.

Red Light On by J.T.T.

Start-Up OK'd by J.T.T. Time 12 45 ~~AM~~ PM Date 2/14 1955

MULTIPLICATION

Expr. A-4a Time 12 45 ~~AM~~ PM Date 2/14 1955

Settings

	Scalar	H. V.	Disc.	E. G. c/(2) min.
C(4)		1950	45	3.5
C(5)		1950	45	4.25
C( )				

Time	Temperature Refl.	Temperature Sol'n	Height Refl.	Height Sol'n	~~C( )~~ Volume	M^{-1} ~~( )~~	C(4)	$M^{-1}_{(4)}$	C(5)	$M^{-1}_{(5)}$	or Remarks
12.55 p	62°	>70	Full	0		0	3.5	1	4.25	1	
1 22 p	62°	>62	"	18.3 cm	5.9 l.		7.5	.467	5.5	.273	
1 42 p	62°	>62	"	30.5 cm	6.37 l.		15.5	.225	8.75	.485	
1 55 p	62°	>62	"	>25 cm	6.70 l.		19.25	.195	10.2	.416	

Reactor not critical: Extrapolated critical volume ~ 6.6 liters

Expr. D-11 Time 8:50 AM ~~PM~~ Date 2/15 1955

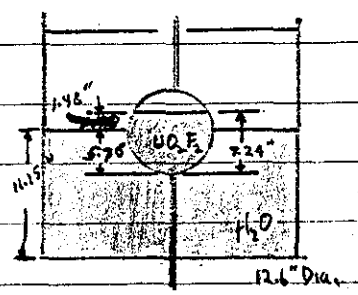
Purpose Obtain critical point in 12.6" Dia Sphere with UO_2F_2 soln of $H/U^{235} \sim 27$ having ½ water reflector

Personnel: J. K. Fox & J. T. Thomas

INSTRUMENT CHECK

Date 2/15 1955 Time 8:50 AM ~~PM~~ Source No. RA #80

Instrument	Trip Value	Scale	Source Distance	Start-Up Scale
~~DC-1~~ No				
DC-2 Yes	95	10/10	4"	10/1
DC-3 Yes	95	100/1	4"	10/1
Log N Yes	5 sec	—	4"	—
R-1 Yes	1.0	1000/1000	4"	25/1000
R-2 No				
P. M. yes	Trip ck.			



START-UP CHECK LIST

Equipment Checked by J.T.T. Personnel Check by J.T.T.

Instrument and Safeties Checked and Reset by J.T.T.

"Source In" Checked by J.T.T. Source No. PN-15

Emergency Equipment in Control Room Checked by J.T.T.

Red Light On by J.T.T.

Start-Up OK'd by J.T.T. Time 8:50 AM ~~PM~~ Date 2/15 1955

Critical height = 48.8cm - 30.5 = 18.4cm = 7.24"

SUMMARY OF CRITICAL CONDITIONS

Expr. D-11 Reactor 12.6" Dia Sphere

Solution UO_2F_2 Height 7.24" Volume 11.34 Temp 71°F

Reflector H_2O Height 5.76" ~~5.75"~~ in Hemi Sphere Temp 71°F

Time Critical 9:55 AM ~~PM~~ Duration 20 min. Log N < .02

Anal. Req. 354702 gms U / gm .44278 Sp. Gr. 2.0136

Critical Mass 9.418 Kg U^{235} Atomic Ratio 26.9

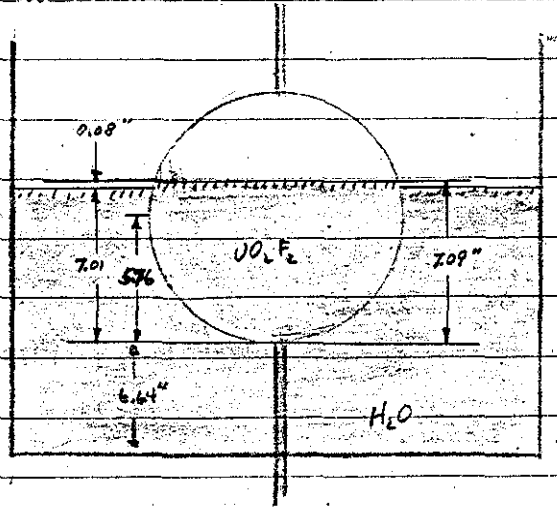
941

Expr. D-12 Time 1037 AM PM Date 2/15 1955
Purpose Obtain critical pt. in 12-6" Dia Sphere with UO_2F_2 Soln at H/U^{235} = 27 having Soln level and water reflector level equal.
Personnel: J. K. Fox & J. T. Thomas

START-UP CHECK LIST

Equipment Checked by J.T.T. Personnel Check by J.T.T.
Instrument and Safeties Checked and Reset by J.T.T.
"Source In" Checked by J.T.T. Source No. PN-15
Emergency Equipment in Control Room Checked by J.T.T.
Red Light On by J.T.T.
Start Up OK'd by J.T.T. Time 1037 AM PM Date 2/15 1955

Reflector water height 7.01" (12.4" from bottom of cylinder)
Solution height at critical 7.09"



SUMMARY OF CRITICAL CONDITIONS

Expr. D-12 Reactor 12.6" Dia Sphere
Solution UO_2F_2 Height 7.09" Volume 11.00 ℓ Temp 71°F
Reflector H_2O Height 7.01" Temp 71°F
Time Critical 1115 AM PM Duration 12 min. Log N 2.02
Anal. Req. 354702 gms U/gm .44278 Sp. Gr. 2.0136
Critical Mass 9.135 kg U^{235} Atomic Ratio 26.9

912

Expr. D-13 Time 8:40 AM ~~PM~~ Date 2/16 1955

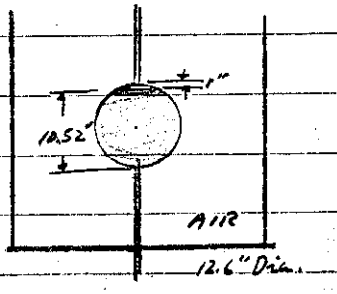
Purpose Obtain critical point in 12.6" Dia Sphere with UO_2F_2 at 14/225-27, unreflected at ~90°F

Personnel: J. K. Fox & J. T. Thomas

INSTRUMENT CHECK

Date 2/16 1955 Time 8:40 AM ~~PM~~ Source No. RA-480

Instrument	Trip Value	Scale	Source Distance	Start-Up Scale
DC-1	No	—	—	—
DC-2	Yes	9.5	10/10	4"	10/1
DC-3	Yes	9.5	100/1	4"	10/1
Log N	Yes	5 sec	—	—	—
R-1	Yes	1.0	1000/1000		25/1000
R-2	No	—	—	—	—
P. M.	Yes	Trip check only			



START-UP CHECK LIST

Equipment ~~Checked~~ by J.T.T. Personnel Check by J.T.T.

Instrument and Safeties Checked and Reset by J.T.T.

"Source In" ~~Checked~~ by J.T.T. Source No. PN-15

Emergency Equipment in Control Room Checked by J.T.T.

Red Light On by J.T.T.

Start-Up OK'd by J.T.T. Time 8:45 AM ~~PM~~ Date 2/16 1955

Reactor just critical: Sight Glass reading 57.0 - 30.5 = 26.5 cm.

SUMMARY OF CRITICAL CONDITIONS

Expr. D-13 Reactor 12.6" Dia Sphere

Solution UO_2F_2 Height 10.42" Volume 16.39 Temp 93°F

Reflector AIR Height — Temp 93°F

Time Critical 9:45 AM ~~PM~~ Duration 15 min. Log N 40.02

Anal. Req. 354702 gms U/gm .44278 Sp. Gr. 2.01360

Critical Mass 13.603 Kg U^{235} Atomic Ratio 26.9

Expr. D-14a Time 12[15] AM PM Date 2/17 1955

Purpose Determine the delayed neutron fraction of UO_2F_2 soln at $H/U^{235} = 27$ using 12.6" dia. reflector unreflected.

Personnel: T.K. Fox, A.D. Callihan, W. Gilley & J.T. Thomas

INSTRUMENT CHECK

Date 2/17 1955 Time 12[15] AM PM Source No. EA 4.80

Instrument	Trip Value	Scale	Source Distance	Start-Up Scale
DC-1	No	—	—	—
DC-2	Yes	9.0	10/10	4"	10/1
DC-3	Yes	3.5	100/1	4"	10/1
Log N	Yes	5 sec		4"	
R-1	Yes	1	1000/1000	4"	25/1000
R-2	No	—	—	—	—
P. M.	Yes	trip check		2"	—

Brush recorder using signal from R-1

START-UP CHECK LIST

~~Equipment Checked by~~ J.T.T. Personnel Check by J.T.T.

Instrument and Safeties Checked and Reset by J.T.T.

~~"Source In" Checked by~~ Source No. PN-15

Emergency Equipment in Control Room Checked by J.T.T.

~~Red Light On by~~ J.T.T.

Start-Up OK'd by J.T.T. Time 12[30] AM PM Date 2/17 1955

Background on counters: no solution or source present; scale 64

$C_4 = 1^{17}$ $C_5 = 2$ 181 counts in 2 min.

With source only: $C_4 = 5^{25}$ $C_5 = 5^{49}$; 369 " " "

With Soln + source at $H/U = 27$: $C_4 = 79^{53}$ $C_5 = 143^{24}$; 9076 " " "

From Brush recorder $N_0 = 48.0 - 60 = 38$

$n_2 = 21.5 - 10 = 11.5$

$$\beta_e = \frac{1}{\frac{N_0}{n_2} - 1} M^{-1} = \frac{1}{\frac{38}{11.5} - 1} \frac{369 - 181}{9076 - 181} = \frac{1}{3.303 - 1} \frac{188}{8895}$$

$$\beta_e = \frac{.02015}{2.303} = .00875$$

D-14b

START-UP CHECK LIST

Equipment Checked by J.T.T. Personnel Check by J.T.T.
Instrument and Sample Checked and Tested by J.T.T.
Source In Checked by J.K.F. Source No. PN-15
Emergency Equipment in Control Room Checked by J.T.T.
Red Light On by J.T.T.
Start-Up OK'd by J.T.T. Time 3 00 ~~AM~~ PM Date 2/17 195 5

Repeat of D-14 page 84.

	C_4	C_5
Background with Source	5^{5}	5^{50}
" " Soln + Source	110^{53}	102^{201} (256 counts)

From Bmah recorder $N_0 = 40$

$n_2 = 1821$

$\frac{N_0}{n_2} = 1.906$

$$\beta_4 = \frac{1}{\frac{2.227}{1.906} - 1} \quad \frac{371 - 181}{26112 - 181} = \frac{1}{.906} \quad \frac{190}{25931}$$

$$\beta_4 = \frac{.00745}{.906} = 0.00822$$

$$\text{ave } \beta = \frac{.00979 + .0060}{2}$$

$$\text{ave } \beta = .00759$$

Expr. D-14c Time 10:50 AM PM Date 2/18 1955

Purpose Determine ρ using 3 different Sources 12.6" Dia Sphere with U.F. sol. at $\nu\Sigma/10\pi S = 2.7$

Personnel: Fox, Gilley + Thomas

INSTRUMENT CHECK

Date 2/18 1955 Time 10:50 AM PM Source No. RA 4.80

Instrument	Trip Value	Scale	Source Distance	Start-Up Scale
DC-1	No	—		
DC-2	Yes	9.0	10/10	4"	10/1
DC-3	Yes	9.5	100/1	4"	10/1
Log N	Yes	5 sec	—	4"	—
R-1	Yes	1	1000/1000	4"	25/1000
R-2	No	—	—	—	—
P. M.	Yes	Trip check			

Brush Recorder - signal off R-1.

START-UP CHECK LIST

Equipment Checked by J.T.T. Personnel Check by J.T.T.

Instrument and Safeties Checked and Reset by J.T.T.

"Source In" Checked by J.T.T. Source Nos. PN-15; PN-58; Pb267

Emergency Equipment in Control Room Checked by J.T.T.

Red Light On by J.T.T.

Start-Up OK'd by J.T.T. Time 10:50 AM PM Date 2/18 1955

Estimate of Source strengths

S_1 : PN-15 : 3×10^6 n/sec

S_3 : PN-58 : 1×10^7 n/sec

S_2 : Pb-267 : 2×10^5 n/sec.

Counts for 2 min. 64 Scale.

	Background Source in Pig			Background Source in Sphere			
	C_4		C_5	C_4		C_5	
S_1	$1^5, 1^1, 1^{11}, 1^{25}, 1^{11}, 1^{18}, 1^{30}$	1^{16}	$3^{30}, 3^6, 3^{30}, 3^{27}, 3^{30}, 3^{10}, 3^{38}$	3^{17}	$5^{33}, 4^{51}, 5^5$	5^{08}	$5^{44}, 5^{39}, 5^1$	5^{28}
S_2	$0^9, 0^5, 0^{11}$	0^8	$0^{19}, 0^{17}, 0^{26}$	0^{21}	$0^{37}, 0^{33}, 0^{33}$	0^{34}	$0^{35}, 0^{21}, 0^{40}$	0^{33}
S_3	$5^{54}, 5^{58}, 5^{28}$	5^{48}	$11^4, 10^{36}, 10^{42}$	10^{41}	$14^{48}, 13^{47}, 15^{20}, 13^{25}$	14^{39}	$19^9, 18^{63}, 18^{60}, 20^4$	19^{34}

Counts for 2 minutes, Solution + Source. Soln height 55.3 cm.

		C_4	C_5
S_1	S_{11}	64^3, 65^{23}, 66^{44}, 69^{54}	118^{28}, 115^{19}, 117^{21}, 116^{35}
Scale 64	S_{12}	71^{57}, 74^{35}, 77^{7}, 75^{44}	119^{1}, 113^{20}, 114^{61}, 113^{18}
	S_{13}	74^{54}, 79^{10}, 77^{41}, $77''$	113^{37}, 112^{20}, 114^{50}, 115^{4}
	S_{21}	13^{57}, 14^{27}, 14^{21}, 14^{48}	8^{27}, 8^{14}, 8^{25}, 8^{63}
S_2	S_{22}	14^{50}, 13^{45}	8^{27}, 8^{8}
Scale 64	S_{23}	14^{25}, 14^{19}	8^{17}, 8^{32}
	S_{24}	$14''$	8^{51}
S_3	S_{31}	35^{124}, 33^{42}, 31^{99}	101^{219}, 102^{138}, 102^{198}
Scale 256	S_{32}	37^{180}, 37^{224}	102^{76}, 103^{45}
	S_{33}	40^{169}, 39^{128}	103^{30}, 104^{40}

	$M^{-1}_{C_5}$	$M^{-1}_{C_5}$	$M^{-1}_{C_5}$
S_{11}	$\frac{139}{7273} = .0191$	S_{21} $\frac{12}{508} = .0236$	S_{31} $\frac{545}{25523} = .02135$
S_{12}	$\frac{139}{7160} = .0194$	S_{22} $\frac{12}{509} = .0236$	S_{32} $\frac{545}{25612} = .0213$
S_{13}	$\frac{139}{7083} = .0196$	S_{23} $\frac{12}{516} = .0233$	S_{33} $\frac{545}{25542} = .0211$
		S_{24} $\frac{12}{542} = .0221$	

Summary of β Experiments

Date	Source	Fuel Ht.	M^{-1}_{ave}	N_0/N_2 ave.	β
2/11/55	PN-15	55.5	.02016	$\frac{38}{11.5} = 3.30$	.00825
2/17/55	PN-15	56.3	.00745	$\frac{40}{21} = 1.906$	.00823
2/18/55	PN-15	55.3	.0194	$\frac{40}{11.3} = 3.54$	.00764
2/18/55	Pb 267	55.3	.0233	$\frac{40}{31} = 1.290$	.0815
2/18/55	PN-58	55.3	.0213	$\frac{40}{14.7} = 3.42$	.0088
	ave neglecting	Pb 267	.01708	2.0415	.00834

S^{28} 0^{23} 0^{4} 19^{8}

Expr. D-15 Time 2330 ~~AM~~ PM Date 2/18 1955

Purpose Check critical wt. in 12-6" Dia Sphere unreflected with UO_2F_2 at H/U235 ~27 - Room Temp.

Personnel: Gilley, Fox, & Thomas

START-UP CHECK LIST

Equipment Checked by J.T.T. Personnel Check by J.T.T.

Instrument and Safeties Checked and Reset by J.T.T.

~~"Source In" Checked by~~ J.T.T. Source No. PN-15

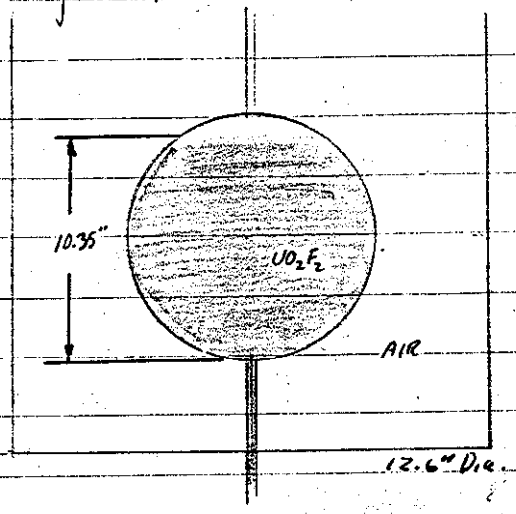
Emergency Equipment in Control Room Checked by J.T.T.

Red Light On by J.T.T.

Start-Up OK'd by J.T.T. Time 2330 ~~PM~~ Date 2/18 1955

Sight glass reading at just critical = 56.7 cm - 30.4 = 26.3cm

Manifold reading 50.89"



SUMMARY OF CRITICAL CONDITIONS

Expr. D-15 Reactor 12.6" Dia. Sphere

Solution UO_2F_2 Height 10.35" Volume 16,310 Temp 22°C.

Reflector AIR Height — Temp 22°C

Time Critical 3 ~~AM~~ PM Duration 15 min. Log N <5.02

Anal. Req. 354702 gms U/gm .44278 Sp. Gr. 2.01360

Critical Mass 13.545 Kg U^{235} Atomic Ratio 269

2/21/55

Cd Blade in Reflector Water 12.6" Dia Sphere

$N_0 = 40$ $\quad \frac{40-12}{12} = \phi_{2.33}$

$N_1 = 12$

Expr. D-16.1 Time 11 AM ~~PM~~ Date 2/21 1955

Purpose Obtain Fission distribution in 12.6" D. Sphere

Personnel: Fox + Thomas

Foil	Spacer	Center of Sphere
18	16	
9 —	6 —	19
	7	
17 —		10
	13	
11 —		15
	8	
3 —		1
	15	
5 —		13
	3	
—	~5"	

Monitor foil F-4

INSTRUMENT CHECK

Date 2/21 1955 Time 11 AM ~~PM~~ Source No. RA 4.80

Instrument	Trip Value	Scale	Source Distance	Start-Up Scale
DC-1	No			
DC-2	Yes	9.0	10/10	4"	10/1
DC-3	Yes	9.5	100/1	4"	10/1
Log N	Yes	5 sec.	—	4"	—
R-1	Yes	1	1000/1000	4"	25/1000
R-2	No				
P. M.	Yes	Trip check		—	—

START-UP CHECK LIST

~~Equipment Checked by~~ J.T.T. Personnel Check by J.T.T.

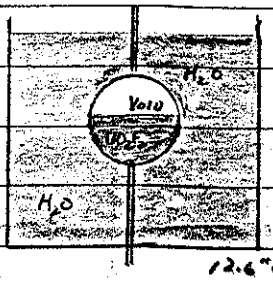
Instrument and Safeties Checked and Reset by J.T.T.

"Source In" Checked by J.T.T. Source No. PN-15

Emergency Equipment in Control Room Checked by J.T.T.

Red Light On by T.T.T.

Start-Up OK'd by J.T.T. Time 11 AM ~~PM~~ Date 2/21 1955



12.6" dia.

5.6 = 16.3 cm; Sol'n height = 15.9 cm. = 6.26"

Value of Cd safety Blade $\frac{N_0 - N}{N_1} = \frac{40-12}{12} = \$2.33$

[redacted]

SUMMARY OF CRITICAL CONDITIONS

Expr. D-16.1 Reactor 12.6" Dia Sphere

Solution UO_2F_2 Height 6.26" Volume 9.25 Temp 22°C

Reflector H_2O ~~Height~~ Full Temp 24°C

Time Critical 1150 AM ~~PM~~ Duration 45 min. Log N 0.2

Anal. Req. 354202 gms U / gm .44278 Sp. Gr. 2.01360

Critical Mass 7.682 Kg U^{235} Atomic Ratio 26.1

Expr. D-16.2 Time 840 AM ~~PM~~ Date 2/22 1955

Purpose Obtain Fission distribution in 12.6" Dia Sphere - full water reflector.

Personnel: Fox & Thomas

Fuel caps
6
6 } Center of Sphere
19
10 7
15 13
1 8
13 15
3

Monitor F-4

START-UP CHECK LIST

Equipment Checked by J.T.T. Personnel Check by J.T.T.

Instrument and Safeties Checked and Reset by J.T.T. & JKF

"Source In" Checked by J.T.T. Source No. PN-15

Emergency Equipment in Control Room Checked by J.T.T.

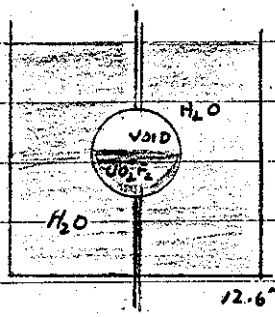
Red Light On by J.T.T.

Start-Up OK'd by J.T.T. Time 840 AM ~~PM~~ Date 2/22 1955

INSTRUMENT CHECK

Date 2/22 1955 Time 840 AM ~~PM~~ Source No. RA-480

Instrument	Trip	Value	Scale	Source Distance	Start-Up Scale
DC-1	No				
DC-2	Yes	9.0	10/10	4"	10/1
DC-3	Yes	9.5	10/1	4"	10/1
Log N	Yes	5 sec			
R-1	Yes	9.5	100/1000		25/1000
R-2	No				
P. M.	Yes	Trip check			



13.60
9.42
5.18

9.42
2.68
1.74

SUMMARY OF CRITICAL CONDITIONS

Expr. D-16.2 Reactor 12.6" Dia. Sphere

Solution UO_2F_2 Height 6.26" Volume 9.250 l Temp 21°C

Reflector H_2O Height Full Temp 21°C

Time Critical 950 AM ~~PM~~ Duration 35 min. Log N <5.0

Anal. Req. 354702 gms U/gm .44278 Sp. Gr. 2.01360

Critical Mass 7.682 Kg U^{235} Atomic Ratio 26.9

Expr. D-16.3 Time 10^00 AM ~~PM~~ Date 2/23 1955
Purpose Obtain Bare In Traverse in
12.6" Dia Sphere.
Personnel: Eof + Thomas

In Foils

B-31 — 7/4" — {center of sphere
B-30 — 3/4"
B-29 — 3/4"
B-28 — 3/4"
B-26 — 3/4"
B-11 — 3/4"

INSTRUMENT CHECK

Date 2/23 1955 Time 10 AM ~~PM~~ Source No. RA-4-80

Instrument	Value	Scale	Source Distance	Start-Up Scale
DC-1	No	—		
DC-2	Yes	9.0	10/10	4" 10/1
DC-3	Yes	9.5	100/1	4" 10/1
Log N	Yes	5 sec.		4"
R-1	Yes	1	1000/1000	4" 23/1000
R-2	No			
P. M.	Yes	Trip	Check	

Monitor F-1

START-UP CHECK LIST

~~Equipment Checked by~~ J.T.T. ~~Personnel Check by~~ J.T.T.
Instrument and Safeties Checked and Reset by J.K.F.
~~"Source In" Checked by~~ J.K.F. Source No. PN-15
Emergency Equipment in Control Room Checked by J.T.T.
~~Red Light On by~~ J.T.T.
Start-Up OK'd by J.T.T. Time 10 AM ~~PM~~ Date 2/23 1955

S.C. = 46.4 - 30.4 = 16 cm.

SUMMARY OF CRITICAL CONDITIONS

Expr. D-16.3 Reactor 12.6" Dia Sphere.
Solution UO_2F_2 Height 6.30" Volume 9.35 Temp 18.5°C
Reflector H_2O Height Full Temp 18.5°C
Time Critical 11^00 AM ~~PM~~ Duration 30 min. Log N 2.0
Anal. Req. 35702 gms U/gm .44278 Sp. Gr. 201360
Critical Mass 7.765 Kg U^{235} Atomic Ratio 26.9

92

Expr. D-16.4 Time 940 AM ~~PM~~ Date 2/24 1955

Purpose Cd covered In Traverse in 12.6" Sphere

Personnel: Fox + Thomas

Cd-covered In-foils

31 — 3/4" — Center of Sphere
30 — 3/4"
29 — 3/4"
28 — 3/4"
26 — 3/4"
B-11 — 3/4"

Monitor F-1

INSTRUMENT CHECK

Date 2/24 1955 Time 940 AM ~~PM~~ Source No. RA 4.80

Instrument	Trip Value	Scale	Source Distance	Start-Up Scale
DC-1	No	—		
DC-2	Yes	9.0	10/10	4"	10/1
DC-3	Yes	9.5	100/1	4"	10/1
Log N	Yes	5 sec		4"	
R-1	Yes	1.0	1000/1000	4"	25/1000
R-2	No	—			
P. M.	Yes	Trip check		4"	

START-UP CHECK LIST

Equipment Checked by J.T.T. Personnel Check by J.T.T.

Instrument and Safeties Checked and Reset by J.T.T. J.K.F.

"Source In" Checked by J.K.F. Source No. PN-15

Emergency Equipment in Control Room Checked by J.T.T.

Red Light On by J.T.T.

Start-Up OK'd by J.T.T. Time 945 AM ~~PM~~ Date 2/24 1955

S.G. 46.3 − 30.4 = 15.9 cm.

SUMMARY OF CRITICAL CONDITIONS

Expr. D-16.4 Reactor 12.6" Sphere

Solution UO$_2$F$_2$ Height 6.26 Volume 8.250 l. Temp 7.4 °C

Reflector H$_2$O Height Full Temp 19°C

Time Critical 1030 AM ~~PM~~ Duration 20 min. Log N 1

Anal. Req. 35470 2 gms U / gm .44278 Sp. Gr. 2.01360

Critical Mass 2.682 Kg U^{235} Atomic Ratio 26.9

Expr. D-16.5 Time 1⁰⁰ ~~PM~~ Date 2/25 1955
Purpose Cd-covered fuel Traverse in 12.6" Sphere

Personnel: Fox + Thomas

Cd covered Fuel
6 □ {Center of Sphere
19 6
10 7 (no cover)
15 13
1 8 (no cover)
13
3

INSTRUMENT CHECK

Date 2/25 1955 Time 1⁰⁰ ~~PM~~ Source No. RA 4.80

Instrument	Trip Value	Scale	Source Distance	Start-Up Scale
DC-1	No	—	—	—
DC-2	yes	90	10/10	4"	10/1
DC-3	yes	9.5	100/1	4"	10/1
Log N	yes	5 sec		4"	—
R-1	yes	1.0	1000/1000	4"	35/1000
R-2	No				
P. M.	yes	Trip Check			

Monitor F-4

START-UP CHECK LIST

~~Equipment Checked by~~ J.T.T. Personnel Check by J.T.T.
Instrument and Safeties Checked and Reset by J.K.F.
"Source In" Checked by J.T.T. Source No. PN-15
Emergency Equipment in Control Room Checked by J.T.T.
Red Light On by J.T.T.
Start Up OK'd by ~~J.T.T.~~ Time 1⁰⁰ ~~PM~~ PM Date 2/25 1955

S.G. 46.4 - 30.4 = 16.0 cm.

SUMMARY OF CRITICAL CONDITIONS

Expr. D-16.2 Reactor 12.6" Dia Sphere
Solution UO_2F_2 Height 6.30" Volume 9.350 Temp 17°C
Reflector H_2O Height Full Temp 17°C
Time Critical 2⁰⁰ ~~PM~~ Duration 20 min. Log N 2.0
Anal. Req. 354702 gms U / gm .44278 Sp. Gr. 2.01860
Critical Mass 7.765 Kg U^{235} Atomic Ratio 26.9

Expr. D-16.6 Time 11 AM ~~PM~~ Date 2/28 1955

Purpose (3-determination using sources: PN-15 and PN-58

Personnel: Gilley, Fox + Thomas

INSTRUMENT CHECK

Date 2/28 1955 Time 11 AM ~~PM~~ Source No. RA-480

Instrument	Trip Value	Scale	Source Distance	Start-Up Scale
DC-1	No			
DC-2	Yes	9.0	10/10	4"	10/1
DC-3	Yes	9.5	100/1	4"	10/1
Log N	Yes	Sec		4"	
R-1	Yes	1.0	100%/1000	4"	25/1000
R-2	No				
P. M.	Yes	Trip Cks.		2"	—
	Bonshaw R-1				

START-UP CHECK LIST

Equipment Checked by J.T.T. Personnel Check by J.T.T.

Instrument and Safeties Checked and Reset by J.T.T.

"Source In" Checked by J.T.T. Source No. PN-15 PN-58

Emergency Equipment in Control Room Checked by J.T.T.

Red Light On by J.T.T.

Start-Up OK'd by J.T.T. Time 11 AM ~~PM~~ Date 2/28 1955

S_1 : PN-15 ; S_2 - PN-58

	Background (Source in Rig)			Background (Source in Spkane, No Soln.)			
	C_4	C_5		C_4	C_5		
Count 2 min. S_1	$1^{36}, 1^{35}, 1^{19}$	$3^{2}, 3^{6}, 2^{52}$	189 c/2 min.	$16^{30}, 13^{0}, 4^{1}$	$15^{21}, 15^{8}, 5^{25}$		
64 Scale				6 min	6 min	325 c/2 min.	
S_3	$4^{38}, 5^{21}, 4^{39}, 4^{58}$	$9^{52}, 9^{22}, 9^{30}, 9^{26}$	609 c/2 min.	$36^{15}, 36^{37}, 12^{6}, 13^{23}, 13^{7}$	$50^{43}, 51^{49}, 17^{31}, 17^{28}, 17^{24}$		
				6 min	6 min	1118 c/2 min.	

Counts for 2 min. Solution + source : solution height = 55.5 cm.

		C_4	C_5
		Time Source out ~ .125 sec	
S_1	S_{11}	53^{40} 53^{0} 55^{55} 62^{35}	164^{3} 162^{30} 159^{5} 163^{29}
64 scale	S_{12}	63^{50} 68^{51} 71^{36}	162^{5} 164^{19} 163^{44}
S_2	S_{21}	25^{219} 26^{185} 25^{253}	140^{115} 140^{191} 139^{153}
256 scale	S_{22}	30^{169} 29^{64} 30^{127}	140^{26} 140^{99} 140^{105}
		Time Source out ~ .103 sec.	
S_2	S_{23}	31^{41} 30^{20} 33^{241}	136^{173} 139^{202} 139^{86}
256 scale	S_{24}	31^{200} 33^{138} 33^{186}	137^{155} 138^{144} 139^{225}
S_1	S_{13}	87^{15} 88^{12}	161^{19} 161^{2}
64 scale	S_1	83^{54} 83^{51}	159^{11} 160^{34}

Ave. on C_5, $S_{11}, S_{12}, S_{13}, S_{14}$ = 10371 c/2 min.

" " " $S_{21}, S_{22}, S_{23}, S_{24}$ = 35654 c/2 min.

$$M_{S_1}^{-1} = \frac{325-189}{10371-189} = \frac{146}{10182} = .01433$$

$$M_{S_2}^{-1} = \frac{1118-609}{35654-609} = \frac{509}{35085} = .01450$$

} Ave = .0144

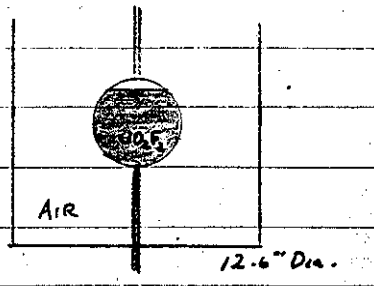
Ave $\frac{N_0}{N_L} = \frac{40}{14.8} = 2.6846$

Ave. $\beta_{eff} = \frac{.0144}{1.6846} = 0.00854$

Expr. D-17.0 Time 2:55 ~~AM~~ PM Date 3/1 1955
Purpose Obtain critical point in 12.6" Dia Sphere
unreflected at H/U235 ~35
Personnel: Gilley, Fox & Thomas

START-UP CHECK LIST
Equipment Checked by J.T.T. Personnel Check by J.T.T.
Instrument and Safeties Checked and Reset by J.T.T.
~~Source In~~ Checked by J.T.T. Source No. PN-15
Emergency Equipment in Control Room Checked by J.T.T.
Red Light On by J.T.T.
Start-Up OK'd by J.T.T. Time 2:55 ~~PM~~ Date 3/1 1955

Slightly above critical 5.6 = 55.5cm. - 30.7 = 24.8cm.
just critical 5.6 = 55.45cm. - 30.7 = 24.75cm.
Period meter faulty! (battery was not on!!)



SUMMARY OF CRITICAL CONDITIONS
Expr. D-17.0 Reactor 12.6" Dia Sphere
Solution UO_2F_2 Height 9.74" Volume 15.600 l. Temp 29°C
Reflector AIR Height — Temp 29°C
Time Critical 3:40 ~~AM~~ PM Duration 5 min. Log N —
Anal. Req. 354707. gms U/gm .38799 Sp. Gr. 1.79495
Critical Mass 10.125 Kg. Atomic Ratio 35.8

$.38799 (.932)(1.79495) =$
$= 0.64906 \frac{gm\ U^{235}}{cc}$

Expr. D-17.1 Time 2:30 AM PM Date 3/2 1955

Purpose Repeat Exp D-17.0

Personnel: Fox & Thomas

INSTRUMENT CHECK

Date 3/2 1955 Time 2:30 AM PM Source No. RA-480

Instrument	Trip	Value	Scale	Source Distance	Start-Up Scale
DC-1	No				
DC-2	Yes	2.0	10/10	4"	10/100
DC-3	Yes	2.5	100/1	4"	10/1
Log N	Yes	5 sec		4"	
R-1	Yes	1.0	1000/000		25/1000
~~R-2~~	No				
P. M.	Yes	Trip check			

START-UP CHECK LIST

~~Equipment Checked by~~ J.T.T. ~~Personnel Check by~~ J.T.T.

Instrument and Safeties Checked and Reset by J.T.T.

~~"Source In" Checked by~~ J.T.T. ~~Source No.~~ PN-15

Emergency Equipment in Control Room Checked by J.T.T.

~~Red Light On by~~ J.T.T.

Start-Up OK'd by J.T.T. Time 2:30 AM PM Date 3/2 1955

Zero on sight glass = 30.7 cm. Temp. 24°C

Just critical : 5.6 = 55.45 - 30.7 = 24.75 cm

SUMMARY OF CRITICAL CONDITIONS

Expr. D-17.1 Reactor 12.6" Dia. Sphere

Solution UO$_2$F$_2$ Height 9.74" Volume 15.600 l. Temp 24°C

~~Reflector~~ AIR ~~Height~~ — Temp 24°C

Time Critical 3:10 AM PM Duration < 5 min. Log N < .05

Anal. Req. 354707 gms U / gm .38789 Sp. Gr. 1.79495

Critical Mass 10.125 Kg U^{235} Atomic Ratio 35.8

Expr. D-17.2 Time 340 ~~AM~~ PM Date 3/2 1955
Purpose Obtain Critical point for 12.6" Dia Sphere
Full H_2O reflector. $H/U^{235} \sim 35$
Personnel: Fox & Thomas

START-UP CHECK LIST
Equipment Checked by J.T.T. Personnel Check by J.T.T.
Instrument and Safeties Checked and Reset by J.T.T.
~~Source In~~ Checked by J.K.F. Source No. PN-15
Emergency Equipment in Control Room Checked by J.T.T.
Red Light On by J.T.T.
Start Up OK'd by J.T.T. Time 342 ~~AM~~ PM Date 3/2 1955

Zero on Sight glass 30.7 cm.
Just critical at 46.0 cm - 30.7 cm = 15.3 cm.

SUMMARY OF CRITICAL CONDITIONS
Expr. D-17.2 Reactor 12.6" Dia Sphere
Solution UO_2F_2 Height ~~46.0~~ Volume 9.740 l. Temp 26.0°C
Reflector H_2O Height Full Temp 26.0°C
Time Critical 408 ~~AM~~ PM Duration 5 min. Log N < .01
Anal. Req. 354.07 gms U/gm .38789 Sp. Gr. 1.79495
Critical Mass 5.673 Kg U^{235} / 5.70 Atomic Ratio 35.8

Expr. A-5 Time 845 AM ~~PM~~ Date 3/3 1955

Purpose Obtain critical point in 9.0" Sphere; full H_2O Reflector; $H/U^{235} \sim 35$

Personnel: Fox & Thomas

INSTRUMENT CHECK

Date 3/3 1955 Time 845 AM ~~PM~~ Source No. RA-Y-10

Instrument	Trip Value	Scale	Source Distance	Start-Up Scale
DC-1	No			
DC-2	Yes	6.0x	10/10	4"	10/1
DC-3	Yes	9.0	100/1	4"	10/1
Log N	Yes	5 sec		4"	
R-1	Yes	1.0	1000/1000	4"	25/1000
R-2	No				
P. M.	Yes	Trip check		4"	

START-UP CHECK LIST

Equipment Checked by J.T.T. Personnel Check by J.K.F.

Instrument and Safeties Checked and Reset by J.T.T.

Source In" Checked by J.T.T. Source No. PN-15

Emergency Equipment in Control Room Checked by J.T.T.

Red Light On by J.T.T.

Start-Up OK'd by J.T.T. Time 850 AM ~~PM~~ Date 3/3 1955

Zero on sight glass = 27.9 cm.

SUMMARY OF CRITICAL CONDITIONS

Expr. A-5 Reactor 9.0" Dia Sphere

Solution UO_2F_2 Height 8.5" Volume 6.400 l. Temp 23°C

Reflector H_2O Height Full Temp 23°C

Time Critical 855 AM ~~PM~~ Duration 15 min. Log N ~.02

Anal. Req. 354707 gms U/gm .38789 Sp. Gr. 1.79495

Critical Mass 4.154 Atomic Ratio 35.8

Expr. B-2 Time 945 AM ~~PM~~ Date 3/3 1955

Purpose Obtain critical point in 10.4" Sphere ;
Full H_2O Reflector ; $H/U^{235} \sim 35$

Personnel: Gilley, Fox + Thomas

START-UP CHECK LIST

Equipment Checked by J.T.T. Personnel Check by J.T.T.

Instrument and Safeties Checked and Reset by J.T.T.

Source In" Checked by J.T.T. Source No. PN-15

Emergency Equipment in Control Room Checked by J.T.T.

Red Light On by J.T.T.

Start Up OK'd by J.T.T. Time 930 AM ~~PM~~ Date 3/3 1955

Zero on sight Glass = 27.9 cm.

just critical : S.G. = 45.6 - 27.9 = 17.7 cm.

SUMMARY OF CRITICAL CONDITIONS

Expr. B-2 Reactor 10.4" Dia Sphere

Solution UO_2F_2 Height 6.88" Volume 7.410 ℓ Temp. 23°C

Reflector H_2O Height Full Temp. 23°C

Time Critical 10^{13} AM ~~PM~~ Duration 10 min. Log N <.01

Anal. Req. 354707 gms U/gm .38799 Sp. Gr. 1.79495

Critical Mass 4.810 Kg U^{235} Atomic Ratio 35.8

Expr. C-4 Time 1100 AM ~~PM~~ Date 3/3 1955
Purpose Check Critical point in 11.0" Sphere
Full H2O Reflector; H/U235 ~35
Personnel: Gilley, Fox & Thomas

START-UP CHECK LIST

Equipment Checked by J.T.T. Personnel Check by J.T.T.
Instrument and Safeties Checked and Reset by J.T.T.
"Source In" Checked by J.T.T. Source No. PN-15
Emergency Equipment in Control Room Checked by J.T.T.
~~Red Light~~ On by J.T.T.
Start-Up OK'd by J.T.T. Time 1105 AM ~~PM~~ Date 3/3 1955

Zero on Sight Glass 27.5 cm.

Just critical: 5.6 = 44.2 - 27.5 = 16.7 / 16.3 cm.

SUMMARY OF CRITICAL CONDITIONS

Expr. C-4 Reactor 11.0" Dia. Sphere
Solution UO_2F_2 Height 6.56 / ~~6.46~~" Volume ~~7.10~~ 7.05 l. Temp 23°C
Reflector ~~Ext~~ H_2O Height Full Temp 23°C
Time Critical 1115 AM ~~PM~~ Duration 15 min. Log N < .02
Anal. Req. 354707 gms U / gm .38799 Sp. Gr. 1.79495
Critical Mass ~~5.209~~ 5.225 Kg U^{235} Atomic Ratio 35.8

Expr. C-5 Time 12⁰⁰ ~~AM~~ PM Date 3/3 1955

Purpose Obtain critical point for 11.0" Dia Sphere Unreflected H/U235 ~ 35

Personnel: Tilley, Fox & Thomas

START-UP CHECK LIST

Equipment Checked by J.T.T. Personnel Check by J.T.T.

Instrument and Safeties Checked and Reset by J.T.T.

"Source In" Checked by J.T.T. Source No. PN-15

Emergency Equipment in Control Room Checked by J.T.T.

Red Light On by J.T.T.

Start-Up OK'd by J.T.T. Time 12⁰⁵ ~~AM~~ PM Date 3/3 1955

MULTIPLICATION

Expr. C-5 Time 12³⁰ ~~AM~~ PM Date 3/3 1955

Settings

Scalar	H. V.	Disc.	C (2) min.
C(4)	1950	45	16¹³
C(5)	1980	45	23⁰
C( )			

Temperature Time	Refl.	Sol'n	Refl. Vol	Sol'n	C( )	$M_{(\ )}^{-1}$	C(4)	$M_{(4)}^{-1}$	C(5)	$M_{(5)}^{-1}$
				11.45l			29⁹	.656	35¹⁴	.64
				12.25			26¹⁵	.616	42⁷	.546
				12.92			29⁵	.58	47⁰	0.49

Not able to extrapolate: Multiplication ~2

Expr. D-17.3 Time 11:30 AM Date 3/7 1955

Purpose β determination in UO_2F_2 solution

H/U^{235} ~ 35

Personnel: Gilley + Thomas

INSTRUMENT CHECK

Date 3/7 1955 Time 11:30 AM Source No. RA-4-80

Trip

Instrument	Value	Scale	Source Distance	Start-Up Scale
DC-1	No			
DC-2	Yes	8.0	10/10	4"	10/1
DC-3	Yes	9.5	100/1	4"	10/1
Log N	yes	Sec		4"	—
R-1	yes	1.0	1000/1000	4"	100/1000
R-2	No				
P. M.	yes	Response check		9"	—
Brush		off R-1.			

START-UP CHECK LIST

Equipment Checked by J.T.T. Personnel Check by J.T.T.

Instrument and Safeties Checked and Reset by J.T.T.

"Source In" Checked by J.T.T. Source No. PN-15 - PN 58

Emergency Equipment in Control Room Checked by J.T.T.

Red Light On by J.T.T.

Start-Up Signal by J.T.T. Time 11:30 AM Date 3/7 1955

S.G. = 54.0 cm

Manifold = 48.42

		Source in Empty Sphere		Source + Solution in Sphere		
		C_4	C_5	C_4	C_5	
Scale 64	S_1	$3^{12}, 2^{62}, 2^{50}, 3^{11}$	$4^{38}, 4^{43}, 4^{46}, 4^{31}$	S_4: $22^8, 20^{12}$	$67^{18}, 64^{61}$	67^{61}
			4^{39}	S_{12}: $21^{15}, 23^3$	$68^{46}, 67^{54}$	
	S_2	$7^{53}, 7^{58}, 7^{11}$	$15^{58}, 15^{34}, 16^{30}$	S_{21} $9^{32}, 8^{69}$	$62^{143}, 62^{120}$	62^{55}
			15^{62}	S_{22} $9^{115}, 8^{241}$	$61^{184}, 62^{29}$	
				256 Scale		

Bkgd no source in room $C_4 = 0^2$: $C_5 = 0^{15}$

Expr. D-17.4 Time 10:50 AM Date 3/8 1955

Purpose β determinations

Personnel: Gilley + Thomas

INSTRUMENT CHECK

Date 3/8 1955 Time 10:50 AM Source No. RA 4.80

Instrument	Trip Value	Scale	Source Distance	Start-Up Scale
DC-1	No			
DC-2	Yes	9.0	100/10	4" 50/1
DC-3	Yes	8.5	100/1	4" 10/1
Log N	Yes	5 sec.		4" —
R-1	Yes	1.0	1000/1000	4" #5/1000
R-2	No			
P. M.	Yes	Trip Check only		4" —
Brush on R-1				—

START-UP CHECK LIST

Equipment Checked by J.T.T. Personnel Check by J.T.T.

Instrument and Safeties Checked and Reset by J.T.T.

Source In" Checked by J.T.T. Source No. PN-15

Emergency Equipment in Control Room Checked by J.T.T.

Red Light On by J.T.T.

Start-Up OK'd by J.T.T. Time 10:55 AM Date 3/8 1955

		C_4	C_5
	Background on counters (~~No Source~~)		
	No Source	0^2	0^{15}
64 Scale	S_1 Source in Bare Sphere (10 min count)	151 c/2 min.	304 c/2 min.
64 Scale	S_1 Source in Sphere + H_2O (10 min count)	127.6 c/2 min.	140.2 c/2 min.
64 Scale	S_2 Source in Bare Sphere (10 min count)	388 c/2 min.	1021 c/2 min.
64 Scale	S_2 Source in Sphere + H_2O (10 min count)	318 c/2 min.	471 c/2 min.
64 Scale	S_{11} and S_{12} ave c/2 min	1141 c/2 min.	6544 c/2 min.
256 Scale	S_{21}	$5^{204}\,6^{112}$	$86^{33}\,87^{75}$ } 22,247 c/2 min.
256 Scale	S_{22}	6^{124}	88^{25} }

Correction factor for past β exp. $\left.\frac{C(H_2O)}{C(Bare)}\right|_{S_1} = .461$ $\left.\frac{C(H_2O)}{C(Bare)}\right|_{S_2} = .461$

Expr. D-17.5 Time 11 AM PM Date 3/9 1955

Purpose Excess Core Tank vs 12.6" Dia Sphere with reflector

Personnel: Tuck & Thomas

INSTRUMENT CHECK

Date 3/9 1955 Time 11 AM PM Source No. RA4-80

Instrument	Trip Value	Scale	Source Distance	Start-Up Scale
DC-1	No			
DC-2	Yes	90	10/10	4"	10/1
DC-3	Yes	95	100/1	4"	10/1
Log N	Yes	Safe		4"	—
R-1	Yes	1.0	1000/1000	4"	25/1000
R-2	Yes		—		—
P. M.	Yes	Response Check		2"	—

32 —
1"
30 —
1"
29 —
1"
28 — " Top
3/4
27 — "
3/4
26 —
1"
25 —
1"
24 — "
3/4
23 — "
3/4
21 — " Top of Safe
3/4 " 6"
20 — "
3/4
19 —
1"
18 —
1"
11 —
1"
9 —
1"
8 —
1" Bottom
6

START-UP CHECK LIST

Equipment Checked by J.T.T. Personnel Check by J.T.T.

Instrument and Safeties Checked and Reset by J.T.T.

"Source In" Checked by J.K.E. Source No. PN-15

Emergency Equipment in Control Room Checked by J.T.T.

Red Light On by J.T.T.

Start-Up OK'd by J.T.T. Time 1102 AM PM Date 3/9 1955

just critical S.C. = 46.2 cm - 30.7 = 15.5 cm

SUMMARY OF CRITICAL CONDITIONS

Expr. D-17.5 Reactor 12.6" Dia Sphere

Solution UO_2F_2 Height 6.1 Volume 8.425 l Temp 21°C

Reflector H_2O Weight Full Temp 22°C

Monitor F-1

Time Critical 1140 AM PM Duration 20 min. Log N < 1.0

Anal. Req. 554707 gms U/gm .38799 Sp. Gr. 1.79495

Critical Mass 5.793 Kg U^{235} Atomic Ratio 35.8

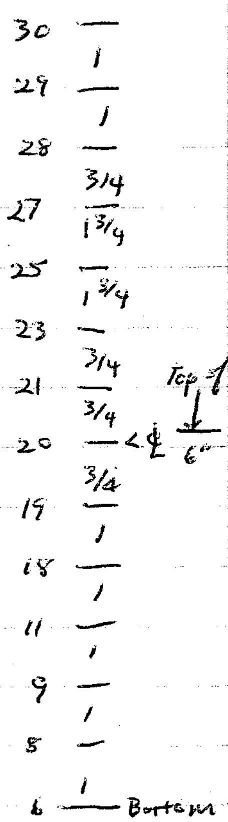
Expr. D-17.6 Time 9:45 AM Date 3/10 1955
Purpose Expose Cd-Covered In in 12.6" Sphere

Personnel: Gilley, Fox, + Thomas

INSTRUMENT CHECK

Date 3/10 1955 Time 9:45 AM Source No. RA 4.80

Instrument		Trip Value	Scale	Source Distance	Start-Up Scale
DC-1	No				
DC-2	Yes	90	10/10	4"	10/1
DC-3	Yes	9.5	100/1	4"	10/1
Log N	Yes	5 sec		4"	
R-1	Yes	1.0	1000/1000	4"	25/10000
R-2	No				
P. M.	Yes	Trip checks		1/2"	—



START-UP CHECK LIST

Equipment Checked by J.T.T. Personnel Check by J.T.T.
Instrument and Safeties Checked and Reset by J.T.T.
"Source In" Checked by J.T.T. Source No. PN-15
Emergency Equipment in Control Room Checked by J.T.T.
Red Light On by J.T.T.
Start-Up OK'd by J.T.T. Time 10 AM Date 3/10 1955

S.C. at Critical 46.2 cm − 30.7 = 15.5 cm.

Monitor F-1
F-3 + F-4
Calibration

SUMMARY OF CRITICAL CONDITIONS

Expr. D-17.6 Reactor 12.6" Dia Sphere
Solution UO_2F_2 Height 610cc Volume 5.725 l Temp 18.5°C
Reflector H_2O Height Full Temp 18.5°C
Time Critical 10:20 AM Duration 25 min. Log N < 6.2
Anal. Req. 354702 gms U/gm .38799 Sp. Gr. 1.79495
Critical Mass 5.793 Kg U^{235} Atomic Ratio 35.8

Expr. D-17.7 Time 8:53 AM ~~PM~~ Date 3/11 1955

Purpose Obtain fission distribution in 12" Sphere UO_2F_2 w H/x = 35

Personnel: Gilley Fox & Thomas

1
6
2
3
6
1
5
3
9
13
10
7
11
7
13 1
15
17
8
18 Bottom

INSTRUMENT CHECK

Date 3/11 1955 Time 8:55 AM ~~PM~~ Source No. RA 4.80

Instrument	Trip Value	Scale	Source Distance	Start-Up Scale
DC-1 No				
DC-2 yes	9.0	10/10	4"	10/1
DC-3 yes	9.5	10/10	4"	10/1
Log N yes	5 sec			
R-1 yes	6.0	1000/1000	4"	25/1000
R-2 No	—			
P. M. yes	tape			

START-UP CHECK LIST

Equipment Checked by J.T.T. Personnel Check by J.T.T.

Instrument and Safeties Checked and Reset by J.T.T.

Source Inst'l Checked by J.T.T. Source No. PW-15

Emergency Equipment in Control Room Checked by J.T.T.

Red Light On by J.T.T.

Start-Up OK'd by J.T.T. Time 9:00 AM ~~PM~~ Date 3/10 1955

S.C. at Critical 86.2 cm = 5.5 cm soln.

SUMMARY OF CRITICAL CONDITIONS

Expr. D-17.7 Reactor 12" sphere

Solution UO_2F_2 Height 6.1" Volume 5.925 ℓ Temp 19°C

Reflector H_2O Height Full Temp 19°C

Time Critical 9:35 AM ~~PM~~ Duration 20 min. Log N 23.0

Anal. Req. 35.702 gms U/gm 38.799 Sp. Gr. 1.79495

Critical Mass 5.793 Kg U^{235} Atomic Ratio 35.8

Monitor F-4
F-1 + F-3
Calibration

Expr. D-17.8 Time 9:25 AM Date 3/14 1955

Purpose Covered Fuel cups in 12.6" D. Sphere water reflector

Personnel: Gilley Y Thomas

I
6-Bare
2
3
6
5
3
9
13
10
7
11
7
13-Bare
15
17
8
18 Bottom of Sphere

Monitor F-4

INSTRUMENT CHECK

Date 3/14 1955 Time 9:50 AM Source No. RA-450

Instrument	Trip Value	Scale	Source Distance	Start-Up Scale
DC-1	No			
DC-2	Yes	4.0	10/10	6"	10/1
DC-3	Yes	6	100K/1	4"	10/1
Log N	Yes	Stable		4"	
R-1	Yes	4.0	100%/sec	4"	25/1000
R-2	No				
P. M.	Yes	Trip check.		4½"	

START-UP CHECK LIST

Equipment Checked by J.T.T. Personnel Check by J.T.T.

Instrument and Safety Interlocks Checked by J.T.T.

"Source In" Checked by J.T.T. Source No. PN-75

Emergency Equipment in Control Room Checked by J.T.T.

Red Light On by J.T. Start-Up OK'd by J.T.T. Time 9:50 AM Date 3/14 1955

Critical S.G. = 46.15 - 30.7 = 15.45 cm.

SUMMARY OF CRITICAL CONDITIONS

Expr. D-17.8 Reactor 12.6" D Sphere

Solution UO_2F_2 Height 6.085 Volume 5.890 l. Temp 20°C

Reflector H_2O Height Full Temp 20°C

Time Critical 10:25 AM Duration 20 min. Log N < 4.5

Anal. Req. 354707 gms U / gm 38798 Sp. Gr. 1.79445

Critical Mass 5.770 Kg U^{235} Atomic Ratio 35.8

Expr. E-1 Time 1:15 PM Date 3/15 1955

Purpose B determination in 27" Sphere
Water reflector

Personnel: Fox, Gilley & Thomas

INSTRUMENT CHECK

Date 3/15 1955 Time 1:15 PM Source No. RA 48

Instrument	Trip Value	Scale	Source Distance	Start-Up Scale
DC-1	No			
DC-2	Yes	4.0	10/10	4"	10/1
DC-3	Yes	4.5	100/1	4"	10/1
Log N	Yes	Scale	100/1000	4"	50/1000
R-1	Yes	1.0			
R-2	No				
P. M.	Yes	Tape ok.		11/2"	
	Brush	on R-1			

START-UP CHECK LIST

Equipment Checked by J.T.T. Personnel Check by J.T.T.
Instrument and Source Locked and Closed by J.T.T.
"Source In" Checked by J.T.T. Source No. PM-15
Emergency Equipment in Control Room Checked by J.T.T.
Red Light On by J.T.T.
Start-Up OK'd by J.T.T. Time 1:20 PM Date 3/15 1955

Unable to take data; instrument response to source when withdrawn from reflector water obscures reactor response. Necessary to "hide" source from instrument if experiment is to be done with a reflected system. Otherwise one can conclude that the experiment is better done with an unreflected reactor.

Expr. D-18.1 Time 10 AM PM Date 3/16 1955

Purpose Obtain critical pt in 12.6" Sphere with water reflector $G_{U^{235}} = 42$

Personnel: Fox & Thomas

INSTRUMENT CHECK

Date 3/16 1955 Time 10 AM Source No. RA 4.80

Instrument	Trip	Value	Scale	Source Distance	Start-Up Scale
DC-1	No				
DC-2	Yes	4.0	10/10	4"	10/1
DC-3	Yes	4.5	10/1	4"	10/1
Log N	Yes	Safe		4"	
R-1	Yes	1.0	100/100	4"	25/100
R-2	No	—			
P. M.	Yes	Tripod.		1/2"	

START-UP CHECK LIST

Equipment Checked by T.T.T. Personnel Check by T.T.T.

Instrument and Safeties Checked and Reset by T.T.T.

"Source In" Checked by T.T.T. Source No. PM-15

Emergency Equipment in Control Room Checked by T.T.T.

Red Light On by T.T.T.

Start-Up OK'd by T.T.T. Time 10 AM PM Date 3/16 1955

Zero on Sight glass = 30.7 cm.

Critical at 46.25 - 30.7 = 15.55 cm.

SUMMARY OF CRITICAL CONDITIONS

Expr. D-18.1 Reactor 12.6" Sphere

Solution UO_2F_2 Height 6.12" Volume 8.98 l. Temp 21°C

Reflector H_2O Depth Full Temp 21°C

Time Critical 1030 Buckling 10 Coin. Log N 4.61

Anal. Rep. 354.09 gms U/l 357.99 Sp. Gr. 1.7222

Critical Mass 5.077 Kg U^{235} Atomic Ratio 41.4

$(.35799)(932)(1.70) =$

$= 0.56721$ gms $\frac{U^{235}}{cc}$

Expr. D-18.2 Time 1035 AM PM Date 3/16 1955
Purpose Obtain critical pt in 12.6" Sphere
unreflected 4.1235 242
Personnel: Fox + Thomas

START-UP CHECK LIST

Equipment Checked by J.T.T. Personnel Check by J.T.T.
Instrument and Safeties Checked and Reset by J.T.T.
"Source In" Checked by J.T.T. Source No. PN-15
Emergency Equipment in Control Room Checked by J.T.T.
Red Light On by J.T.T.
Start-Up OK'd by J.T.T. Time 1035 AM PM Date 3/16 1955

Critical at 55.5 - 30.7 = 24.8

SUMMARY OF CRITICAL CONDITIONS

Expr. D-18.2 Reactor 12.6" Sphere
Solution UO_2F_2 Height 9.77" Volume 15.610 Temp 21°C
Reflector ~~H2O~~ AIR Height None Temp *
Time Critical 1135 AM PM Duration 10 min. Log N < .02
Anal. Req. 354709 gms U/gm .35799 Sp. Gr. 1.7000
Critical Mass 8.854 Kg U^{235} Atomic Ratio 41.9

Expr. C-6 Time 1 ~~AM~~ PM Date 3/16 1955
Purpose Obtain critical pT in 11" Sphere
unreflected
Personnel: Kelley & Thomas

START-UP CHECK LIST
Equipment Checked by J.T.T. Personnel Check by J.T.T.
Instrument and Safeties Checked and Reset by J.T.T.
"Source In" Checked by J.T.T. Source No. PN-15
Emergency Equipment in Control Room Checked by J.T.T.
Red Light On by J.T.T.
Start-Up OK'd by J.T.T. Time 1 ~~AM~~ PM Date 3/16 1955

- S.G. 28.4 cm (zero)

Full but not critical! $M^{-1} \sim .43$

Expr. C-7 Time 3:30 ~~AM~~ PM Date 3/16 1955
Purpose Obtain critical pt in 11" sphere with H_2O reflector: 41.9 - 42
Personnel: Tilley & Thomas

START-UP CHECK LIST

Equipment Checked by J.T.T. Personnel Check by J.T.T.
Instrument and Safety Checked and Reset by J.T.T.
"Source In" Checked by J.T.T. Source No. PN-15
Emergency Equipment in Control Room Checked by J.T.T.
Red Light On by J.T.T.
Start-Up OK'd by J.T.T. Time 3:30 ~~AM~~ PM Date 3/16 1955

Critical pt 41.9 - 25.4 = 16.5 cm.

SUMMARY OF CRITICAL CONDITIONS

Expr. C-7 Reactor 11" sphere
Solution UO_2F_2 Height 6.50" Volume 7.90 L Temp 22°C
Reflector H_2O Height Full Temp 22°C
Time Critical 3:45 ~~AM~~ PM Duration 10 min. Log N <.02
Anal. Req. 354709 gms U/gm .35799 Sp. Gr. 1.7000
Critical Mass 41.81 Atomic Ratio 41.9

Expr. A-6 Time 855 AM ~~PM~~ Date 3/17 1955

Purpose Obtain critical point in 9" sphere with H_2O reflector. $H/u \approx 32$

Personnel: Fox, Gilley & Thomas

INSTRUMENT CHECK

Date 3/17 1955 Time 855 AM ~~PM~~ Source No. RA-4.80

Instrument	Trip Value	Scale	Source Distance	Start-Up Scale
DC-1	N/O			
DC-2	Yes	9.0	10/10	4" 10/1
DC-3	Yes	9.5	10/1	4" 10/1
Log N	Yes	Safe	—	4" —
R-1	Yes	1.0	300/1000	4" 50/100
R-2	No			
P. M.	Yes	Trip check		

START-UP CHECK LIST

Equipment Checked by J. T. T. Personnel Check by J. T. T.

Instrument and Safeties Checked and Reset by J. T. T.

"Source In" Checked by J. T. T. Source No. PM-5

Emergency Equipment in Control Room Checked by J. T. T.

Red Light On by J. T. T.

Start-Up OK'd by J. T. T. Time 855 AM ~~PM~~ Date 3/17 1955

Zero on S.C. = 28.6

Critical Height = 49.2 - 28.6 = 20.6 cm.

SUMMARY OF CRITICAL CONDITIONS

Expr. A-6 Reactor 9" Sphere

Solution UO_2F_2 Height 8.11" Volume 6.34 l Temp 21°C

Reflector H_2O Height Full Temp 21°C

Time Critical 925 AM ~~PM~~ Duration 10 min. Log N < .1

Anal. Req. 35.4709 gms U/gm 35.799 Sp. Gr. 1.7000

Critical Mass 3596 $Kg\ U^{235}$ Atomic Ratio 41.9

Expr. D-18.3 Time 10:45 AM PM Date 3/17 1955
Purpose Expose UO_2F_2 cups in 12 6" Sphere; H_2O reflector; H/U235 ~ 42
Personnel: Willey & Thomas

START-UP CHECK LIST
Equipment Checked by J.T.T. Personnel Check by J.T.T.
Instrument and Safeties Checked and Reset by J.T.T.
"Source In" Checked by J.T.T. Source No. PN-15
Emergency Equipment in Control Room Checked by J.T.T.
Red Light On by J.T.T.
Start-Up OK'd by J.T.T. Time 10:45 AM PM Date 3/17 1955

Critical is S.G. = 46.8 cm − 31.0 = 15.8 cm.

8.875
18 8.625
3
7.625
17 7.375
1
2
6.375
13 6.125
11 5.875
10 5.625 Center of Sphere
7
5.125
9 4.875
13
4.375
5 4.125
15
3.625
3 3.375
6
2.875
1 2.625
8
2.125
2 1/8"
Bottom

Monitor F-4

SUMMARY OF CRITICAL CONDITIONS
Expr. D-18.3 Reactor 12 6" Sphere
Solution UO_2F_2 Height 6.22" Volume 9.17 l Temp 21°C
Reflector H_2O Height Full Temp 21°C
Time Critical 11:00 AM PM Duration 20 min. Log N < 4.0
Anal. Req. .354709 gms U/gm .35499 Sp. Gr. 1.7000
Critical Mass 5.201 Kg U^{235} Atomic Ratio 41.9

Expr. E-2 Time 10:32 AM ~~PM~~ Date 3/21 1955

Purpose determination in 5% soln 27" sphere in well.

Personnel: Gilley & Thomas

INSTRUMENT CHECK

Date 3/21 1955 Time 10:30 AM ~~PM~~ Source No. RA-1-80

Instrument	Trip Value	Scale	Source Distance	Start-Up Scale
DC-1	No			
DC-2	yes	9.0	10/10	4"	10/1
DC-3	yes	9.5	100/1	4"	10/1
Log N	yes	5 sec	—	4"	—
R-1	Yes	1.0	100/1000	4"	50/1000
R-2	No				
P. M.	yes	Trip check			650 V.
		Brush on R-1			

START-UP CHECK LIST

Equipment Checked by J.T.T. Personnel Check by J.T.T.

Instrument and Safeties Checked and Reset by J.T.T.

"Source In" Checked by J.T.T. Source No. PN-15

Emergency Equipment in Control Room Checked by J.T.T.

Red Light On by J.T.T.

Start-Up OK'd by J.T.T. Time 10:30 AM ~~PM~~ Date 3/21 1955

Water temp. 76°F; Soln Temp 74°F

Background Scale 256; Water reflector only, I^{75} = 331 ½ min.

Count Source + Solution at -61.0 cm 50^{28} = 1358 ½ min.

Expr. 12-18.4 Time 1:50 AM PM Date 3/22 1955
Purpose Cd covered UO_2F_2 Capsules in 12.6" Sphere with H_2O reflector
$H/U^{235} = 42$
Personnel: Gilley & Thomas

18
1
3
17

INSTRUMENT CHECK

Date 3/22 1955 Time 1:53 AM PM Source No. PA 4.80

Instrument	On	Trip Value	Scale	Source Distance	Start-Up Scale
DC-1	No				
DC-2	Yes	9.0	10/10	4"	10/1
DC-3	Yes	9.1	10/1	4"	10/1
Log N	Yes	Scram		4"	
R-1	Yes	1.0	100/1000	4"	25/1000
R-2	No				
P. M.	Yes	Trip check			6800 V.

2
13
11 – Bare
10
7
9
13
5
15
3
6
1
8
1

START-UP CHECK LIST

Equipment Checked by J.T.T. Personnel Check by J.T.T.
Instrument and Safeties Checked and Reset by J.T.T.
Source In? Checked by J.T.T. Source No. PM-15
Emergency Equipment in Control Room Checked by J.T.T.
Red Light On by J.T.T.
Start-Up OK'd by J.T.T. Time 1:57 AM PM Date 3/22 1955

Critical height = 46.8 cm. − 31.0 = 15.8

$2\frac{6}{8}$"

Bottom

Monitor = F-4

Start watch at 2:57 PM

SUMMARY OF CRITICAL CONDITIONS

Expr. 12-18.4 Reactor 12.6" Sphere
Solution UO_2F_2 Height 6.22 Volume 9.17 l Temp. 18°C
Reflector H_2O Height Full Temp. 18°C
Time Critical 2:35 AM PM Duration 20 min. Log N < 4.0
Anal. Req. 354709 gms U/gm 35799 Sp. Gr. 1.7000
Critical Mass 5.201 Kg U^{235} Atomic Ratio 41.9

Expr. D-18.5 Time 10 30 AM PM Date 3/23 1955

Purpose Ice traverse in 12.6" Sphere

H_2O Reflector 11/8235 - 42

Personnel: Colby & Thomas

INSTRUMENT CHECK

Date 3/23 1955 Time 10 30 AM PM Source No. RA 480

Instrument	Trip Value	Scale	Source Distance	Start-Up Scale
DC-1	NO			
DC-2	Yes	9.0	14/1.0	4"	1011
DC-3	Yes	9.5	10#1	4"	1011
Log N	Yes	Sec.		4"	
R-1	Yes	1.0	100%000	4"	25/100
R-2	NO			
P. M.	Yes	Trip Check		4½"	680 V.

START-UP CHECK LIST

Equipment Checked by J.T.T. Personnel Check by J.T.T.

Instrument and Safeties Checked and Reset by J.T.T.

"Source In" Checked by J.T.T. Source No. PM-1-5

Emergency Equipment in Control Room Checked by J.T.T.

Red Light On by J.T.T.

Start-Up OK'd by J.T.T. Time 10 35 AM PM Date 3/23 1955

Critical Height = 46.7 - 31.0 = 15.7 cm.

Start Watch at 11:20.5 AM

SUMMARY OF CRITICAL CONDITIONS

Expr. D-18.5 Reactor 12.6" Sphere

Solution UO_2F_2 Height 6.18" Volume 9.18 l Temp 17°C

Reflector H_2O Height Full Temp 17°C

Time Critical 10 52 AM PM Duration 20 min. Log N 1.0

Anal. Req. 354709 gms U/gm .35799 Sp. Gr. 1.7000

Critical Mass 5.161 Kg U^{235} Atomic Ratio 41.9

34 —
33 — ½
32 — ½
30 — ½
29 — ½
28 — ½
27 — 1
26 — 2
24 — 1⅛
23 — ⅜
21 — 7/16
20 — 5/16
19 — ½
18 — ¾
17 — 1
15 — ½
14 — ½
11 — ½
9 — ¾
8 — ⅜
7 — ⅜
6 — ¾ Bottom of Sphere

Monitors B-1
F-1

Expr. D-18.6 Time 11:15 AM PM Date 3/24 1955
Purpose Cd covered In Traverse in 12.6" Sphere
H_2O reflector H/U235 = 42
Personnel: Ailey & Thomas

INSTRUMENT CHECK

Date 3/24 1955 Time 11:15 AM PM Source No. 12A 480

Instrument	Trip Valve	Scale	Source Distance	Start-Up Scale
DC-1	No			
DC-2	Yes	9.0	10/10 4"	10/1
DC-3	Yes	9.5	100/1 4"	10/1
Log N	Yes	5 amp		
R-1	Yes	1.0	100/1000 4"	25/100
R-2	No			
P. M.	Yes	Trip check	½"	680 V.

START-UP CHECK LIST

Equipment Checked by J.T.T. Personnel Check by J.T.T
Instrument and Safeties Checked and Reset by J.T.T
"Source In" Checked by J.T.T. Source No. PN-15
Emergency Equipment in Control Room Checked by J.T.
Red Light On by J.T.T.
Start-Up OK'd by J.T.T. Time 1145 AM PM Date 3/24 1955

Critical height 47.0 - 31.0 = 16.0 cm.

34 — 1
33 — 1
32 — 1
28 — 1
27 — 2
23 — 1
21 — ½
20 — ½ — 6"
19 — ½
18 — ¾
17 — ¾
15 — ¾
14 — ½
10 — ¾
9 — 1
7 — ¾
¼ Bottom

Monitors B-1
F-1

SUMMARY OF CRITICAL CONDITIONS

Expr. D-18.6 Reactor 12.6" Sphere
Solution UO_2F_2 Height 5.20" Volume 9.37 l. Temp 18°C
Reflector H_2O Height Full Temp 18°C
Time Critical 1150 AM PM Duration 20 min. Log N 1.0
Anal. Req. 354709 gms U/gm .35799 Sp. Gr. 1.7000
Critical Mass 5.315 kg U^{235} Atomic Ratio 41.9

Expr. D-18.7 Time 830 AM ~~PM~~ Date 3/25 1955

Purpose Repeat UO_2F_2 capacities in 12.6" Sphere at H/U=42 Especially with reflector

Personnel: Fox & Thomas

INSTRUMENT CHECK

Date 3/25 1955 Time 830 AM ~~PM~~ Source No. RA-480

Instrument	Trip Value	Scale	Source Distance	Start-Up Scale
DC-1	No			
DC-2	Yes	9.0	10/10	4"	10/1
DC-3	Yes	9.5	100/1	4"	10/1
Log N	Yes	5 sec			
R-1	Yes	1.0	1000/1000	4"	25/100
R-2	No				
P. M.	Yes	Trip check	12"	680V.

START-UP CHECK LIST

Equipment Checked by T.T.T. Personnel Check by T.T.T.

Instrument and Safeties Checked and Reset by T.T.T.

"Source In" Checked by T.T.T. Source No. PM-15

Emergency Equipment in Control Room Checked by T.T.T.

Red Light On by T.T.T.

Start-Up OK'd by T.T.T. Time 839 AM ~~PM~~ Date 3/25 1955

Critical Height 46.8 cm - 31.0 = 15.8 cm

Start Watch 952 AM

Bottom Monitor F-4 and B-1

SUMMARY OF CRITICAL CONDITIONS

Expr. D-18.7 Reactor 12.6" Sphere

Solution UO_2F_2 Height 1.22' Volume 9.17 l. Temp 21°C

Reflector H_2O Height Full Temp 24°C

Time Critical 932 AM ~~PM~~ Duration 20 min. Log N 3.0

Anal. Req. 354709 gms U/gm .35799 Sp. Gr. 1.7000

Critical Mass 5.201 Kg U^{235} Atomic Ratio 41.9

Expr. D-18.8 Time 10[15] AM ~~PM~~ Date 3/29 1955
Purpose β determination in 12.6" Spheres
H₂O ~ 42
Personnel: Ottley & Thomas

INSTRUMENT CHECK

Date 3/29 1955 Time 1015 AM ~~PM~~ Source No. RA-482

Instrument	Yes/No	Trip Value	Scale	Source Distance	Start-Up Scale
DC-1	No				
DC-2	Yes	9.0	1000/1	4"	10/1
DC-3	Yes	9.5	100/1	4"	10/1
Log N	Yes	Saec	—	4"	—
R-1	Yes	1.0	1000/1000	4"	25/100
R-2	No				
P. M.	Yes	Trip check			680 V.
	Issued on R-1				

START-UP CHECK LIST

Equipment Checked by J.T.T. Personnel Check by J.T.T.
Instrument and Source Supplied and Tested by J.T.T.
"Source In" Checked by J.T.T. Source No. PN 15+58
Emergency Light Switch in Control Room Checked by J.T.T.
~~Red Light~~ On by J.T.T.
Start-Up OK'd by J.T.T. Time 1015 AM ~~PM~~ Date 3/29 1955

S.C. = 55.1 cm
Temp 22°C

		C_4	C_5	
Background				
	S_{10}	$7^{18}, 7^{4}, 6^{57}$	$5^{23}\ 5^{18}\ 5^{-4}$	
	S_{20}	$24^{28}, 25^{27}, 25^{32}$	$14^{42}, 14^{45}, 15^{18}$	
64 Scale	Soln + Source			
	S_{11}	$192^{20}, 195^{59}, 193^{20}$	$106^{22}\ 107^{42}\ 104^{48}$	R-1 = .8 × 100, Att = .01
	S_{12}	$195^{21}\ 196^{52}$	$102^{56}\ 106^{35}$	
256 Scale	S_{21}	$168^{139}\ 170^{38}\ 170^{217}$	$91^{120}\ 93^{38}\ 92^{208}$	R-1 = .24 × 1000, Att = .01
	S_{22}	169^{44}	92^{82}	

Expr. D-19.1 Time 3:30 AM PM Date 3/30 1955

Purpose Check Critical pt. in 12.6" Sphere
Unreflected H/U235 ~45

Personnel: Gilley & Thomas

INSTRUMENT CHECK

Date 3/30 1955 Time 3:30 AM PM Source No. RA-480

Instrument	Trip	Value	Scale	Source Distance	Start-Up Scale
B	NO				
I	YES	9.0	10/10	4'	10/1
I &	YES	9.5	100/1	4"	10/1
Log N	YES	10sec		4'	
R-1	YES			4"	25/100
R-2	NO				
P. M.	YES	Trip check		1"	690V.

START-UP CHECK LIST

Equipment Checked by J.T.T. Personnel Check by J.T.T.
Instrument and Safeties Checked and Reset by J.T.T.
"Source In" Checked by J.T.T. Source No. PN-15
Emergency Equipment in Control Room Checked by J.T.T.
Red Light On by J.T.T.
Start-Up OK'd by J.T.T. Time 3:30 AM PM Date 3/30 1955

Critical height 55.8 - 31.2 = 24.6 cm.

SUMMARY OF CRITICAL CONDITIONS

Expr. D-19.1 Reactor 12.6" Sphere
Solution UO_2F_2 Height 9.69" Volume 15.650 Temp 22°C
Reflector NONE Height AIR Temp 22°C
Time Critical 4:15 AM PM Duration 15 min. Log N 2.02
Anal. Req. 35470 gms U / gm ~~2.4470~~ 34375 Sp. Gr. 2.6449
Critical Mass ~~7.302~~ 8.123 Kg U^{235} Atomic Ratio 45.8

(.34375)(.932)(2.6449) =
= 0.52239 gms U^{235}/cc.

Expr. D-19.2 Time 8:30 AM ~~PM~~ Date 3/31 1955
Purpose Obtain critical point in 12.6" Sphere
H_2O reflected 4/31 23.5 ~45
Personnel: Gilley & Thomas

INSTRUMENT CHECK

Date 3/31 1955 Time 8:30 AM ~~PM~~ Source No. RA-480

Instrument	Trip Value	Scale	Source Distance	Start-Up Scale
DC-1	No			
DC-2	yes	90	1/10	4"	10/1
DC-3	yes	9.5	100/1	4"	5/1
Log N	yes	10 amps		4"	~~50 cps~~
R-1	yes	60	1000/1022	4"	50 cps
R-2	No				
P. M.	yes	Trip check		2"	600 v.

START-UP CHECK LIST

Equipment Checked by J.T.T. Personnel Check by J.T.T.
Instrument and Safeties Checked and Reset by J.T.T.
"Source In" Checked by J.T.T. Source No. RA-75
Emergency Equipment in Control Room Checked by J.T.T.
Red Light On by J.T.T.
Start Up OK'd by J.T.T. Time 8:45 AM ~~PM~~ Date 3/31 1955

Critical height 46.6 - 31.2 = 15.4

SUMMARY OF CRITICAL CONDITIONS

Expr. D-19.2 Reactor 12.6" Sphere
Solution UO_2F_2 Height 6.06" Volume 8.82 l Temp 22°C
Reflector H_2O Height Full Temp 22°C
Time Critical 9:30 AM ~~PM~~ Duration 30 min. Log N .02
Anal. Req. 354710 gms U / gm .34075 Sp. Gr. 1.6449
Critical Mass 4.607 Kg U^{235} Atomic Ratio 45.8

Expr. C-8 Time 10:22 AM PM Date 3/31 1955
Purpose Obtain Critical point in 11" sphere
Unreflected
Personnel: Gilley + Thomas

START-UP CHECK LIST
Equipment Checked by J.T.T. Personnel Check by J.T.T.
Instrument and Safeties Checked and Reset by J.T.T.
"Source In" Checked by J.T.T. Source No. PN-15
Emergency Equipment in Control Room Checked by J.T.T.
Red Light On by J.T.T.
Start-Up OK'd by J.T.T. Time 10:30 AM PM Date 3/31 1955

Not Critical full.

Jesco at 28.4 cm on eight discs.

		C_4	C_5
Solution level 60.1 cm.		62"	39"
Background		29"	18"
	M-1	.418	.475

Expr. C-9 Time 11⁰⁵ AM ~~PM~~ Date 3/31 1955

Purpose Obtain critical point in 11.0" Sphere with H_2O Reflector H_2O 35 ~ 45

Personnel: Gillespie Thomas

START-UP CHECK LIST

Equipment Checked by J.T.T. Personnel Check by J.T.T.

Instrument and Safeties Checked and Reset by J.T.T.

"Source In" Checked by J.T.T. Source No. PN-1

Emergency Equipment in Control Room Checked by J.T.T

Red Light On by J.T.T.

Start-Up OK'd by J.T.T. Time 11⁰⁰ AM ~~PM~~ Date 3/31 1955

Sight Glass at Critical 44.7 - 28.4 = 16.3 cm

SUMMARY OF CRITICAL CONDITIONS

Expr. C-9 Reactor 11.0" Sphere

Solution UO_2F_2 Height 6.42" Volume 7.77 ℓ Temp 22°C

Reflector H_2O Height Full Temp 22°C

Time Critical 12⁵⁰ AM PM Duration 10 min. Log N .03

Anal. Req. 354.10 gms U / gm .34075 Sp. Gr. 1.6449

Critical Mass 4.059 Kg U^{235} Atomic Ratio 45.8

Expr. A-7 Time 1[0] ~~AM~~ PM Date 3/31 1965
Purpose Obtain critical point in 9.0" Sphere with H₂O Reflector 6/0235-45
Personnel: Colley + Thomas

START-UP CHECK LIST
Equipment Checked by J.T.T. Personnel Check by J.T.T.
Instrument and Safeties Checked and Reset by J.T.T.
"Source In" Checked by J.T.T. Source No. PN 15
Emergency Equipment in Control Room Checked by J.T.T.
Red Light On by J.T.T.
Start-Up OK'd by J.T.T. Time 1[0] ~~AM~~ PM Date 3/31 1965

Critical Height 48.9 cm - 28.5 = 20.4 cm.

SUMMARY OF CRITICAL CONDITIONS
Expr. A-7 Reactor 9.0" Sphere
Solution UO_2F_2 Height 8.03" Volume 6.32 l Temp 22°C
Reflector H_2O Height Full Temp 22°C
Time Critical 11[2]5 ~~AM~~ PM Duration 10 min. Log N .35
Anal. Req. 354710 gms U/gm .34075 Sp. Gr. 1.6449
Critical Mass 3.302 Kg U^{235} Atomic Ratio 45.8

Expr. F-1 Time 11:45 AM ~~PM~~ Date 4/19 1955

Purpose Axial Traverse in 6" Dia cylinder with H_2O Reflector Fuel ht = H_2O height

Base for foils

Personnel: Gilbert + Thomas

INSTRUMENT CHECK

Date 4/19 1955 Time 8:45 AM ~~PM~~ Source No. RA-480

Instrument	Trip Value	Scale	Source Distance	Start-Up Scale
DC-1	No			
DC-2	Yes	9.0	10/10	4"	10/1
DC-3	yes	9.5	100/1	4"	10/1
Log N	Yes	See	—	4"	
R-1	Yes	9.5	1000/1000	4"	1000/1000
R-2	No				
P. M.	Yes	Trip	check	12"	800 V.

START-UP CHECK LIST

Equipment Checked by J.T.T. Personnel Check by J.T.T.

Instrument and Safeties Checked and Reset by J.T.T.

"Source In" Checked by J.T.T. Source No. PN-58

Emergency Equipment in Control Room Checked by J.T.T.

Red Light On by J.T.T.

Start-Up OK'd by J.T.T. Time 11:00 AM ~~PM~~ Date 4/19 1955

Stop Watch Started 12:31 PM.

SUMMARY OF CRITICAL CONDITIONS

Expr. F-1 Reactor 6" cylinder

Solution UO_2F_2 Height ~~22.20~~ 22.20" Volume 13,530 Temp R.T

Reflector H_2O Height 10.71cm Temp R.T.

Time Critical 12 ~~AM~~ PM Duration 50 min. Log N 2.0

Anal. Req. 354712 gms U/gm .34765 Sp. Gr. 1.6630

Critical Mass 7.290 Kg 25 Atomic Ratio 44.2

0.53883 gms/cc

Monitor F-1

—33
2
—32
2
—28
2
—27
2
—23
2
—21
2
—20
2
—19
1
—18
1
—17
2
—15
2
—14
2
—11
2
—9
2
—7
1
— Bottom

Expr. F-2 Time 915 AM PM Date 4/20 1955
Purpose Radial Fn Traverse in 6" cylinder
13" from bottom.
Hgt Refl. Fuel ht = H2O Height
Personnel: Gilley & Thomas

INSTRUMENT CHECK

Date 4/20 1955 Time 915 AM PM Source No. RA-480

Instrument	Trip Value	Scale	Source Distance	Start-Up Scale
DC-1	No			
DC-2	Yes	9.0	10/10	4" 50/1
DC-3	Yes	9.5	100/1	4" 5/1
Log N	Yes	Sec		4"
R-1	Yes	1.0	100/1000	4" 100/1000
R-2	No			
P. M.	Yes	Trip Check		2" 600V

START-UP CHECK LIST

Equipment Checked by W.G. Personnel Check by W.G.
Instrument and Safeties Checked and Tested by J.T.T.
"Source In" Checked by J.T.T. Source No. PN-58
Emergency Equipment in Control Room Checked by J.T.T.
Red Light On by J.T.T.
Start-Up OK'd by J.T.T. Time 930 AM PM Date 4/20 1955

B-7 9 11 14 15 17 18 19 20 21 23 27 28
1/4 | 1/2 | 1/2 | 1 1/2 | 1/2 | 7/8 | 3/8 | 3/8 | 3/8 | 1/2 | 1/2 | 1/2 | 1/2 | 1/4

Monitor F-4

Start Wed 10.18 AM

SUMMARY OF CRITICAL CONDITIONS

Expr. F-2 Reactor 6" cylinder
Solution UO_2F_2 Height 29.07" Volume 13.470 ℓ Temp R.T.
Reflector H_2O Height 110" Temp R.T.
Time Critical 955 AM PM Duration 20 min. Log N .1
Accl. Req. 35471 gms U/gm 34765 Sp. Gr. 1.1130
Critical Mass 1.258 K_g^{25} Atomic Ratio 44.2

Expr. F-3 Time 9[10] AM PM Date 4/21 1955

Purpose Radial Cd covered - Fe Traverses in 6" cylinder; H_2O Reflector. Slab ht. = $\frac{1}{4}$ ht.

Personnel: Gallup + Thomas

INSTRUMENT CHECK

Date 4/21 1955 Time 9[10] AM ~~PM~~ Source No. RA 4.80

Instrument	Trip Value	Scale	Source Distance	Start-Up Scale
DC-1	Nb			
DC-2	Yes	9.0	10/10 4"	50/1
DC-3	Yes	9.5	10/1 4"	20/1
Log N	Yes	5 seconds	4"	
R-1	Yes	1.0	100/1000	500/1000
R-2	Nb			
P. M.	Yes	Tag check	2"	800 V

START-UP CHECK LIST

Equipment Checked by T.T.T. Personnel Check by T.T.T.

Instrument and Safeties Checked and Reset by T.T.T.

"Source In" Checked by T.T.T. Source No. PN-58

Emergency Equipment in Control Room Checked by T.T.T.

Red Light On by T.T.T.

Start-Up OK'd by T.T.T. Time 9[10] AM ~~PM~~ Date 4/21 1955

7 15 18 20 23 28

1/4 | 1 | 1 | 3/4 | 3/4 | 1 | 1 | 1/4

Monitor F-4

Start Watch 10[08] AM.

SUMMARY OF CRITICAL CONDITIONS

Expr. F-3 Reactor 6" cylinder

Solution UO_2F_2 Height 29.25 Volume 13.553 Temp R.T

Reflector H_2O Height — Temp R.T

Time Critical 9[45] AM PM Duration 20 min. Log N 0.1

Anal. Req. 35.4712 gms U/gm .34765 Sp. Gr. 1.6630

Critical Mass 7.303 Kg 25 Atomic Ratio 44.2

$N_{U^{235}}$		γ^{u}/gm	ρ/ρ_0	
297.5	354902	.083906	1.1076	25°C
296.3	903	.084216	1.1096	"
49.47	904	.326445	1.6053	"
49.44	905	.326571	1.6011	"
1114.69	906	.024341	1.0503	"
1108.09	907	.024476	1.0504	"
1386.51	908	.019693	1.0444	"
1398.17	909	.019530	1.0449	"

5000 ppm iron

265 Ni

Anal. req. ____ Critical Mass 7.363 Kg 25 Atomic Ratio 44.2

Expr. A-8 Time 10[illegible] AM/PM Date May 26 1955

Purpose Preliminary critical [illegible] [illegible] [illegible] from [illegible] 9" sphere - fully reflected with H_2O

Personnel: Fox & Thomas

INSTRUMENT CHECK

Date May 26 1955 Time 10[illegible] AM Source No. Ra-Be 30

Instrument		Trip Value	Scale	Source Distance	Start-Up Scale
DC-1	No				
DC-2	Yes	90	10/10	4"	10/1
DC-3	Yes	95	100/1	4"	10/1
Log N	Yes	13,000	—	4"	—
R-1	Yes	9.5	250/1000	4"	50/1000
R-2	No	—			—
P. M.	Yes	750 V.			—

START-UP CHECK LIST

Equipment Checked by J.T.T. Personnel Check by J.T.T.

Instrument and Safeties Checked and [illegible] by J.T.T. & JRF

"Source In" Checked by J.T.T. Source No. PN-58

Emergency Equipment in Control Room Checked by J.T.T.

Red Light On by J.T.T.

Start-Up OK'd by J.T.T. Time 10[illegible] AM/PM Date 5/26 1955

Zero 28.7 cm

Critical height = 49.0 - 28.7 = 20.3

SUMMARY OF CRITICAL CONDITIONS

Expr. A-8 Reactor 9" Dia Sphere

Solution UO_2F_2 Height 18.9" Volume 6.32 Temp 24.5°C

Reflector H_2O Height Full Temp 25°C

Time Critical 10[illegible] AM Duration 10 min. Log N ~.01

Anal. Req. 354712 gms U/gm .34765 Sp. Gr. 1.6630

Critical Mass 3.400 Kg 25 Atomic Ratio 44.2

Expr. A-8.1 Time 10 ~~PM~~ AM Date 5/27 1955
Purpose Expose Eu foils in 9.0" Dia Sphere

Personnel: Gilley & Thomas

INSTRUMENT CHECK

Date 5/27 1955 Time 10 ~~PM~~ AM Source No. RA-4.80

Instrument	Trip Value	Scale	Source Distance	Start-Up Scale
DC-1	No			
DC-2	yes	8.0	10/10	4"	10/1
DC-3	yes			
Log N	yes	7 arc		9"	
R-1	yes	~~10~~ 5	10 Amps	4"	25/1000
R-2	No				
P. M.	yes	Trip Check			

START-UP CHECK LIST

Equipment Checked by T.T.T. Personnel Check by T.T.T.
Instrument and Safeties Checked and Reset by T.T.T.
"Source In" Checked by T.T.T. Source No. PN-58
Emergency Equipment in Control Room Checked by T.T.T.
Red Light On by T.T.T.
Start-Up OK'd by T.T.T. Time 10 ~~PM~~ AM Date 5/27 1955

Crit at 49.3 cm - 28.7 = 20.6

25 — 3/4
24 — 1/2
23 — 1/2
21 — 1/2
20 — 1
19 — 1
18 — 1
17 — 3/4
15 —
14 — 1/2 4
11 — 1/2
9 — 3/4
8 — 1
7 — 1
6 — 1
Bottom

Monitors
F-4
B-1

Stant Watches, 11 Oc AM

SUMMARY OF CRITICAL CONDITIONS

Expr. A-8.1 Reactor 9" Dia. Sphere
Solution UO_2F_2 Height 8.11 Volume 6.345 Temp 25°C
Reflector H_2O Height Full Temp 25°C
Time Critical 1040 ~~PM~~ AM Duration 20 min. Log N 1.0
Anal. Req. 354712 gms U/gm .34765 Sp. Gr. 1.6690
Critical Mass 3.419 Kg ^{25} Atomic Ratio 44.2

Expr. [illegible] 8.2 Time 8:45 AM Date 5/31 1955
Purpose Expose [illegible] foils
Personnel: Fox & Thomas

INSTRUMENT CHECK

Date 5/31 1955 Time 8:15 AM Source No. RA-K58

Instrument	Trip Value	Scale	Source Distance	Start-Up Scale
DC-1 No				
DC-2 Yes	9.0	100/1	4"	10/1
DC-3 Yes	9.5	100/1	4"	10/1
Log N Yes	7 sec		4"	—
R-1 Yes	1.0	1000/1000	4"	25/1
R-2 No	—		—	—
P. M. Yes	Trip check only			

START-UP CHECK LIST

Equipment Checked by J.T.T. Instrument Check by J.T.T.
Instrument and Safeties Checked by J.K.F.
"Source In" Checked by J.K.F. Source No. PN-58
Emergency Equipment in Control Room Checked by J.T.T.
Red Light On by J.T.T.
Start-Up OK'd by J.T.T. Time 8:05 AM Date 5/31 1955

Critical height = 49.3 cm − 28.7 = 20.6

25 —
3/4
24 —
1 1/2
20 —
1
19 —
2
17 —
1 1/4
14 —
1 1/4
9 —
2
7 —
1
6 — out
bottom

Start to clock = 9:50 AM.

SUMMARY OF CRITICAL CONDITIONS

Expr. A-8.2 Reactor, 9.0" Dia Sphere
Solution UO_2F_2 Height 8.11 Volume 6.848 Temp. 22°C
Reflector H_2O Height Full Temp. 22°C
Time Critical 9:50 Duration 20 min. Log N 1.0
Anal. Req. 354712 gms U/gm 3.4765 Sp. Gr. 1.6680
Critical Mass 3.417 kg 25 Atomic Ratio 44.2

Monitors
F-4
B-1

Expr. 4-8.3 Time 8:55 AM PM Date 6/1 1955

Purpose Expose Bare UO_2F_2 capsules in 8" Sphere H_2O Reflector

Personnel: Fox + Thomas

1
20 H_2O_5
20
23 H_2O_5
19
11 H_2O_5
18
7_5
17
8_5
15
13_5
13
7_5
11
10
10_5
6 — 4
5
6_5
9

INSTRUMENT CHECK

Date 6-1 1955 Time 8:55 AM Source No. RA-4.80

Instrument	Operable	Sensitivity	Range	Compensated	Start-Up Scale
DC-1	No				
DC-2	Yes	9.0	1/10	4"	1/1
DC-3	Yes	9.5	100/1	4"	10/1
Log N	Yes	7 cps			
R-1	Yes	1.0	100/1000	4"	25/1000
R-2	No				
P. M.	Yes	Tripcheck			

START-UP CHECK LIST

Equipment Checked by J.T.T. Personnel Check by J.T.T.

Instrument and [illegible] Checked and Set by J.T.T.

"Source In" [illegible] J.T.T. Source No. J.T.T.

Emergency [illegible] and Room Checked by J.T.T.

Red Light On by J.T.T.

Start-Up OK'd by J.T.T. Time 5:55 AM Date 6-1 1955

Critical height 49.2 cm. - 28.7 = 20.5 cm.

Start Watch 9:46 AM.

SUMMARY OF CRITICAL CONDITIONS

Expr. A-8.3 Reactor 9.0" Sphere

Solution UO_2F_2 Height 8.07 Volume 6.330 Temp 22°C

Reflector H_2O Height Full Temp 22°C

Time Critical 9:20 AM Duration 20 min. Log N 3.0

Anal. Req. 354712 gms U/gm .34765 Sp. Gr. 1.6630

Critical Mass 3.411 Kg U^{235} Atomic Ratio 44.2

Monitors
F-4
6-1

134

Expr. A-8-4 Time 9[10] AM PM Date 6-2 1955

Purpose Cd-Covered UO_2F_2 capsules in 9" Sphere

Personnel: Fox + Thomas

XI
2Dw
20
23w
19
11w
X18
7
12
8s
X15
13s
13
7s
11
X10
10s
X6
5
6s
X9
~~8s~~

INSTRUMENT CHECK

Date 6-2 1955 Time 9[10] AM PM Source No. RH-4.80

Instrument					
DC-1	NL				
DC-2	yes	90	10/10	4"	10/1
DC-3	yes	65	10/1	4"	10/1
Log N	yes	7 sec	100 Volts	4"	25/1000
R-1	yes	1.0	100 Volts	4"	25/1000
R-2	No				
F. M.	yes	Tape Check			

START-UP CHECK LIST

Equipment Checked by J.T.T. Personnel Check by J.T.T.

Instrument and Safeties Checked and Tested by J.T.T.

"Source In" Checked by J.T.T. Source No. RN-5.8

Emergency Equipment in Control Room Checked by J.T.T.

Red Light On by J.T.T.

Start-Up OK'd by J.T.T. Time 9[10] AM PM Date 6-2 1955

Critical height 49.8 cm. - 28.7 = 21.2 cm.

Achieved Power Level with end of source.

3.41 Watts at 10^{12} nv.

SUMMARY OF CRITICAL CONDITIONS

Expr. A-8-4 Reactor 9" Sphere

Solution UO_2F_2 Height 8.35 Volume 6.395 Temp. 22C

Reflector H_2O Height Full Temp. C

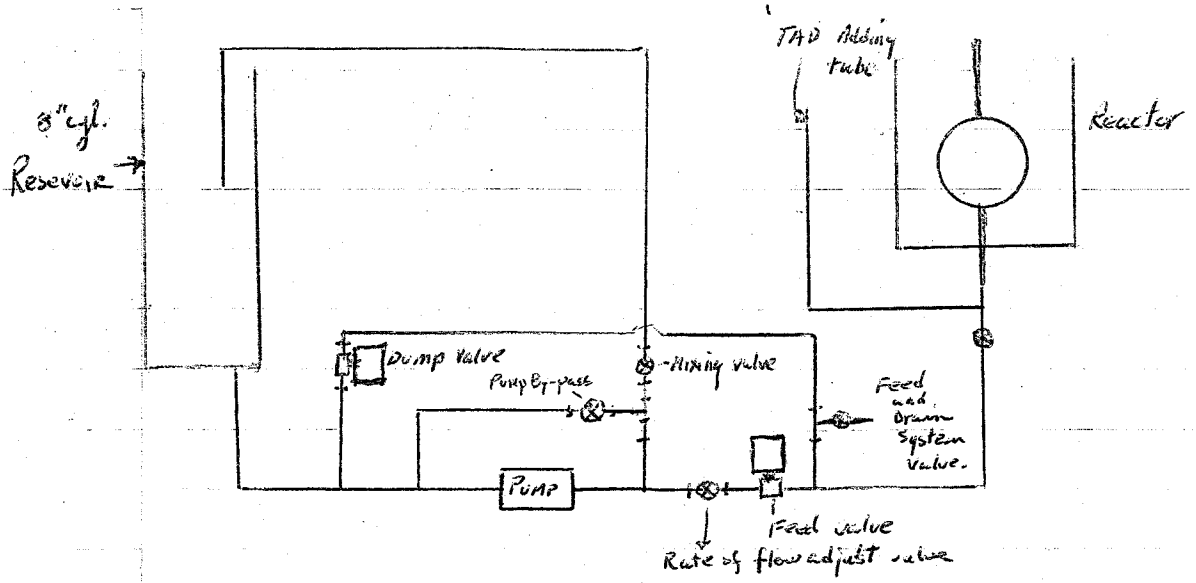
Time Critical 9[10] AM PM Duration 20 min. Log N -3.0

Anal. Req. 35712 gms U/gm 34765 Sp. Gr. 1.6630

Critical Mass 3.476 Kg U^{235} Atomic Ratio 44.2

Monitors
F-4
5
B-1

East end solution assembly



Pump by-pass and mixing valve are to be open at all times during Exps.

Position of Feed adjust valve.	Flow rate ℓ/m.	Flow rate cm³/sec.	Time to fill (F) or Drain (D)	
Full open	11.1	185	to 11" F	90.78 s.
" "	5.38	89.4	D to 6"	91.02
" "	12.75	212.5	D to 6"	38.3 Pump on
1 turn closed.	10.7	179	F to 11"	94.07
1½ " "	9.5	158	F to 11"	106.4
1½ " "	12.47	208	D to 1"	89.52
2 " "	6.5	108	F to 11"	155.7
2½ " "	1.013	26.9	F to 11"	626.3
2¼ " "	3.876	64.1	F to 11"	262.7

Time to drain 12.6" Dia sphere without pump 264.758 sec.

Use 2¼ turns closed otherwise near full may spurt solu out of sphere; also this gives $\frac{\text{Drain}}{\text{Feed}} = \frac{12.47}{3.876} = 3.24$

C.A. _____ Exp 51 Run 1

Sheet 1 Da 8-16 1957 Time 2 — AM PM

Purpose To obtain critical concentration in 12.6" Dia Sphere unreflected but with aluminum reflector to add2 present.

Personnel J.J. Lynn, K Gwin, J ET.

INSTRUMENT CHECK

Time 2[illegible] PM Run 1

	A	B	C	D	E
Range	10/1000	Spr.	10^{-10}	10/1000	900V
Source Dist.	0"	0"	0"	0"	16"
% F.S. Trip	80	—	100	70	80

MULTIPLICATION

Expr. 5-1 Time 2[illegible] AM PM Date 8-16 1957

	Settings H. V.	Disc.	B. G. c/(2) min.
Scalar 16 C(1)	1.6 K.	20	36.75
C(2)	1.6	20	8.0
C(3)	1.6	5	10.5

Time	Temperature Reg Refl.	Sol'n	Height Refl.	Sol'n	C(1)	$M^{-1}_{(1)}$	C(2)	$M^{-1}_{(2)}$	C(3)	$M^{-1}_{(3)}$
2.57	74.6	73.1		7.9	40.1		9.0		13.1	
				9.27	47.7		9.8		16.1	
				10	62.5		10.7		21	
				10.77	97		20		31	
				11.5	263		47		74	
				11.52	325		61		94	

C.A. _____ Expr. S-2 Run 2

Sheet 1 Date 8-19 195 7 Time 9⁰⁰ AM ~~PM~~

Purpose To obtain critical concentration in 12.6" Dia Sphere Unreflected but with aluminum reflector tank present.

Personnel: J.J. Lynn, R. Gwin, J.T.T.

INSTRUMENT CHECK

Time 8:40 AM ~~PM~~ Source PB (Y on E)

	Channel A	B	C	D	E
Range	10/1000	apr.	10^{-10}	10/1000	900V
Source Dist.	1"	OK	0"	1"	16"
% F.S. Trip	90	OK	No	70	90

MULTIPLICATION

Expr. S-2 Time 9⁰⁰ AM ~~PM~~ Date 8-19 195 7

	Scalar 16	Settings H. V.	Disc.	B. G. c/(2) min.
C(1)		1.6 K	20	33.75
C(2)		1.6	20	10.75
C(3)		1.6	5	13.5

B.6 with 4.69" o.Un.

Time	Temperature Refl. ~~Refl.~~	Sol'n	Height Refl.	Sol'n	C(1)	$M^{-1}_{(1)}$	C(2)	$M^{-1}_{(2)}$	C(3)	$M^{-1}_{(3)}$
9²⁵				8.00	37.0		10.75		14.25	
9³⁴				10.10	59.25		18.0		23.0	
9⁴¹				10.57	76.0		19.75		28.25	
9⁴⁹				11.09	124		35.25		46.25	
9⁵⁸				11.28	150		44.5		56.0	
10⁰⁶				11.46	200		57.0		70.3	
10¹⁵				11.53	245		55.0		76.5	

C.A. _____ Expr. 5-1 Run 3

Sheet 1 Date 8-19 1957 Time 11^05 AM ~~PM~~

Purpose Obtain critical concentration in 12.6" Dia Sphere unreflected.

Personnel: J.J. Lynn, R. Lewis, J.T.T.

Have critical solution at 11^035 ~50 (0.15 c/g)

MULTIPLICATION

Expr. 5-1 Time 11^05 AM ~~PM~~ Date 8-19 1957

Settings

	Scalar	H. V.	Disc.	B. G. c/(2).min.
C(1)	16	1.6	2	34.5
C(2)		1.6	2	5.25
C(3)		1.6	5	19.25

5.00" Soln.

Time	Temperature Roft.	Soln	Rem.	Height Soln	C(1)	$M^{-1}_{(1)}$	C(2)	$M^{-1}_{(2)}$	C(3)	$M^{-1}_{(3)}$ or Remarks
11^13				9.02	42.0		11.75		15.25	
11^21				10.56	85.0		22.25		27.25	
11^28				11.00	115		32.25		41.0	
11^36				11.43	211		60.0		76.25	
11^45				11.53	435		0.5		86	

C.A. _____ Expr. 5-1 Run 4

Sheet 1 Date 8-19 1957 Time 108 ~~AM~~ PM

Purpose Same

Have added soln at 11/0235 ~ 50 (~100 cm³)

Personnel: J.J. Lynn, R. Gwin, J.T.

MULTIPLICATION

Expr. 5-1 Time 108 ~~AM~~ PM Date 8-19 1957

	Scalar	Settings H. V.	Disc.	B. G. c/(2) min.	
C(1)	16	1.6	26	35.5	5.0 Soln. for B.G.
C(2)		1.6	20	11.0	
C(3)		1.6	5	13.25	

Time	Temperature Refr.	Sol'n	Height Refl.	Sol'n	C(1)	$M^{-1}_{(1)}$	C(2)	$M^{-1}_{(2)}$	C(3)	$M^{-1}_{(3)}$	M^{-1} or Remarks
119	77.4	77.8		9.00	116		13		17		
126				11.05	140		40.5		47		
134				11.36	226.5		62		75.5		
147			Added ~100 cc of 11/0235 ~50.								
205				10.42	78		23.5		29		
220				11.53	138		148		170		
245			Added ~50 cc of H/0235 ~50.								Mult' ~.05
350	77.7	77.5									
358				11.69							

140

period 21.7187 constant

C.A. ____ Expr. S-1 Run 5

Sheet 1 Date 8-20 1957 Time 8:40 AM

Purpose Obtain critical concentration of 12.6" Dia Sphere unreflected. Al. refl. tanks Present

Personnel: J.J. Lynn, R Gwin, J.T. Thomas

INSTRUMENT CHECK

Time 8:40 AM

Source PB

	Channel A	B	C	D	E
Range	1/1000	Opr.	10⁻¹⁰	1/1000	900V
Source Dist.	0	0	0"	1"	15"
% F.S. Trip	65	OK	No	70	90

SUMMARY OF CRITICAL CONDITIONS

Expr. S-1 R5 Reactor 12.6" Dia Sphere

Solution OC,F Height 11.50" (42) Volume ____ Temp 74°F

Reflector ____ Height ____ Temp ____

Time Critical 9:22 AM Duration 46 min. Log N 1

Anal. Req. 354884 gms U/gm ____ Sp. Gr. ____

Critical Mass ____ Atomic Ratio ____

Period associated with solution at 12.00" = 107.48 ρ = 9.16 ¢

C.A. _____ Expr. 5-1 Run 6

Sheet 1 Date 8-20 1957 Time 1 25 ~~AM~~ PM

Purpose To obtain ΔP as a fcn of Temp.

Personnel: J.J. Lynn; R Gwin; J.T.T.

Temperature of Soln in Reservoir 74.5°F at 1 25 PM.

" " " " in Sphere at critical (Ht. = 11.54") = 76.4°F @ 25 PM

SUMMARY OF CRITICAL CONDITIONS

Expr. 5-1 R6 Reactor 12.6" Dia Sphere

Solution UO_2F_2 Height 11.54 Volume _____ Temp 76.4°F

Reflector — Height — Temp —

Time Critical 24 ~~AM~~ PM Duration 16 min. Log N .01

Anal. Req. 357887 gms U / gm _____ Sp. Gr. _____

Critical Mass _____ Atomic Ratio _____

Period ass. with soln at 12.00" = 182.4 , ρ = 6.00 ¢

SUMMARY OF CRITICAL CONDITIONS

Expr. 5-1 R7 Reactor 12.6" Dia Sphere

Solution UO_2F_2 Height 11.59" Volume 17,059 Temp 78.4°F 77.7

Reflector _____ Height _____ Temp _____

Time Critical 2 30 ~~AM~~ PM Duration _____ min. Log N .005

Anal. Req. 354687 gms U / gm _____ Sp. Gr. _____

Critical Mass _____ Atomic Ratio _____

Period ass with solution at 12.00" = ~1098.7 ρ = 1.4 ¢

142

C.A. _____ Expr. S-1 Run 8

Sheet 1 Date 8-21 1957 Time 8:40 AM PM

Purpose to obtain stable Period for the 12.6" dia. sphere as a fcn. of Temperature

Personnel Linn, McLeroy, Guth

INSTRUMENT CHECK

Time 8:40 AM ~~PM~~ Source Pr 124

	Channel A	B	C	D	E
Range	$\frac{10}{1000}$	M.	10^{-10}	$\frac{10}{1000}$	900V
Source Dist.	$\frac{1}{2}$"		0	1"	17"
% F.S. Trip	75		—	10	90

SUMMARY OF CRITICAL CONDITIONS

Expr. S-1 K8 Reactor 12.6" dia. sphere

Solution UO_2F_2 Height 11.49" Volume 17.035 Temp 74.5°

Reflector _____ Height _____ Temp _____

Time Critical 9.05 AM ~~PM~~ Duration 2.5 min. Log N 024

Anal. Req. 354889 gms U / gm _____ Sp. Gr. _____

Critical Mass _____ Atomic Ratio _____

Period with solution at 12.00" = 105.3 ρ = 9.2

C.A. _____ Expr. S-1 Run 9

Sheet 1 Date 8-21 1957 Time 1 35 ~~AM~~ PM

Purpose Same as Run 8

Have cooled solution with ice and water

Personnel: J.J. Lynn, B. McCarty, R. Gwin, J.T.T.

SUMMARY OF CRITICAL CONDITIONS

Expr. S-1 R9 Reactor 12.6" Dia Sphere

Solution UO_2F_2 Height 11.35 Volume _____ Temp 64.5°F

Reflector _____ Height _____ Temp _____

Time Critical 1 35 PM Duration 7 min. Log N Varying

Anal. Req. _____ gms U / gm _____ Sp. Gr. _____

Critical Mass _____ Atomic Ratio _____

wt = 11.45" period ≈ 36.9 sec

set off Bldg Alarm

At Power level 0.18

2 35 Critical height 11.33" Temp. 64.5°F

SUMMARY OF CRITICAL CONDITIONS

Expr. S-1 R-10 Reactor 12.6" Dia Sphere

Solution UO_2F_2 Height 11.40 Volume 17.005 Temp 68.5°F

Reflector _____ Height _____ Temp _____

Time Critical _____ AM PM Duration _____ min. Log N _____

Anal. Req. 354885 gms U / gm _____ Sp. Gr. _____

Critical Mass _____ Atomic Ratio _____

Period assoc. with 12.00" of Sol'n = 35.83 ρ = 19.8

R-11 4:00 PM Critical height 11.44" Temperature 72.2°F

Period ass with soln at 12.00" = 57.12 ρ = 14.62

C.A. _____ Expr. S-1 Run R-12

Sheet 1 Date 8-22 1957 Time 9:10 ~~AM~~

Purpose to obtain stable periods in 12.6" Dia Sphere as a fctn. of Temperature.

INSTRUMENT CHECK

Time 9:10 ~~AM~~ Source Pb (None)

	Channel A	B	C	D	E
Range	1/1000	qr2	10^{-10}	1/1000	900 V
Source Dist.	0"	1/	0"	0"	16"
% F.S. Trip	75%	1/		60	70

SUMMARY OF CRITICAL CONDITIONS

Expr. S-1 R-12 Reactor 12.6" Dia Sphere

Solution UO_2F_2 Height 11.46 Volume 17,926 Temp. 73.0

Reflector _____ Height _____ Temp. _____

Time Critical 9:30 ~~AM~~ Duration 13 min. Log N .01

Anal. Req. 354589 gms U/gm _____ Sp. Gr. _____

Critical Mass _____ Atomic Ratio _____

Period ass. with soln of 12.00" = 76 , ρ = 11.9

R-13 Critical at 9:56 AM. height = 11.46" Temp. 73°

Period ass. with Soln at 12.00" = 76 , ρ = 11.9

C.A. _____ Expr. S-1 Run R-14

Sheet 1 Date 8-22 1957 Time 1040 AM ~~PM~~

Purpose Same as R-12 and R-13.

SUMMARY OF CRITICAL CONDITIONS

Expr. S-1 R-14 Reactor 12.6" Dia Sphere

Solution UO_2F_2 Height 11.49 Volume _____ Temp 74.4

Reflector _____ Height _____ Temp _____

Time Critical 1043 AM PM Duration 10 min. Log N .01

Anal. Req. 354889 gms U / gm _____ Sp. Gr. _____

Critical Mass _____ Atomic Ratio _____

Period ass. with soln at 12.00" = 113.47 , ρ = 8.75

SUMMARY OF CRITICAL CONDITIONS

Expr. S-1 R-15 Reactor 12.6" Dia Sphere

Solution UO_2F_2 Height 11.51" Volume 17,040 Temp 75.1

Reflector _____ Height _____ Temp _____

Time Critical 1245 AM PM Duration 20 min. Log N .01

Anal. Req. 354889 gms U / gm .11914 Sp. Gr. 1.1603 @ 26.0°C

Critical Mass 2.195 Kg Atomic Ratio 188.8

Period ass with soln at 12.00" = 139.00 , ρ = 7.52

The sphere is full when probe reads 11.60"

SUMMARY OF CRITICAL CONDITIONS

Expr. S-1 R-16 Reactor 12.6" Dia Sphere

Solution UO_2F_2 Height 11.56 Volume 1.852 Temp 76.9

Reflector _____ Height _____ Temp _____

Time Critical 1:20 AM Duration 20 min. Log N .01

Anal. Req. 354889 gms U / gm .11914 Sp. Gr. 1.1603 @ 26.6°C

Critical Mass 2.197 Kg. Atomic Ratio 198.8

Period ass. with solution at 12.60" = 279.1 , ρ = 4.15

Samples taken 8/22/57 S-1a = 35g S-1b = 60 gm.

S-1a Req. # 354887 G: 56 gU/g 0.120500
T: 21 sp gr. 1.155
N = 35 g
129.72 gU.

H/U^{235} = 196.144 } uncorrected for impurities

S-1b Req # 354889 G 81 gU/g = 0.119138
T 21
N 60 gm. sp gr. = 1.1603 @ 26.6°C

H/U^{235} = 198.8 ; $g^{U^{235}}/cc$ = 0.12884

C.A. _____ Expr. S-2 Run 1

Sheet 1 Date 8-26 195 7 Time 12^20 ~~PM~~

Purpose Determine effect of ⅛" aluminum placed over top of reflector cylinder. Reactor unreflected 12.6" Dia Sphere.

Personnel: J.T. Lynn, E Erwin T.T.T.

INSTRUMENT CHECK

Time 12^30 ~~PM~~ PM Source PB (Rone)

	Channel A	B	C	D	E
Range	1/100	opr	10^-10	1/1000	700 V.
Source Dist.	0	—	0	0	15"
% F.S. Trip	90%	—	—	80	95

SUMMARY OF CRITICAL CONDITIONS

Expr. S-2 R-1 Reactor 12.6" Dia Sphere

Solution UO_2F_2 Height 11.50" Volume 12.032 Temp. 74.4

Reflector — Height — Temp —

Time Critical 12^50 ~~PM~~ PM Duration 8 min. Log N .01

Anal. Req. _____ gms U/gm _____ Sp. Gr. _____

Critical Mass _____ Atomic Ratio _____

Period at 12.00" = 81.43

ρ = 11.3

S-2 Have Removed ⅛" Aluminum from top of Reflector tank

SUMMARY OF CRITICAL CONDITIONS

Expr. S-2 R-2 Reactor 12.6" Dia Sphere

Solution UO_2F_2 Height 11.51 Volume 12.040 Temp. 74.3

Reflector _____ Height _____ Temp _____

Time Critical 1:00 ~~PM~~ PM Duration 12 min. Log N .01

Anal. Req. 357882 gms U/gm _____ Sp. Gr. _____

Critical Mass _____ Atomic Ratio _____

Period at 12.00 = 89.05

ρ = 10.5

C.A. _____ Expr. S-2 Run 3

Sheet 1 Date 8-27 1957 Time 1:50 ~~AM~~ PM

Purpose Repeat S-2 R-1 and R-2

R-3 No Aluminum cover on refl. tank.

INSTRUMENT CHECK

Time 1:51 ~~AM~~ PM Source PB (& n E)

	Channel A	B	C	D	E
Range	1%/1000	opr.	10^{-10}	1%/1000	900 V
Source Dist.	0	-	0	0	15"
% F.S. Trip	75	"	"	95	95

SUMMARY OF CRITICAL CONDITIONS

Expr. S-2 R-3 Reactor 12.6" Dia Sphere

Solution UO_2F_2 Height 16.48 Volume 17.032 Temp ~73.7

Reflector — Height — Temp —

Time Critical 1:56 ~~AM~~ PM Duration 15 min. Log N .01

Anal. Req. 35+809 gms U / gm _____ Sp. Gr. _____

Critical Mass _____ Atomic Ratio _____

10:7 PM Storage 73.2

4.25

Period at 12.00" :

ρ =

Copper lead on thermal couple eaten away - necessary

Have repaired and coated with paraffin.

R-4 Aluminum on top of reflector cylinder

SUMMARY OF CRITICAL CONDITIONS

Expr. S-2 R-4 Reactor 12.6" Dia sphere

Solution UO_2F_2 Height 11.535" Volume 17.046 Temp 74.3

Reflector — Height — Temp —

Time Critical 2:55 ~~AM~~ PM Duration 11 min. Log N .01

Anal. Req. — gms U/gm — Sp. Gr. —

Critical Mass — Atomic Ratio —

3:06 74.05

3:10 74.3

3:14 74.3

Period at 12:00" = 107.6 (5.05)

ρ = 8.95

R-5 Removed Aluminum from top of Refl. Tank.

SUMMARY OF CRITICAL CONDITIONS

Expr. S-2 R-5 Reactor 12.6" Dia Sphere

Solution UO_2F_2 Height 11.545" Volume 17.049 Temp 74.4

Reflector — Height — Temp —

Time Critical 3:16 ~~AM~~ PM Duration 15 min. Log N .01

Anal. Req. 354889 gms U/gm — Sp. Gr. —

Critical Mass ? Atomic Ratio —

3:32 74.2

Period at 12:00 = 118.3 (5.45)

ρ = 8.55

Storage Cyl. before drainback 73.9°F after drain 74.1°F

12.29

2.3

C.A. _____ Expr. 5-3 Run 1

Sheet 1 Date 8-30 1957 Time 12 40 AM PM

Purpose Obtain Critical Concentration in 12.6" Dia Sphere with water reflector.

INSTRUMENT CHECK

Time 12 28 PM Source 18 - (Yone E)

	A	B	C	D	E
Range	1/100	opr.	10^{-10}	1/1000	900 V.
Source Dist.	0	—	—	0	18"
% F.S. Trip	65	—	—	75	—

Many dilutions - many criticals!
a few periods too.

C.A. _____ Expr. S-3 Run 2

Sheet 1 Date 9/3 1957 Time 855 AM ~~PM~~

Purpose See R-1

INSTRUMENT CHECK

Time 8 55 AM ~~PM~~ Source PB (Yon E)

	Channel A	B	C	D	E
Range	1/1000	oper.	10^{-10}	1/1000	900V
Source Dist.	0	—	—	0	15"
% F.S. Trip	75%	—	—	65	—

9:11 AM Critical ht 11.08" - (74.8°F) Storage Sphere 73.0° F

SUMMARY OF CRITICAL CONDITIONS

Expr. S-3 R-2 Reactor 12.6" Dia. Sphere

Solution UO_2F_2 Height 11.35" Volume 16.986 Temp 74.2

Reflector H_2O Height Full Temp 73.25°F

Time Critical 1028 AM ~~PM~~ Duration 8 min. Log N .01

Anal. Req. _____ gms U / gm _____ Sp. Gr. _____

Critical Mass _____ Atomic Ratio _____

Soln at 12" T = 69.5

ρ = 12.9

Soln not well mixed!

R-3 11°° AM critical ht = 11.345 Sp. Temp 74.9°F, H_2O Temp. 22.9°C 73.25°F

Period at 12.00" = 67.33

ρ = 13.1

Exp. S-3 R-4

9/3/57 3²⁵/PM critical ht. = 11.38" Sp Temp = 76.9°F H_2O Temp = 76.85°F

Period ass. with 12" soln ht. = 76.54 ρ = 11.83

C.A. _____ Expr. S-3 Run R-5

Sheet 1 Date 9/4 195 6 Time 10¹⁵ AM ~~PM~~

Purpose Same as R-1

INSTRUMENT CHECK

Time 10¹⁵ AM ~~PM~~ Source PB-124 (Box E)

	Channel A	B	C	D	E
Range	10/1000	cpr	10^{-11}	1"/1000	900 V
Source Dist.	2	ok	0	0	17"
% F.S. Trip	80	✓	100+	50	95

SUMMARY OF CRITICAL CONDITIONS

Expr. S-3 R-5 Reactor 12.6" Dia. Sphere

Solution UO_2F_2 Height 11.31" Volume 16.969 Temp 73°

Reflector H_2O Height Full Temp 72.1

Time Critical 11²⁰ AM ~~PM~~ Duration 8 min. Log N .01

Anal. Req. 354890 gms U/gm .049371 Sp. Gr. 1.0585 @ 26.6°C

Critical Mass 826.5 gm Atomic Ratio 531.1

Period ass. with soln at 12.00" = 43.4 ρ = 17.7

SUMMARY OF CRITICAL CONDITIONS

Expr. S-3 R-6 Reactor 12.6" Dia. Sphere

Solution UO_2F_2 Height 11.29" Volume 16,960 Temp 72.6

Reflector H_2O Height Full Temp 72.8

Time Critical 12⁵⁵ ~~AM~~ PM Duration 7 min. Log N .01

Anal. Req. 354890 gms U / gm _____ Sp. Gr. _____

Critical Mass _____ Atomic Ratio _____

Period at 12"00 = 39.09 ρ = 18.9

SUMMARY OF CRITICAL CONDITIONS

Expr. S-3 R-7 Reactor 12.6" Dia Sphere

Solution UO_2F_2 Height 11.378 Volume 16,997 Temp 79.9

Reflector H_2O Height Full Temp 79.8

Time Critical 3²⁵ ~~AM~~ PM Duration 15 min. Log N .01

Anal. Req. 354890 gms U / gm .049371 Sp. Gr. 1.0585 @26.6°C

Critical Mass 827.8 gm Atomic Ratio 531.1

Period at 12'00" = 117.3 ρ = 8.6

Have taken sample of solution. Added ~38cc H_2O to remaining solution.

Req # 354890 G 81 T 21 N 60 g^U/g g^U/g = .049371

ρp_r. = 1.0585 @ 26.6°C

H/U^{235} = 531.1 ; $g^{U^{235}}/cc$ = .048705

C.A. _____ Expr. S-4 Run 1

Sheet 1 Date 9/5 195 7 Time 10 AM ~~PM~~

Purpose added 38 cc H_2O to solution of S-3
To obtain periods as a fctn of Temp

INSTRUMENT CHECK

Time 10 AM ~~PM~~ Source PB-124 (front)

	Channel A	B	C	D	E
Range	0/1000	Off	10^{-11}	1/1000	900V
Source Dist.	0	-	0	0	15"
% F.S. Trip	80	~	100	65	95

SUMMARY OF CRITICAL CONDITIONS

Expr. S-4 R-1 Reactor 12.6" Dia Sphere

Solution UO_2F_2 Height 11.345 Volume 16.92 Temp 73.8

Reflector H_2O Height Full Temp 73.4

Time Critical 10^08 AM PM Duration 10 min. Log N .01

Anal. Req. _____ gms U / gm _____ Sp. Gr. _____

Critical Mass _____ Atomic Ratio _____

Period with Soln at 12" = ρ=

Have added 40 cc H_2O to soln.

SUMMARY OF CRITICAL CONDITIONS

Expr. S-4 R-2 Reactor 12.6" Dia Sphere

Solution UO_2F_2 Height 11.44" Volume 17,020 Temp 75°

Reflector H_2O Height Full Temp 73.35

Time Critical 10^25 AM PM Duration 30 min. Log N To .01

Anal. Req. _____ gms U / gm _____ Sp. Gr. _____

Critical Mass _____ Atomic Ratio _____

Period at 12" = 175.24

ρ =

SUMMARY OF CRITICAL CONDITIONS

Expr. S-4 R-3 Reactor 12.6" Dia Sphere

Solution UO_2F_2 Height 11.565 Volume 16,992 Temp 73.75

Reflector H_2O Height Full Temp 73.3

Time Critical 1^10 ~~AM~~ PM Duration 15 min. Log N To .01

Anal. Req. 354893 gms U / gm _____ Sp. Gr. _____

Critical Mass _____ Atomic Ratio _____

Period at 12" = 108.57

ρ =

SUMMARY OF CRITICAL CONDITIONS

Expr. S-4 R-4 Reactor 12.6" Dia Sphere

Solution UO_2F_2 Height 11.415 Volume 17,012 Temp 75.1

Reflector H_2O Height Full Temp 74.95

Time Critical 2^10 ~~AM~~ PM Duration 10 min. Log N to .01

Anal. Req. 354893 gms U / gm _____ Sp. Gr. _____

Critical Mass _____ Atomic Ratio _____

Period at 12" = 725.45

ρ =

SUMMARY OF CRITICAL CONDITIONS

Expr. S-4 R-5 Reactor 12.6" Dia Sphere

Solution UO_2F_2 Height 11.443 Volume 17,014 Temp 77.15

Reflector H_2O Height Full Temp 76.95

Time Critical 3^20 AM PM Duration 10 min. Log N .01

Anal. Req. 354893 gms U / gm _____ Sp. Gr. _____

Critical Mass _____ Atomic Ratio _____

Period at 12" = 218.24

ρ =

C.A. _____ Expr. S-4 Run 6

Sheet 1 Date 9/6 1957 Time 9 AM ~~PM~~

Purpose Repeat Runs 4, 5

INSTRUMENT CHECK

Time 9 10 AM ~~PM~~ Source PB-124 (zone E)

	Channel A	B	C	D	E
Range	1%/1000	cfpz	10^{-5}	1%/1000	900V
Source Dist.	0	—	7"	2"	18"
% F.S. Trip	70	—	100+	55	100+

SUMMARY OF CRITICAL CONDITIONS

Expr. S-4 R-6 Reactor 12.6" Dia Sphere

Solution UO_2F_2 Height 11.365 Volume 16.993 Temp 73.1

Reflector H_2O Height Full Temp 73.1

Time Critical 954 AM ~~PM~~ Duration 8 min. Log N to .01

Anal. Req. 354893 gms U/gm _____ Sp. Gr. _____

Critical Mass _____ Atomic Ratio _____

Period at 12" = ~~120.49~~ 91.20

ρ = 10.38

SUMMARY OF CRITICAL CONDITIONS

Expr. S4 R7 Reactor 12.6" Dia Sphere

Solution UO_2F_2 Height 11.365 Volume 16.993 Temp 74.5

Reflector H_2O Height Full Temp 74.5

Time Critical 1035 AM PM Duration 10 min. Log N to .01

Anal. Req. 354893 gms U/gm _____ Sp. Gr. _____

Critical Mass _____ Atomic Ratio _____

Period at 12" = 108.57

ρ = 9.0

SUMMARY OF CRITICAL CONDITIONS

Expr. S-4 R8 Reactor 12.6" Dia Sphere

Solution UO_2F_2 Height 11.380 Volume 16.998 Temp 75.5

Reflector H_2O Height Full Temp 75.3

Time Critical 11^20 AM PM Duration 10 min. Log N to .01

Anal. Req. 354893 gms U/gm .04918 Sp. Gr. 1.0596 @ 25°C

Critical Mass 825.6 gm. Atomic Ratio

Period at 12" = 125.99

ρ =

Samples taken at 9 AM

S-4a Req# 354891 G. 81 T 20 N 60

$g^u/_{soln.}$ = 0.049228 sp gr. 1.0592 Temp. 26.6°C

S-4

Req# 354893

$g^u/_g$ = .049178 Corr.; sp gr. 1.0596 @ 25°C

$H/_{U^{235}}$ = 533.3 $g^{U^{235}}/_{cc}$ = .04857

gm'd BJT 9/4/58

SUMMARY OF CRITICAL CONDITIONS

Expr. S-4 R-9 Reactor 12.6" Dia Sphere

Solution UO_2F_2 Height 11.425" Volume 17.014 Temp 75.5

Reflector H_2O Height Full Temp 75.35

Time Critical 12^50 AM PM Duration 6 min. Log N to .01

Anal. Req. 354893 gms U/gm Sp. Gr.

Critical Mass Atomic Ratio 533.3

Period at 12" = 133.60

ρ = 7.7

R-10 critical Ht = 11.420 Soln temp = 75.45 H_2O temp. 75.45

Period at 12.00 = 141.2 ρ = 7.45

over on page 158

SUMMARY OF CRITICAL CONDITIONS

Expr. S-4 R-10 Reactor 12.6" Dia Sphere

Solution UO_2F_2 Height 11.410 Volume 17.009 Temp 75.45

Reflector H_2O Height Full Temp 75.45

Time Critical 1 52 ~~AM~~ PM Duration 8 min. Log N to .01

Anal. Req. _____ gms U / gm _____ Sp. Gr. _____

Critical Mass _____ Atomic Ratio _____

Period at 12" = 141.2

ρ = 7.45

SUMMARY OF CRITICAL CONDITIONS

Expr. S-4 R-11 Reactor 12.6" Dia Sphere

Solution UO_2F_2 Height 11.480 Volume 17.031 Temp 78.1

Reflector H_2O Height Full Temp 78.8

Time Critical 2 50 ~~AM~~ PM Duration 15 min. Log N to .01

Anal. Req. _____ gms U / gm _____ Sp. Gr. _____

Critical Mass _____ Atomic Ratio _____

Period at 12" = 248.5

ρ = 4.53

SUMMARY OF CRITICAL CONDITIONS

Expr. S-4 R-12 Reactor 12.6" Dia Sphere

Solution UO_2F_2 Height 11.455 Volume 17.024 Temp 78.1

Reflector H_2O Height Full Temp 78.1

Time Critical 3 30 ~~AM~~ PM Duration 15 min. Log N to .01

Anal. Req. _____ gms U / gm _____ Sp. Gr. _____

Critical Mass _____ Atomic Ratio _____

Period at 12" = 262.8

ρ = 4.35

C.A. _____ Expr. S-5 Run 1

Sheet 1 Date 9-11- 1957 Time 1.05 ~~AM~~ PM

Purpose Critical H/X 12.6" dia. sphere
cadmium wrapped 10 mils, H_2O
Reflected

INSTRUMENT CHECK

Time 1.05 ~~AM~~ PM Source Pb-124 (Tower)

	Channel A	B	C	D	E
Range	$\frac{10}{1000}$	Off	10^{-10}	$\frac{10}{1000}$	900V
Source Dist.	0	—	0	0	16"
% F.S. Trip	60	U	—	60	95

H/X = 324 Not critical

C.A. _____ Expr. 5-5 Run 2

Sheet 1 Date 9-12- 1957 Time 10:05 AM ~~PM~~

Purpose Critical H/x 12" d-d sphere, cad wrapped, 10 mil/s

TJ Lynn, McCarty, Gwin

INSTRUMENT CHECK

Time 10:05 AM ~~PM~~ Source Pb. 124

	Channel A	B	C	D	E
Range	10/1000	0.1V	3×10^{-8}	10/1000	900
Source Dist.	0	OK	0	0	10"
% F.S. Trip	60	✓	100+	50	100+

counters 1+2 O.K.

100 cm³ H/x ~ 50 added to soln. of run 1

counters 1 and 2, 2 minute count

soln. to 12.00 on indicator

full sphere

scale 1L

①	②
132.5	80.5
147	78.5
150.5	82.5

added 60 cm³ H/x ~ 50 to soln of Run 2

System critical not full.
adjust

1:20 PM
added 40 cm³ of H_2O to obtain a less reactive system

Soln. to 12" on indicator

H_2O Temp = 73.7° F
Soln. Temp = 76.4° F

Reactor Period ≅ 166 seconds

2:45 P.M.
adjust Water reflector temperature to ~ 76.3°F
Power failure failure 3'30

INSTRUMENT CHECK

Time 9.55 AM PM Source Pb. 124

	Channel A	B	C	D	E
Range	10/1000	off	5×10^{-11}	10/1000	900
Source Dist.	0	0	0	0	15
% F.S. Trip	70	~~60~~	60	60	95

C.A. _____ Expr. S-5 Run 3

Sheet 1 Date 4-13- 1957 Time 10:00 AM PM

Purpose Critical H/x 12.6" dia sphere with 10 mils cadmium, H_2O Reflector 4 pwr, 4 Gain

Start up Time 10:40 A.M.

2 critical 11:05

sphere filled to 12" 11:40 A.M.

for Period

H_2O Temp = 72.8°F

Soln. Temp = 72.7°F

T = 58.6 sec $\rho \cong 14.5\,\phi$

SUMMARY OF CRITICAL CONDITIONS

Expr. S-5 Reactor 12.6" dia. sphere

Solution UO_2F_2 Height ~11.33 Volume _____ Temp 72.7°F

Reflector H_2O Height Full Temp 72.8°F

~~Time Critical~~ 11:05 ~~PM~~ AM Duration 20 min. Log N 0.01

Anal. Req. _____ gms U / gm _____ Sp. Gr. _____

Critical Mass _____ Atomic Ratio _____

sphere filled to 12.00 on indicator

Pos Period

T = 58.6 sec.

C.A. _____ Expr. S-5 Run 4

Sheet 1 Date 9-13- 1957 Time 1:00 ~~AM~~ PM

Purpose Critical n/x 12.6" dia sphere and $\frac{dk}{dTemp}$, H_2O reflected and 10 mils Cad. Lum. & Gwin

1:25 P.M. Soln. indicator at 12.00" for positive period.

H_2O Temp = 74.5° F

Soln Temp = 74.5° F

T = 97.7 sec ρ = 9.8 ¢

Start Run 5 at 1:52 P.M.
Same as Run 4 at higher temperature
Temp H_2O = 76.2 °F
Temp soln = 76.2 °F
recheck of Temp at end of run
Temp H_2O = 76.1 °F
Temp soln = 76.1 °F

Probe at 12.00"
T = 180 sec.
S = 6.05 ¢

INSTRUMENT CHECK

Time 9:55 AM ~~PM~~ Source Pb.-124

	Channel A	B	C	D	E
Range	10/1000	D/V	5×10^{-11}	10/1000	900V
Source Dist.	1/2"			2"	15
% F.S. Trip	70		Off	40	100

Counter 1 O.K.
counter 2 O.K.
3 dead

C.A. _____ Expr. S-6 Run 1

Sheet 1 Date 9-17- 1957 Time _____ AM PM

Purpose Critical H/X and Temp. coeff. 12.6" dia. sphere, H_2O reflected and 15 mil/s. cadmium.

Lynn, Gwin, Mccarty

Crit. delayed because of Temp. recording difficulties.
Start 10.55 A.M.

on positive Period with Probe at 12.00"
at 11:25 A.M.
Temp. H_2O = 73.6° F
Temp. Soln = 73.6° F
T = 800 sec ~ 1.55¢

Same H/X as S-5

SUMMARY OF CRITICAL CONDITIONS

Expr. S-6, K-1 Reactor 12.6" dia. sphere

Solution UO_2F_2 Height 12.66" Volume full Temp 73.6°F

Reflector ~~H2O~~ Height Full Temp 73.6°F

Time Critical 2-10:25 ~~PM~~ AM Duration 20 min. Log N .0005

Anal. Req. 354896 gms U/gm .080278 Sp. Gr. 1.005 @ 25°C

Critical Mass 1.2827 Kg. Atomic Ratio 312.6

S¹-6

Req. No. 354892

gram/gram T = 0.079316 corrected

Sp. gr. = 1.1009 @ 25°C

S²-6

Req. No. 354896

gross 109 gm

Tare 20 gm

Net 89 gm

gram U/gram ~~=~~ 0.080278

Sp. gr. 1.1005 @ 25.0°C

75.14 $gU^{235}/L.$

INSTRUMENT CHECK

Time 11:05 AM ~~PM~~ Source Pb-124

Channel	A	B	C	D	E
Range	10/1000	off.	2.3 no⁻¹	10/1000	900
Source Dist.	1"	___	air	3"	17"
% F.S. Trip	70	___	off.	65	100

counters
1. O.K.
2. O.K.
3. - dead

C.A. ___ Expr. S-7 Run 1

Sheet 1 Date 9-19- 1957 Time 10:05 AM ~~PM~~

Purpose Critical H/x and Temp. Coeff.
12.6" dia. sphere bare with
Can removed, see exp S-1
Lynn Ewin, McCarty

Insufficient fuel to keep Pump in operation

INSTRUMENT CHECK

Time 8:50 AM ~~PM~~ Source PB-124

	Channel A	B	C	D	E
Range	10/1000		10^{-10}	10/1000	2000
Source Dist.	2" OK		0	0	15"
% F.S. Trip	65		75 No Trip	65 Safety	100+

~~OK~~ 1 OK 2 OK 2 OK

C.A. _____ Expr. S-7 Run 2

Sheet 1 Date 10-10-1957 Time 2:25 ~~AM~~ PM

Purpose Critical M/x + Temp. Coeff.

12.6" dia. sphere, bare Source in

Scott, Gwin

Move soln. mixed and added to the system.

fill to 5" to check flow rate

6.5 Liters in 2 minutes

3:15 P.M. Probe at 12", sub critical. Power increased with source to obtain negative period.

Temp. soln. ≅ 73.4°F

Temp. = 73.5°F

Negative period, T = 435 sec.

ρ = 3.3¢

INSTRUMENT CHECK

Time 10:40 AM ~~PM~~ Source Pb-124

	Channel A	B	C	D	E
Range	1%000			10/1000	900
Source Dist.	1"	OK		4" sets	13"
% F.S. Trip	60			60	100+

Counters 1 + 3 O.K. 2 bad

C.A. _____ Expr. S-7 Run 3

Sheet _____ Date 10-11- 1955 7 Time 10:50 AM ~~PM~~

Purpose Rerun of Run 2 at different Temperature

Source in

T ≅ 75°F

Probe at 12" Log N ~ .0035

Source removed for neg. Period

T = 74.8°F so 1/2

File Period = .275 sec. ρ = 5.5¢

The room temperature was 70°F. Some cooling took place during the experiment.

C.A. _____ Expr. 5-8 Run 1

Sheet _____ Date 10-11- 1957 Time 3:05 PM

Purpose Reactivity ϕ of 12.6" sphere at same H/x as Expt. 5-7 but with reflector can added source in

McCarty, Scott, Gwin

Slightly super critical with Probe at 12" at 3:30 P.M.

T = 74,5° F

Pile Period = 673 sec

ρ = 1.8 ϕ

S-7 Reg. no. 354898 UO_2F_2

Gross 76 gm.
Tare 20 "
Net 56 "

gram U/gram 0.119469
sp. gr. 1.1599 @ 25.0°C
Specs on file

S-8 Reg. no. 354897

S-8 ≡ S-7

Gross 84 gm
Tare 21 "
Net 63 "

gram U/gram 0.119209
sp. gr. 1.1600 @ 25.0°C

INSTRUMENT CHECK

Time 1:30 PM Source Pb-124

Counters 1-2-3 O.K.

	Channel A	B	C	D	E
Range	10/1000	OK	5×10^{-1}	10/1000	900V
Source Dist	0		No	0	14"
% F.S. Trip	70		100+	75	100+

11/x ~ 1375

22" dia. sphere

Unreflected run to check system before adding reflection water

multiplication

2 min. count
Scalers x16

	height in sphere, inches	counts/2 min. 1	2	3
	5	22+3	0+3	8+5
	7.90	22+8	0+6	8+5
2:05 pm	11.13	22+13	0+4	8+13
2:12	14.04	27+15	0+5	11+2
2:17	16.08	26+10	0+3	12+7
2:22	18.12	29+3	0+8	12+13
	20.04	27+4	NG	11+1

Determination of Drain Rate

20.08 Drain for 10 sec 89.5 l

19.06 87.0 l

2.5 l/10 sec.

19.06 Drain for 20 seconds 37.0 ℓ
82.5 ℓ
17.69 4.5 ℓ/20 sec

Drain system.

2[50] System shutDown.

Nov 8. Measured Specific Gravity 1.023 (J. k. Fox)

Reflected 22" Sphere $\frac{H}{R} \approx 1370$

INSTRUMENT CHECK

Time 2[30] ~~AM~~ PM Source PB-124

	Channel A	B	C	D	E
Range	10/1000		5 x 10"	10/100	900 v
Source Dist.	0"	Resp.	Resp.	~~0~~	12"
~~0~~ F.S. Trip	60	___	X	~~X~~	100

Counters 1 2 3 Respond

Probe	C_1	C_2	C_3	x16
2[35] Background	2^{+1}	4^{+1}	29^{+12}	
Flow rate	to 5.08 "		in 1'37"	~ 130 cm³/sec
5.08	2^{+2}	4^{+7}	35^{+6}	
6.96	2^{+3}	4^{+7}	35^{+13}	
8.96	1^{+8}	2^{+14}	41^{+3}	
10.97	2^{+2}	3^{+10}	43^{+12}	
13.05	2^{+1}	3^{+4}	35^{+13}	
15.00	1^{+10}	3^{+10}	36^{+5}	
17.00	2^{+14}	4^{+4}	37^{+2}	
18.52	2^{+2}	3^{+5}	37^{+2}	
20.04	2^{+4}	3^{+2}	$37^{1?}$	

Tail added
dumped sol'n.
level grew
~~22.04~~ 20.04" to 19.96"

INSTRUMENT CHECK

Time 11:00 AM Source Pb-124

	Channel A	B	C	D	E
Range	10/000	100	5x10"	10/000	900V
Source Dist	0"	Respond	Respond	Respond	12"
% F.S. Trip	60%				100%

J.J.L. R.G. RWM

C_1 C_2 C_3 Response OK

Monitron OK

11:00 AM Start ~~Start~~

Added 1 liter of Exp 7 soln ($\frac{H}{K} \sim 200$)

Trim to 5.04" 1'38½". re drain to mix.

" " " 1'36"

	Probe	C_1	C_2	C_3	x16	
11:16 AM	~ 5.0"	1^{+12}	8^{+1}	31^{+7}		
11:20	6.95	1^{+4}	6^{+9}	34^{+9}		
11:28	10.98	1^{+9}	5^{+3}	38^{+14}		
11:33	12.98	1^{+10}	6^{+1}	34^{+13}		
11:38	15.00	0^{+18}	5^{+3}	35^{+12}		
11:44	17.00	1^{+4}	4^{+9}	46^{+7}		.76
11:51	18.50	2^{+2}	5^{+5}	51^{+11}		.67
11:56	20.12	1^{+7}	5^{+14}	53^{+13}		

Remove source to check that "D" responds - $78 \times \frac{100 \times 200}{10 + 500}$

12:00 Shut down

added ~1 liter of Exp 7 soln ($\frac{H}{X} \approx 200$) and 1 liter of H_2O

1:30 Start exp. Fill to 5", drain back for mixing.

	Probe	C_1	C_2	C_3	x16
1:42	10.98"	1^{+12}	5^{+8}	40^{+13}	
1:48	13.05	1^{+2}	4^{+10}	41^{+7}	
1:53	15.00	1^{+2}	4^{+2}	49^{+1}	1.00
2:02	17.07	1^{+12}	4^{+13}	70^{+14}	.69
209½	18.50	3^{+1}	7^{+7}	102^{+13}	.48
218½	19.57	3^{+5}	7^{+12}	132^{+8}	.37
	22.00	3^{+13}	12^{+2}	171^{+2}	.29

Inserted rod to 12.36" -- negative reactivity

2:35 Drain sphere.

added ~ 0.5 liter of Exp. 7 soln ($\frac{H}{X} \sim 200$)

		C_1	C_2	C_3	x16	D
3:25						
3:41	11.00	1^{+3}	4^{+13}	42^{+15}		
3:46	13.12	1^{+9}	5^{+4}	41^{+5}		
3:51½	15.07	2^{5}	5^{+9}	61^{+7}	1.0	
3:58	17.00	3^{0}	6^{+13}	107^{+1}	.57	→ 72 x 100 x 200
4:07½	18.50	4^{+3}	12^{+10}	209^{+11}	.292	→ 55 x 100 x 500
4:13	19.50	7^{+9}	21^{+13}	418^{+14}	.148	
4:24	20.51	21^{+1}	58^{+7}	$293^{37/64}$	.1052	

293.4
1170

INSTRUMENT CHECK

Time 10⁴⁵ AM ~~PM~~ Source PB-124

	Channel A	B	C	D	E	
Range	10/100		5×10^{-14}	10/1000	900V	C1 C2 C3 OK OK OK
Source Dist.	0"	Respond	Resp.	Resp.	12"	Monitor OK
% F.S. Trip	60%				100%	

Lynn, Gwin, Magnuson - - -

Channel "D" chamber and Counter 3 were moved from center tube to the outer perimeter of the reflector water. No change in (H/x)

Flowrate 1'31" to 5.0"

~12:50 start raising soln in to cplum.

		C_1	C_2	C_3 x16
1:26	20.55	29^{+15}	161^{+0}	252^{+12}

21. start removing source

1:45 Critical approx Soln ht 21.2" ρ=4.79¢ 143 sec

@ 21.46 period approx 150 sec. #1

soln 70.8°F DWM, R.G. Reflector Temp ~~70.1°F~~ ~~70.0°F~~

@ 21.07 just critical

2²⁰ @ 25.05 + period #2 76 sec

2²⁰ Reflect Temp 70.1°F Soln Temp 70.6 ρ=7.64

Start heating Reflector Water.

2³⁷ Probe at 18.15 Soln Temp 70.65

2³⁷ Heater off. H_2O Temp 70.58

Temperatures very close to equilibrium.

2⁴⁰ start + period with temperatures balanced. 73.9 Rx

2⁴⁵ Dump (partially

Soln Temp .844₇₅ MV 70.6

H_2O Temp .843₉₅₈ MV 70.6

Run #1

SUMMARY OF CRITICAL CONDITIONS

Expr. S-22-1 Reactor Spherical

Solution UO_2F_2 Height _____ Volume Full Temp 70.6 F

Reflector _____ Height 6" above sphere Temp 70.6 F

Time Critical 1⁴⁵ PM Duration 60 min. Log N .009 Neg

Anal. Req. _____ gms U / gm _____ Sp. Gr. _____

Critical Mass _____ Atomic Ratio @ ~1250-1300

Hydrometer reading of solution 1.0265

INSTRUMENT CHECK

Time 10:20 AM ~~PM~~ Source Pb-124

	Channel A	B	C	D	E
Range	1/1000	O.K.	5×10^{-1}	Loaded	980 V
Source Dist	0		O.K		15"
% F.S. Trip	70				100

counters 1, 2, and 3 O.K.

C.A. _____ Expr. 3-22-1 Run 2

Sheet _____ Date 11-14- 1957 Time 10:15 AM ~~PM~~

Purpose Reactivity of 22" dia., H_2O moderated + reflected sphere for a given Temperature

soln. height at 25.06"

Pile Period = ~~73.2~~ sec 70.6 sec

Temp soln = 72.7° F ~~ρ = 8.054~~

Temp H_2O = 72.8°

N.B. Selsyn changed from 21.80 to 22.00 in order that 22.00 reading mean the sphere is full

SUMMARY OF CRITICAL CONDITIONS

Expr. S-22-1 R-2 Reactor Spherical 22"

Solution UO_2F_2 Height _____ Volume Full Temp 72.7

Reflector _____ Height 6" above volume Temp 72.8

Time Critical _____ AM PM Duration _____ min. Log N 0.01

Anal. Req. _____ gms U / gm _____ Sp. Gr. _____

Critical Mass _____ Atomic Ratio _____

Same as S-22-1 R-1

INSTRUMENT CHECK

Time 9.55 AM ~~PM~~ Source Pb 124

	Channel A	B	C	D	E
Range	10/1000		10	10/1000	900V
Source Dist.	0 OK	OK	OK	OK	17"
% F.S. Trip	10				100

counters 1 2 3 OK OK OK

C.A. ____ Expr. S-22-1 Run R-3

Sheet Date 11-15- 1957 Time 10:00 AM ~~PM~~

Purpose Same as S-22-1, Run-2 for different temperature

Lynn, Gwin, McCrentz

critical at 11:00 P.M.

Temp in soln + H_2O 78.5°F

Probe at 25.24" 5.35¢

① Reactor Period = 124 sec

Rod inserted to 19.15" for critical

Rod inserted to 17.05" neg. Period

② Neg Reactor Period = 137.6 ~~+1.1~~

Soln withdrawn using tube (Rod added)

Probe at 23.5"

③ Pos. → Reactor Period = 138 sec 5.41¢

Soln. Temp = 78.8°F, H_2O Temp 78.4°

Rod inserted to 16.57"
Heaters turned on to heat reflector Water

(4) Neg. reactor Period = 114.4 sec

Adjusted to critical with rod inserted to 19.03"

Soln Temp = 78.8°F
H_2O Temp = 78.75°F
Withdrew rod for Period
Probe at 23.5"

(5) Pos. Period = ~~114.4~~ 135 sec

INSTRUMENT CHECK

Time 10:30 AM ~~PM~~ Source Pb-124

	Channel A	B	C	D	E	counters
Range	10/1000		5"10"	10/1000	900V	1, 2, 3, OK
Source Dist.	0	V	0	OK	16"	
% F.S. Trip	70				100	

C.A. _____ Expr. S-22-1 Run 4

Sheet _____ Date 11-18-1957 Time 10:30 AM ~~PM~~

Purpose Period of H_2O reflected and Moderated 22" dia sphere

Lyon, Gwin, Mayerson

Exp. delayed until 1:00 P.M.

Zero of Selsyn reading 0.1" less than Previous exp. The relation of the Probe to the sphere did not change.

Soln. in neck of sphere ~ 2"

Reactor critical at Probe = 16.80"

Probe at 17.64"

Period = 149.9 sec $\rho = 4.584$

Soln. Temp 74.3

Reflector H_2O Temp 74.1

over

An average of the temperatures recorded by the operators was 74.1°F in both soln and reflector. The variation was ± 0.1°F.

Note the increase in the reactivity during the exps. R-1 to R-4

SUMMARY OF CRITICAL CONDITIONS

Expr S-22-1, R-4 Reactor 22" dia. sphere

Solution UO_2F_2 Height Full Volume ~90L Temp 74.1°F

Reflector H_2O Height Full Temp 74.1°F

Time Critical 1:45 AM PM Duration 60 min. Log N 0.006

Anal. Req. _____ gms U/gm _____ Sp. Gr. _____

Critical Mass _____ Atomic Ratio _____

Sample Taken

	354900	354899
Gross	109 gm	110 gm
Tare	20 gm	20 gm
Net	89 gm	90 gm
gm U/gram	= 0.021785	gm U/gm = 0.021595
Sp. gr.	= ~~1.0229~~	Sp. gr. = 1.0225
	= 1.0225	

INSTRUMENT CHECK

Time 8:20 AM ~~PM~~ Source Pb-124

	Channel A	B	C	D	E
Range	10/1000		3×10^{-11}	10/1000	900V
Source Dist	0	OK	OK	OK	15"
% F.S. Trip	70				100+

Counters 1, 2, + 3 O.K.

C.A. _____ Expr. S-22-1 Run 5

Sheet _____ Date 11-19- 1957 Time 8:30 AM ~~PM~~

Purpose Check effect of addition of 290 cm^3 of H_2O to the system which contains about 93 liters soln. Lynn + Gwin

compare with S-22-1 Run 4

Soln. to 25" in neck of sphere

Rod inserted to 18.63 for critical / Temp. = 73.7°F soln + Reflector

Rod inserted to 16.80" $\rho = 13.64$

Negative reactor Period = ~~89~~ 139.8 sec

Rod out. soln at 25"

Positive Period = 90.5 sec $\rho = 6.89$

C.A. _____ Expr. S22-1 Run 6

Sheet _____ Date 11-19- 1957 Time 12:30 ~~AM~~ PM

Purpose Reactivity of sphere at a higher temp. than Run-5

Lynn, Gwin, Magnuson

Soln at 25" in neck
Temp 76.3°F in Soln + Reflector
Rod at 19.16" for critical

Rod removed for a Positive Period. Soln. height 25" in neck
Positive Period = 135.8 sec S=7.4

C.A. _____ Expr. S-22-1 Run 7

Sheet _____ Date 11-19 1957 Time 2:20 ~~AM~~ PM

Purpose Sphere Reactivity ~ 78°F

Lynn Gwin Magnuson

Soln at 25" ~ 3:05 PM
3:10 Soln ~.2 below the Reflector, Heater on.
Just Critical Rod Position = 19.79
3:15 Htr Off -- Soln Temp 78.2°F H_2O Reflector = 78.2°F
3:17 Rod Removed - Pos Period = 209.7 sec S=5.4
3:26 Shutdown

INSTRUMENT CHECK

Time 9:50 AM ~~PM~~ Source Pb-124

Channel	A	B	C	D	E
Range	~~10~~ 1000	___	10^{+0}	~~10~~ 1000	900V
Source Dist.	0	OK	OK	OK	12"
% F.S. Trip	70	___	___	___	100

Counters 1 2 3 — OK OK OK

C.A. ___ Expr. S-22 Run 8

Sheet ___ Date 11-29 1957 Time 9.55 AM ~~PM~~

Purpose Adjust concentration for replacement measurements to test stability of system at critical Magnuson Lynn - Gwin

9:00 PM	Approx Crit, solution well up in neck	Soln Temp	Rod at 15.64 H2O Temp
2:03 PM	Rod at 15.64	73.4	72.95
2:09	Rod 15.64 → 15.625	δ_k N .0007	
2:15	15.625	73.3	73.3 heat off
2:49	Power level raised by withdrawing rod		
δNN .0035	reactor rod 15.625	linear instr. decrease	
3.04	Power level dropped to δ_k N → 0.0008		
	rod → 15.625		

C.A. _____ Expr. S-22 Run 9

Sheet _____ Date 12-2- 1957 Time 11.00 AM ~~PM~~

Purpose Exp. to determine mass ~~diff~~ difference in a sample bottle required to produce a period corresponding to ~ 10¢

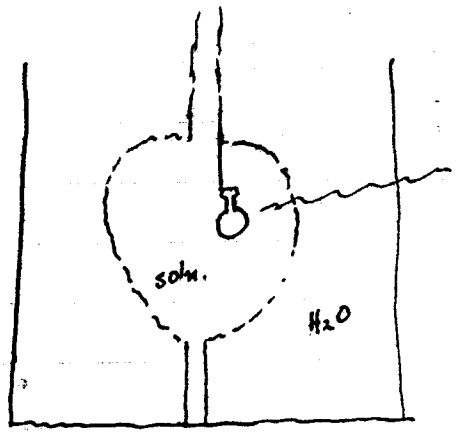
INSTRUMENT CHECK

Time 11.25 AM ~~PM~~ Source Pb-124

	Channel A	B	C	D	E
Range	10/1000	ok	~~ok~~ 11-10	ok	900V
Source Dist.	2		OK		
% F.S. Trip	65				100

Lynn, Gwin, Magnuson

Counters ① ② ③ OK OK OK



sample bottle contains same fuel as sphere

With the sample bottle filled with the same fuel as sphere a Period

will be obtained for a given temperature. In later experiments solns. of different concentrations will be placed in the bottle. The results should indicate a range of semple sizes which will be needed for Perturbation experiments.

Inst. D taken out of operation.

Rod Position	T, sec
17.03"	∞
17.765	169
15.925	148
18.04	124

Temp = 73.15 °F Soln + H_2O

C.A. _____ Expr. 522 Run 10

Sheet _____ Date 12-2 1957 Time 2:30 ~~AM~~ PM

Purpose Same as Run 9.
H_2O in semple bottle

Reactor subcritical full insufficient Power level for negative Period.

Vol. calibration 22" sphere
J.J. 4/1111 Vol = 91,21 liters
Radius = 55,84

INSTRUMENT CHECK

Time 11:10 ~~PM~~ AM Source Pb-124

Channel	A	B	C	D	E
Range	10/1000	OK	10^{-10}	10/1000	900V
Source Dist			OK		
% F.S. Trip	100+			100+	100+

counters ① ② ③ OK OK OK

C.A. _____ Expr. S 22 B Run 1

Sheet _____ Date 12-6-1957 Time 12:55 ~~AM~~ PM

Purpose Critical concentration for an unreflected ~22" dia. sphere

Lyon, Mayerson, Gwin

about 50gm U added to solv. of S22-R9

sphere filled

reactor subcritical

added ~ 300cm³ of UO_2F_2 with a U content of about 113 gm/cm³

Counter	# 1	# 2	# 3
2 min (Scale 16)	36 9	19 11	15 15
	30 7	97 6	19 2

added ~700cc

added ~700cc Subcritical (Very close 75.8°F)

179 4	180 +5	78 +10

INSTRUMENT CHECK

Time 8:45 AM PM Source Pb-124

	Channel A	B	C	D	E
Range	10/1000		10^{-10}	10/1000	900V
Source Dist.	2"	OK	OK		18"
% F.S. Trip	70			70	100+

Counters

①	②	③
OK	OK	OK

C.A. _____ Expr. S22B Run 1 continued

Sheet _____ Date 12-9- 1957 Time 8:55 AM PM

Purpose S22B, R1 continued

Lynn, Gwin, McCarthy

about 150 cm³ UO_2F_2 added

Temp. soln. 72.8°F

Sphere full

rod at 14.91" cm

} with rod at 22" the tip is at the top of the sphere

Added 290 cm³ H_2O

Mixed 2x at 5.17" 1x @ 8.5"

Sphere Full; Critical with rod @ 16.01 Soln Temp = 74.6°F

Added 400 cm³ H_2O

Filled to 11.0", for mixing

Soln Level @ 22.56" Positive Period SPHERE FULL

#1 Pos. Period Rod @ 22.56 $T = 90.2$ sec

Just Critical with Rod @ 18.03" Soln Temp 75.0 °F

#2 Neg Period Rod @ 16.01 " " 75.1

↳ $T = -104.3$ sec

---

raised temperature

soln. level @ 22.56" Pos. Period

#3 Period = 139 sec

Soln. Temp = ~~77.5 °F~~ 76.7 °F

just critical with rod at 18.57"

Soln level unchanged Rod to 18.03 Neg Period #4

Neg Period = −425 sec

2 samples taken

Rep no	354906	354907
gross	133.6 gm	136.4 gm
Tare	20.0 "	20.0 gm
net	113.6 "	116.4 "
grams U/gram	= 0.024341	grams U/gram = 0.024476
sp. gr.	= 1.0503 @ 25°C ← not good 9/14/58	sp. gr. = 1.0504 @ 23.0°C

H/X ~ 1088

(1027)

H/U = 1039 ?

INSTRUMENT CHECK

Time 9:50 AM ~~PM~~ Source Pb-124

Counters ① ② ③

	Channel A	B	C	D	E
Range	10/1000	OK	10^{-10}	10/1000	900V
Source Dist.	0		OK	0	
% F.S. Trip	70			60	100+

C.A. _____ Expr. S-22B Run 2

Sheet _____ Date 12-10-1957 Time 10:30 AM ~~PM~~

Purpose obtain estimate of the effect of the aluminum vessel walls

145 cm³ of H_2O was added to soln. of S22B R1 last dilution

S Phere full, ~~Rod at~~ 22.56"

#1 Reactor Period = 82.6 sec

Just critical, Rod at 17.95"

Rod inserted to 16.50"

#2 Neg Period - 133.6 sec

Temperature = 73.5°F

Average of several determinations.

The experiments for the determination of reaction of aluminum walls was postponed, and it is hoped that a cylinder experiment will be performed at a later date at this Lab.

S 27 Run 1

The 27½" OD Sphere was set up in 107. On the control Rod probe 28.57" corresponds to the tip of the rod at the top of the sphere. The lower limit is still ~5.15" and hence the rod can be inserted 23.4" into the sphere. The tank added has been removed from service, the tube is in a fixed position and can be used as a sight glass.

INSTRUMENT CHECK Dec 12, 1957

Time 1:00 AM ~~PM~~ Source PB-124 and 8

	Channel A	B	C	D	E	C_1 C_2 C_3 CRM
Range	10-1000	opr	10^{-10}	10-1000	600V 900V	OK
Source Dist.	1"	OK		1"	3"	
% F.S. Trip Setting Actual	80	OK	100 70-85	75	90	

Soln height, in	C_1	C_2	C_3
	counts (1/16 scale)		
24.44	17 +2		15 +11

Added ~3.0 ℓ of H/x 300 solution (9.55" in sphere before starting)

At a height of 22.38 the multiplication was sufficient to indicate that the system would be super critical – hence we drained to add

more water.

Added 5 l H_2O. Mixed 7 minutes. during the mixing process several liters of soln. were pumped out of the system and on to the floor After the loss solution level was 9.4 c. An estimate of 100 g of material was in the 5 l of solution spilled

INSTRUMENT CHECK

Time 10 45 A.M. ~~P.M.~~ PG-124

	A	B	C	D	E
	10-1000		10^{-10}	10-1000	900 V
Source	0"		0"	0"	15"
%	70			65	100

Added ~7 l H_2O. To system.

10 45 AM started Mixing with Drain closed and valve to sphere closed

10 50 Pump off

11 00 Start filling

11 22 Probe 25.98 Out of Solution (C) : 3.5×10^{-12}

C_1 C_2 C_3

35 +1 14 +4 11 +2

Added ~4½ l H_2O ~1 l $\frac{H}{X}$ = 300 Soln.

Probe 27.4 Subcritical

Added 1 ℓ H/x ≈300. Subcritical

Probe @ 28.71

Added 1 ℓ H/x ≈ 300 Subcritical

Probe @ 29.22 Definitely enough solution to fill system.

Added 1 ℓ H/x ≈ 300

e critical height 24.24" on rod

Soln. Temp. = 74.25°F

Added ~2 ℓ H_2O Pumped to ~14.0" for mixing and Dumped. Probe disconnected because of power shutdown on weekend.

Probe connected

12-16-57

INSTRUMENT CHECK

Time 8:45 AM ~~PM~~ Source Pb-124

Channel	A	B	C	D	E
Range	10/1000	OK	10^{-10}	10/1000	900V
Source Dist.	2"	"	OK	2"	15"
% F.S. Trip	65			50	100+

counters 1, 2, 3 OK

S27 R1 continued

d Slightly super critical with soln at ~~25.25~~ 24.99"

added about 2 liters H_2O

and ran the soln. up to 17" and

Dumped for mixing.

c

~ 100 sec period at 26.71"
~ critical ~ 26.42"
Temp. = 73.6° F
add 500 cm³ of H_2O to the system
Pumped to 17" in sphere and
drained to mix.

b

108 started Filling critical ~ 26.86" (138 pm)
~ 100 sec period 27.27"

Added 800 cm³
~ critical ~ 28.26"
added to ~ 29.88" Still approx Critical ln N = .0018

a

Inserted source to increase power
Remove Source ln N = .0017 } less than 1¢ excess
In 400 second ln N = .0020 } reactivity
Probe to 25.03 Sol Temp = ~~73.85°F~~ 74.3°F
Neg Period =

INSTRUMENT CHECK

Time 8:25 AM ~~PM~~ Source Pb-124

	Channel A	B	C	D	E
Range	10/1000	OK	10^{10}	10/1000	900V
Source Dist.	1"		1"	2"	15"
% F.S. Trip	80		100+	70	100+

counters ① ② ③ NO OK OK.

C.A. _____ Expr. S27 Run 2

Sheet _____ Date 12-17-1957 Time 8:25 AM ~~PM~~

Purpose Critical concentration and temp. coeff. of unreflected 27" dia. sphere

Sphere full, Rod at 28.84"
Positive Period = 93.4 sec
Temp. = 70.8 +°F
Rod at 21.74"
Neg. Period = -210 sec
Rod withdrawn, sphere full
Positive Period = 90.5 sec

10.4

Rm Temp increased 3°F run pump to warm soln

10^{30} Pump soln to 12.00" 10^{35} Temp = 76.95

10^{40} Start pumping soln into Sphere.

C.A. _____ Expr. 5-27 Run 3

Sheet _____ Date 12-7 1957 Time 10^{40} AM PM

Purpose Temp Coeff and conc for 27" Sphere. (unreflected)

Temp Coeff

$\frac{3.7 \delta}{2.4°F} = 1.54 \frac{\delta}{°}$

x .0064 = 9.85 x 10⁻³

x 155

n 6.77 x 10⁻⁴ δk/°C

12-24-57

Sphere full, Prob @ 28.87

Positive Period #1 = 159.9 sec 6.7 ¢

173.8 liters full

27.24" dia.

Rod at 21.74"

Neg Period #2 = -154.8

Soln Temp. 73.2 °F

Rod Withdrawn Probe @ 28.87

Pos. Period #3 = 151.4 sec

4 samples Taken 2 for X-12, 2 for X-10

Reg. no.	354908	354909
Gross, gm	131.4	141.6
Tare, gm	20	20
Net, gm	111.4	121.6
gram U/gram =	0.019693	0.019530
Sp. gr =	1.0444 @ 25°C	1.0449 @ 25.0°C
H/X =	1363	1021

December 23, 1957

Sample analyses reported by Vaughan by phone

Duplicate samples on 27.5 " sphere

Tare bottle	21.6	21.9
Uranium	20.14 mg Uranium Total/ml	20.11 mg/ml
iron	57 µg/ml	58 µg/ml

Report of ~~Anal~~ Analysis LAB No. 1957-B

Soln A
20.1 mg Uranium per ml
55 micro g Fe " "

Soln B
20.1 mg U per ml
60 micro g Fe " "