VOID SHEET

TO: License Fee Management Branch

FROM: Region III

SUBJECT: VOIDED APPLICATION

Control Number: 9021

Applicant: Ellis Fischel State Cancer Center

Date Voided: 10/30/90

Reason for Void: Duplicate of C/N 9024

Kevin G. O'Neil 10/30/90
Signature Date

Attachment:
Official Record Copy of
Voided Action

FOR LFMB USE ONLY

Final Review of VOID Completed:

☐ Refund Authorized and processed

☐ No Refund Due

☒ Fee Exempt or Fee Not Required

Comments: _____

Log completed ☒
Processed by: FCP ML30

BETWEEN:

LICENSE FEE MANAGEMENT BRANCH, ARM
AND
REGIONAL LICENSING SECTIONS

(FOR LFMS USE)
INFORMATION FROM LTS

PROGRAM CODE: 02300
STATUS CODE: 0
FEE CATEGORY: EX 7A
EXP. DATE: 19930731
FEE COMMENTS: 170.11(A)(9) CODE 12

LICENSE FEE TRANSMITTAL

A. REGION

1. APPLICATION ATTACHED
APPLICANT/LICENSEE: ELLIS FISCHEL STATE CANCER CTR.
RECEIVED DATE: 900914
DOCKET NO: 3000302
CONTROL NO.: 390211
LICENSE NO.: 24-00481-04
ACTION TYPE: AMENDMENT

2. FEE ATTACHED
AMOUNT: $ ------
CHECK NO.: ------

3. COMMENTS

SIGNED P. Dotlett
DATE 9-12-90

B. LICENSE FEE MANAGEMENT BRANCH (CHECK WHEN MILESTONE 03 IS ENTERED (/))

1. FEE CATEGORY AND AMOUNT: ---------- FEE EXEMPT

2. CORRECT FEE PAID. APPLICATION MAY BE PROCESSED FOR:
AMENDMENT ----------/----
RENEWAL ----------
LICENSE ----------

3. OTHER ----------

SIGNED ---------- 09/21/90 ----------
DATE ----------

ELLIS FISCHEL
State Cancer Center
GOVERNED BY THE MISSOURI STATE CANCER COMMISSION

September 13, 1990

Isotopes Branch
Division of Materials Licensing
U.S. Nuclear Regulatory Commission
Washington, D.C. 20545

Re: License #24-00481-04

Dear Sir:

This is a report of surveys and tests required after the installation of a new cobalt teletherapy source. The services were performed by Keith Hickey, Teletherapy Physicist on the above-referenced license, and Emmanuel Ekwelundu, Medical Physicist.

The source was supplied by Neutron Products, Inc., Dickerson, Maryland. The source was installed on August 17, 1990, in an Atomic Energy of Canada Theratron 80 rotational teletherapy unit used for the treatment of humans. The source is a N.P.I.-20-5400W, Serial Number T-1064 containing 4010 curies on September 1, 1990.

1. Report of Inspection

An inspection certificate signed by Leslie Forrest, Neutron Products, Inc., states that the teletherapy unit has been inspected on August, 17, 1990, to assure proper function of the source exposure mechanism. Neutron Products is licensed by the State of Maryland, Number MD-31-025-03 to perform such inspections.

2. Interlocks

Closed circuit TV and an observation window are used to observe the patient during treatment. The interlocks on the treatment room door and the door to a storage room beneath the treatment room were functioning properly. This storage room door is locked and the key is kept on the key ring with the key to the Theratron 80 control console.

With the curved arm of the teletherapy unit at 0°, the source could not be moved to the ON position unless the source head swivel angle was within 10° towards console and 13° away from console. With the

curved arm at 45^0 , the source could not be moved to the ON position unless the source head swivel angle was within $45^0 + 10^0$ towards the console and $45^0 + 13^0$ away from the console. In rotation made, the head swivel angle allowed is between 0 and $\pm$ 1 degree.

3. Warnings - Emergency Plans

The entrance to the therapy room, the fence around the restricted area on the roof, and the storage area under the therapy room are posted "Caution, High Radiation Area." The entrance door and treatment head are posted "Caution - Radioactive Materials". Red warning lights over the door, on the console, and the therapy machine indicate a beam "on" condition. Green lights on the therapy machine and on the console indicate that the source is fully retracted. An independent source position indicator of the G-M type is located in the room giving positive indication of radiation levels of above or below 5 mR/hr. A sign is posted over the control console giving emergency action to be followed if the source fails to retract.

4. Leak Test

Wipes of the inside of the collimator and window area indicate less than 0.005 microcuries of removable activity. Neutron Products leak tested the source by the helium pressure test and found it to be leak free. Wipes of both the inner and outer container indicate 0.020 and 0.0001 microcuries respectively.

5. Field of Irradiation

Coincidence of the light field and photon field was demonstrated with film. Field symmetry films were also taken to insure proper source positioning.

6. Calibration

The output on August 18, 1990, for a 20 x 20 cm2 field at 80 cm was 141.1 rads/min (5429 RHM).

7. Timer Check

The timer operated properly to move the source to the on and off positions. The timer agrees with a stop watch to within 0.2 second on a two minute exposure.

8. Beam-Off Head Leakage

The beam-off head leakage was measured at points on the surface of an imaginary sphere of 1 meter radius and centered on the source in the off position. A maximum reading of 2.7 mR/hr was obtained. The average of 14 readings on the imaginary sphere was 1.3 mR/hr. Measurements were made with a Keithley model 36150 survey instrument. This instrument was calibrated on August 19, 1989, by positioning it at distances from a cesium-137 source which were calculated to produce readings of 1/3 and 2/3 full scale on each scale of the instrument.

The survey form is attached.

9. Survey

The survey assumes 200 treatments per week at given doses of less than 400 rads at one meter each. This gives a workload of less than 80,000 rads per week at one meter. Current beam-on time required to get 80,000 rads/week is 14.7 hours. See attached data and results.

The survey of areas external to the treatment room was done with a polystyrene phantom in treatment position to scatter the radiation, the maximum field size of 32 x 32 cm was used, and the SSD to the phantom was 80 cm. The measurements were made with a Keithley model 36150 survey meter calibrated as described in Section 8 on August 19, 1989. A "nominal" measurement was made with the curved arm at 0° and the source head at 0°, and a "worst case" measurement was made with the curved arm rotated $\pm 30^{\circ}$ and source head at 0° to angle the beam toward the areas adjacent to the treatment room. In both cases the beam stop intercepted the primary beam. The therapy room is located on the first floor with a restricted storage area beneath it and a restricted roof area above it. To the left is the control area (console) and to the right is a restricted roof area. Behind is a restricted room where a cobalt teletherapy unit has just be removed and in front is a restricted storage room.

10. Restricted Areas

A restricted area is below the treatment room. The door is interlocked to the machine. The key to the room below is on the key ring that operates the unit. The roof above the unit is also restricted. Access is through a screened window on the third floor to the roof. From there it is necessary to cross 75 feet to a ledge posted "Caution, High Radiation Area." On this ledge is a fence which encloses the restricted area. Radiation area signs are also posted along the fence.

Entry into the restricted area on the roof is possible through a gate; however, this gate remains locked by a padlock. The key for this padlock is attached to the key ring of the teletherapy unit. It requires the teletherapy unit key ring to open the restricted area gate.

11. Control Console

All indicator lights were found to be correctly indicating the current status of the teletherapy unit and its controls. All controls were found to be operating properly.

Radiation "on" and "off" conditions were tested using an electrometer with an ion chamber in the beam. Beam interlocks were tested using the survey meter mentioned in Section 8.

Emmanuel Ekwelundu

EMMANUEL C. EKWELUNDU, Ph.D.
Medical Physicist

cc: U.S. Nuclear Regulatory Commission
Region III
799 Roosevelt Road
Glen Ellyn, IL 60137

Worksheet (2) for calculating the dose to water at d_{max} from photon beams

Name: E.C. EKWELUNDH Date: 8/18/90

1. Radiation source: Th-80, Co-60; Stated energy: 1.25 MeV
   Ionization ratio: 0.55598 (Sec. IV B) Nominal accelerating potential: 2.5 (Fig. 3) MV
2. Phantom material (med): Polystyrene SSD: 80 cm
   Collimator field size: 10 x 10 cm²; Depth of measurement: 5 cm
1.1. Dose to phantom material per monitor unit [Eq. (9)]:

$$D_{med}/U = (\overline{M/U})\, N_{gas} (\bar{L}/\rho)^{med}_{air} P_{wall} P_{ion} P_{repl},$$

where U refers to accelerator monitor units, or time for a ^{60}Co unit.

1.2. The chamber temperature T = 22.5 °C and pressure P = 741.6 mmHg at the time of measurement. The chamber signal M is normalized to 22 °C and 1 atmosphere using the factor:

$$\frac{T + 273\,^{\circ}C}{295\,^{\circ}C} \times \frac{760\ mmHg}{P} = 1.0274 \quad P_{TP}$$

1.3. Mean chamber signal per monitor unit (at the higher collecting potential, and normalized to 22 °C and 760 mmHg)

1.897, 1.8995, 1.8975 $\bar{M} = 1.898 \times 10^{-8}$

$(\overline{M/U})$ = 1.9918 x 10⁻⁸ C/monitor unit

or $(\overline{M/U})$ = _____ scale division/monitor unit

$k = 1+\alpha = 1 - 0.021 = 0.979$ min

4. Cavity-gas calibration factor:
   Chamber model: PTW N23333 #1226 Wall material: Acrylic
   Inner diameter: 6.1 mm Wall thickness: 0.053 g/cm²
   N_{gas} = 45.32 x 10⁸ Gy/C or Gy/scale division.
5. Stopping-power ratio (Fig. 2, Table IV): $(\bar{L}/\rho)^{med}_{air}$ = 1.112
6. Wall correction factor [Eq. (10)]:

$$P_{wall} = \frac{[a(\bar{L}/\rho)^{wall}_{air}(\bar{\mu}_{en}/\rho)^{med}_{wall} + (1-a)(\bar{L}/\rho)^{med}_{air}]}{(\bar{L}/\rho)^{med}_{air}} = 0.9940$$

Fraction of ionization from chamber wall (Fig. 7): a = 0.44

If $a > 0.25$, enter a and $(1-a)$. $(1-a)$ = 0.56

If $a < 0.25$, enter $a = 0$ and proceed to 4.

Stopping-power ratio (Fig. 2, Table IV): $(\bar{L}/\rho)^{wall}_{air}$ = 1.103

Energy-absorption coefficient ratio (Table IX):

$(\bar{\mu}_{en}/\rho)^{med}_{air}$ 1.072 + $(\bar{\mu}_{en}/\rho)^{wall}_{air}$ 1.078 = $(\bar{\mu}_{en}/\rho)^{med}_{wall}$ 0.9944

4. Ionization recombination correction (Sec. IV C and Fig. 4): P_{ion} = 1.0008
5. Replacement (gradient) correction (Fig. 5): P_{repl} = 0.992
6. Dose to phantom material per monitor unit or per unit time,[1] at point of measurement: D_{med}/U = 99.0588 cGy/monitor unit ✓FAH
7.1. Dose to water per monitor unit, at d_{max} [Eq. (17)]:

$$D_{water}(\text{at } d_{max})/U = \frac{(D_{med}/U) \times ESC \times (\bar{\mu}_{en}/\rho)^{water}_{med}}{P/100}$$

7.2. Correction for excess scatter from acrylic phantoms (Table XIV): ESC = 1.00

7.3. Energy-absorption coefficient ratio (Table XII): $(\bar{\mu}_{en}/\rho)^{water}_{med}$ = 1.036

7.4. Percent depth dose at depth of measurement: P = 78.8 %

7.5. Dose to water per monitor unit, at d_{max}: $D_{water}(\text{at } d_{max})/U$ = 130.2347 cGy/monitor unit ✓KAH

[1] Cobalt-60 units may have a nonlinear relationship between dose per unit time and time, especially for short exposure times. Corrections should be made using the method of Orton and Sieben (Ref. 58).

$D_{tissue} = D_{water} \times 0.99 = 128.93$ cGy/min ✓KAH

ELLIS FISCHEL STATE CANCER CENTER
DEPT OF RADIATION ONCOLOGY

AECL THERATRON 80. S/N 141
NEUTRON PRODUCTS SOURCE
MODEL # NPI-20-5400W. S/N T-1064
80 CM SSD

CAL VALUE = 128.93 RADS/MIN ON 8/15/90

FIELD SIZ	AUG	SEPT	OCT	NOV	DEC	JAN
4x4	120.29	118.98	117.68	116.40	115.12	113.87
5x5	121.71	120.38	119.07	117.77	116.48	115.21
6x6	123.13	121.78	120.46	119.14	117.84	116.55
7x7	124.80	123.44	122.09	120.76	119.44	118.14
8x8	126.09	124.72	123.36	122.01	120.68	119.36
9x9	127.51	126.12	124.74	123.38	122.03	120.70
10x10	128.93	127.52	126.13	124.75	123.39	122.04
11x11	130.09	128.67	127.27	125.88	124.50	123.14
12x12	131.25	129.82	128.40	127.00	125.61	124.24
13x13	132.41	130.97	129.54	128.12	126.72	125.34
14x14	133.57	132.11	130.67	129.25	127.83	126.44
15x15	134.60	133.13	131.68	130.24	128.82	127.41
16x16	135.51	134.03	132.56	131.12	129.68	128.27
17x17	136.28	134.79	133.32	131.86	130.42	129.00
18x18	137.18	135.68	134.20	132.74	131.29	129.85
19x19	137.74	136.45	134.96	133.49	132.03	130.59
20x20	138.60	137.09	135.59	134.11	132.65	131.20
21x21	139.24	137.72	136.22	134.73	133.26	131.81
22x22	139.89	138.36	136.85	135.36	133.88	132.42
23x23	140.40	138.87	137.36	135.86	134.37	132.91
24x24	140.92	139.38	137.86	136.36	134.87	133.39
25x25	141.44	139.89	138.37	136.86	135.36	133.88
26x26	141.82	140.27	138.74	137.23	135.73	134.25
27x27	142.21	140.66	139.12	137.60	136.10	134.61
28x28	142.47	140.91	139.37	137.85	136.35	134.86
29x29	142.60	141.04	139.50	137.98	136.47	134.98
30x30	142.85	141.29	139.75	138.23	136.72	135.22
31x31	142.98	141.42	139.88	138.35	136.84	135.35
32x32	143.11	141.55	140.01	138.48	136.96	135.47

TIMER ERROR: 0.03 MINS (ADD TO TREATMENT TIME)

E.C. EKWELUNDU. Ph D
MEDICAL PHYSICIST
8/24/90

K. HICKEY. Ph.D
TELETHERAPY PHYSICIST
Keith A. Hickey

FULL CALIBRATION

AECL Theratron-80, S/N 141
Neutron Products Source: Model #NPI-20-5400W; S/N T-1064

Calibration Equipment
PTW N23333, S/N 1226 ion chamber with acrylic build-up cap.
Keithley 616/6169 electronmeter, S/N 41952A/41453A
Nx=53.4553 R/Rdg and was calibrated by M.D. Anderson Cancer Center on 7/11/90.
Ngas = 45.32 x 10^{8} cGy/Rdg (includes electrometer calibration factor of 0.996 x 10^{-8})

1. Output in Air
Probe at 80 cm SAD with build-up cap; 10x10 cm2 field.
T = 18.4° C P = 741.5 mmHg
Ctp = 1.0124
Leakage = 0.003 x 10^{-11} A.

Timer Error
M1 = 2.415, 2.415, 2.415 $\bar{M}1$ = 2.415 -- 1 min readings
Mn = 2.26, 2.265, 2.265 $\bar{M}n$ = 2.2633 -- 4 x 0.25 min reading

$$\alpha = \frac{\bar{M}1 - \bar{M}n}{\bar{M}n - 4\,\bar{M}1} \times t$$

$$= \frac{2.415 - 2.2633}{2.2633 - 4 \times 2.415} \times 1 = -\frac{0.1517}{7.3967} = -0.021$$

$\therefore$ Timer Error α = -0.021 mins

$$\text{Output} = \frac{M \cdot Ctp \cdot Nx \cdot BSF \cdot Aeq \cdot f \cdot (80/80.5)^2}{1 + \alpha}$$

Aeq = 0.985 -- attenuation in 0.5 cm of muscle.

a) $$\text{Output} = \frac{2.415 \times 1.0125 \times 53.4553 \times 1.035 \times 0.985 \times 0.957 \times (80/80.5)^2}{1 - 0.021}$$

= 128.63 rads/min for 10x10 cm2 field in tissue.

M = 2.56, 2.555, 2.565 M = 2.56 -- 1 min reading for 20x20 cm2 field.

T = 18.1° C
P = 741.5 mmHg; Ctp = 1.0114

b) Output = $\frac{2.56 \times 1.0114 \times 53.4553 \times 1.059 \times 0.985 \times 0.957 \times (80/80.5)^2}{1 - 0.021}$

= 139.38 rads/min for 20x20 cm2 field in tissue.

= 5429 RHM

2. Timer Linearity

Time (min)	Reading (x10-8C)	Rdg / Time + TE	Δ% w.r.t. 1min
0.10	0.1985	2.5127	1.9
0.25	0.568	2.4803	0.5
0.50	1.188	2.4802	0.5
1.00	2.415	2.4668	---
2.00	4.905	2.4785	0.5
4.00	9.850	2.4755	0.4

Y = MX + b
M = 2.4755
b = -0.0514

Correlation Coefft r = 1.00

3. Output w.r.t. gantry angle in air
Probe at 80 cm SAD, 15 x 15 cm field, probe with acrylic build-up cap.

Angle	Reading ($x10^{-11}$ A)	Δ% from Average Reading
50	40.95	0.17
90	40.75	0.32
180	40.80	-0.20
270	40.95	0.17
0	40.95	0.17
Average Reading =	40.88	

4. Field Size Dependence in Air
Probe at 80 cm SAD with build-up cap.

Field Size	Reading ($x10^{-11}$ A)	FSD air	BSF	FSD Phantom
5 x 5	38.55	0.9601	1.018	0.944
7 x 7	39.25	0.9776	1.025	0.968
10x10	40.15	1.000	1.035	1.000
12x12	40.65	1.0125	1.041	1.018
15x15	41.35	1.0299	1.049	1.044
18x18	41.90	1.0436	1.055	1.064
20x20	42.20	1.0511	1.059	1.075
25x25	42.75	1.0648	1.066	1.097
30x30	43.05	1.0722	1.070	1.108

5. Inverse Square Check in Air
10 x 10 cm2 field at 80 cm SAD with build-up cap.

Distance	Reading ($\times 10^{-10}$ A)	$1/\sqrt{RDG}$	$\frac{R}{R80}$	$\frac{(80)^2}{(d)^2}$	Δ%
60	7.345	0.369	1.807	1.778	1.6%
70	5.355	0.432	1.317	1.306	-0.8%
80	4.065	0.496	1.0	1.0	---
90	3.195	0.560	0.7860	0.7901	-0.5%

Y = MX + b
M = 0.0064 , b = -0.0135 , r = 1.000
When Y = O, x = - b/m = 2.1 cm
∴ source is at 77.9 cm

∴ IVSL is correct for $\left(\frac{80 - 2.1}{(\text{Distance} - 2.1)}\right)^2$

6. Output in polystyrene phantom
Probe at 5 cm depth; 10 x 10 cm2 field at 80 cm SSD.
T = 22.5°C , P = 741.0 mmHg

Ionization Ratio
10 x 10 cm2 at 80 cm SAD
10 cm depth: 2.835 x10-10A
20 cm depth: 1.587 x10-10A

Ionization Ratio = $\frac{1.587}{2.835}$ = 0.5598

Nominal Acc. Potential = 2.5 MV

Pion
Probe at 5cm depth; 80cm SSD , 10x10 cm2 field.
-300V
1.897, 1.8995, 1.8975 -- 1 min readings

-150V
1.895, 1.8965, 1.8975, 1.8965 -- 1 min readings

Pion = $\frac{1.8980}{1.8964}$ = 1.0008

7. Tray Factor
Probe at 5cm depth in polystyrene, 80cm SSD.

Field Size	Open	1/4" Tray, Dotted	1/4" Plane Tray	$\times 10^{-10}$ A
10x10	3.215	3.065	3.08	
20x20	3.58	3.435	3.445	
30x30	3.735	3.60	3.615	

Dotted Tray Factor	Plane Tray Factor
0.9533	0.9580
0.9595	0.9623
0.9639	0.9679
0.9589	0.9627

Extended Tray Factor

Field Size	Open	Extended Tray	Tray Factor
30x30	3.735	3.63	0.972

8. Wedge Factor
Probe at 5cm depth in polystyrene, 80cm SSD

Field Size	Open(x10-10A)	0o Wedged ($x10^{-10}$ A)	180o Wedged ($x10^{-10}$ A)	Average Wedge Fact
30°				
10Wx15	3.305	2.405	2.355	0.720
8Wx15	3.235	2.415	2.465	0.754
6Wx15	3.145	2.445	2.495	0.785
45°				
10Wx15	3.315	2.2195	2.135	0.657
8Wx15	3.235	2.285	2.22	0.696
5Wx15	3.075	2.415	2.48	0.796
6Wx15	broken	----	----	----
10Wx8	3.14	2.00	2.055	0.646
60°				
10Wx15	3.305	1.368	1.443	0.425
8Wx15	3.235	1.544	1.627	0.490
6Wx15	3.145	1.713	1.815	0.561

9. Percent Depth Dose
Used Capintec parallel plate ion chamber in polystyrene; 10x10 cm2 field at 80cm SSD.

Depth (cm)	Reading (x10-10A)	%DD
0.5	3.605	100
3.0	3.165	87.8
5.0	2.785	77.3
10.0	1.965	54.5
15.0	1.354	37.6
18.0	1.079	29.9

From BJR #17, %DD at 5cm = 78.8

10. Light Field

Set	Measured
5x5	5.1 x 4.95
10x10	10.0x10.08
15x15	15.0x14.88
25x25	25.0x24.9
33x33	32.9x32.8

11. Distance Indicator
Stick 32.05 cm

12. Safety/Mechanical Checks

a. Door interlock OK
b. Beam condition indicator light on unit OK
c. Beam condition indicator light on console OK
d. Warning light over door OK
e. TV monitoring unit OK
f. Pb glass viewing window OK
g. Intercom OK
h. 2 area monitors + back-up batteries OK
i. Reset required when enter + exit door OK
j. Radiation warning signs posted OK
k. Timer constancy OK
l. Timer accuracy + linearity OK
m. Lasers adjusted to 80cm OK
n. Radiation/Light field congruence OK
o. ODI + mechanical distance OK
p. Field size indicators OK at 5x5, 10x10, 15x15, 25x25, 33x33.
q. Mercury switches for beam limiting of head rotation OK
r. Emergency stop bar on console OK
s. Emergency stop bar on unit table OK
t. Inside door handle OK

13. Light Field/Radiation field coincidence checked for 6x6, 10x10, 15x15 and 20x20.
Used V film, 80cm SSD and 0.5cm polystyrene build-up.

Uniformity film taken at 10cm depth in polystyrene, 80cm SSD and 15x15 cm2 field.

RESULTS OF RADIATION PROTECTION SURVEY

Point	Area	Beam Toward Floor (mR/hr)	30 Scatter that Gives Max Radiation levels in mR/hr
A	Control area	2.2	4.3
	Typical in control area	2.0	10.0
B	Treatment room door	3.8	10.8
	Typical near door	1.8	14.0
C	Superficial X-ray room	0.3	0.7
D	Adjacent teletherapy treatment room against the wall separating the treatment rooms	6.5	8.4
E	Storage room to the right of treatment room & control console (controlled area)	1.9	3.2
F	Office (non-controlled area)	0.2	0.4
	Restricted storage room beneath treatment room (controlled & interlocked area)		
	Maximum in room	65.4	18
	At entrance to room	3.7	2.5
	Roof area		
G	South fence	0.1	0.3
H	South fence	0.1	0.6
I	South fence	0.3	1.1
J	South fence	0.3	1.3
K	South fence	0.3	0.7
L	North fence	0.1	0.1
M	North fence	0.1	0.2

ELLIS FISCHEL STATE CANCER CENTER
115 Business Loop 70W
Columbia, MO 65203

TELETHERAPY HEAD SURVEY

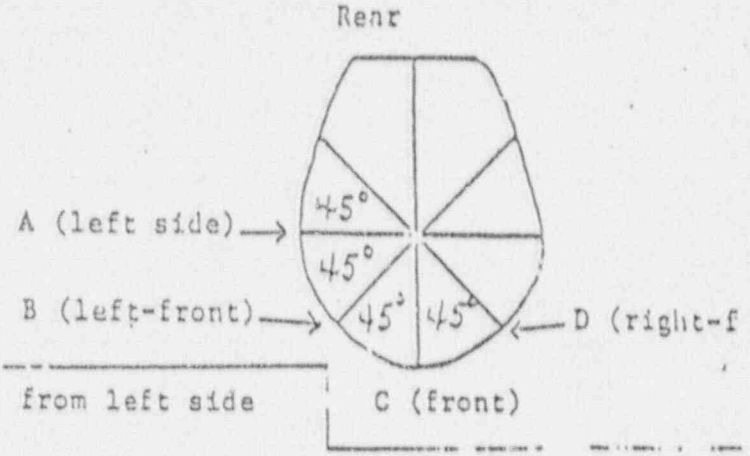
(Source in "OFF" position. Measurements taken one meter from source)

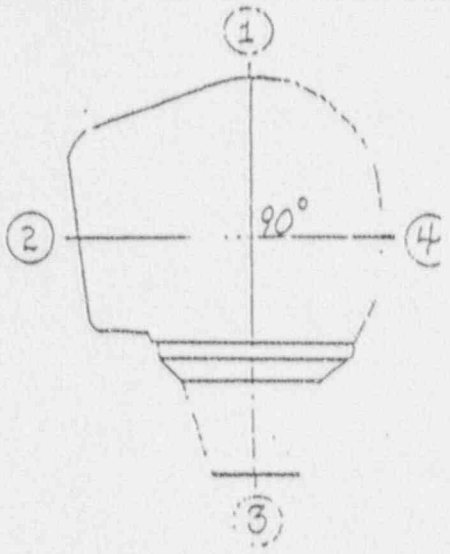
	Position No.	Radiation Level (mR/hr)
View A	1	2.1
	2	0.6
	3	2.7
	4	2.2
View B	5	0.9
	6	2.2
	7	0.8
	8	0.4
View C	9	1.7
	10	1.4
View D	11	0.3
	12	0.3
	13	2.2
	14	0.9

Average value 1.3

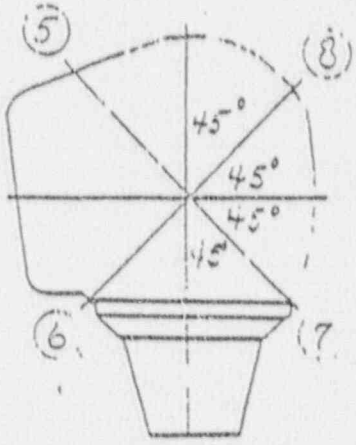
Maximum value 2.7

Top View - Showing orientation of Views A through D

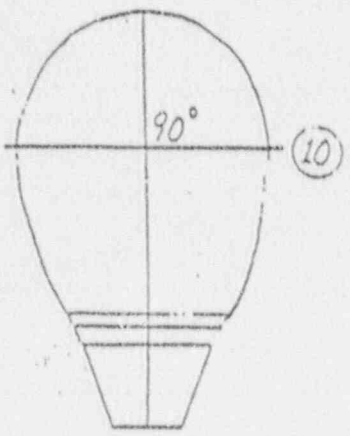




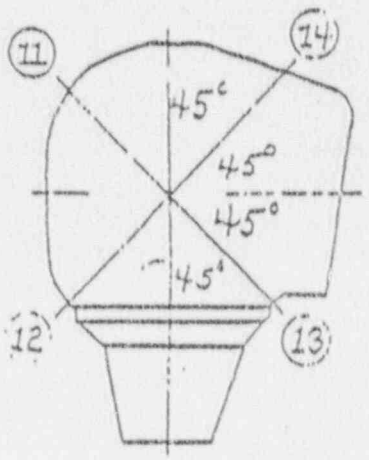
View B - Vertical from left-front



View C - Vertical from front



View D- Vertical from right-front

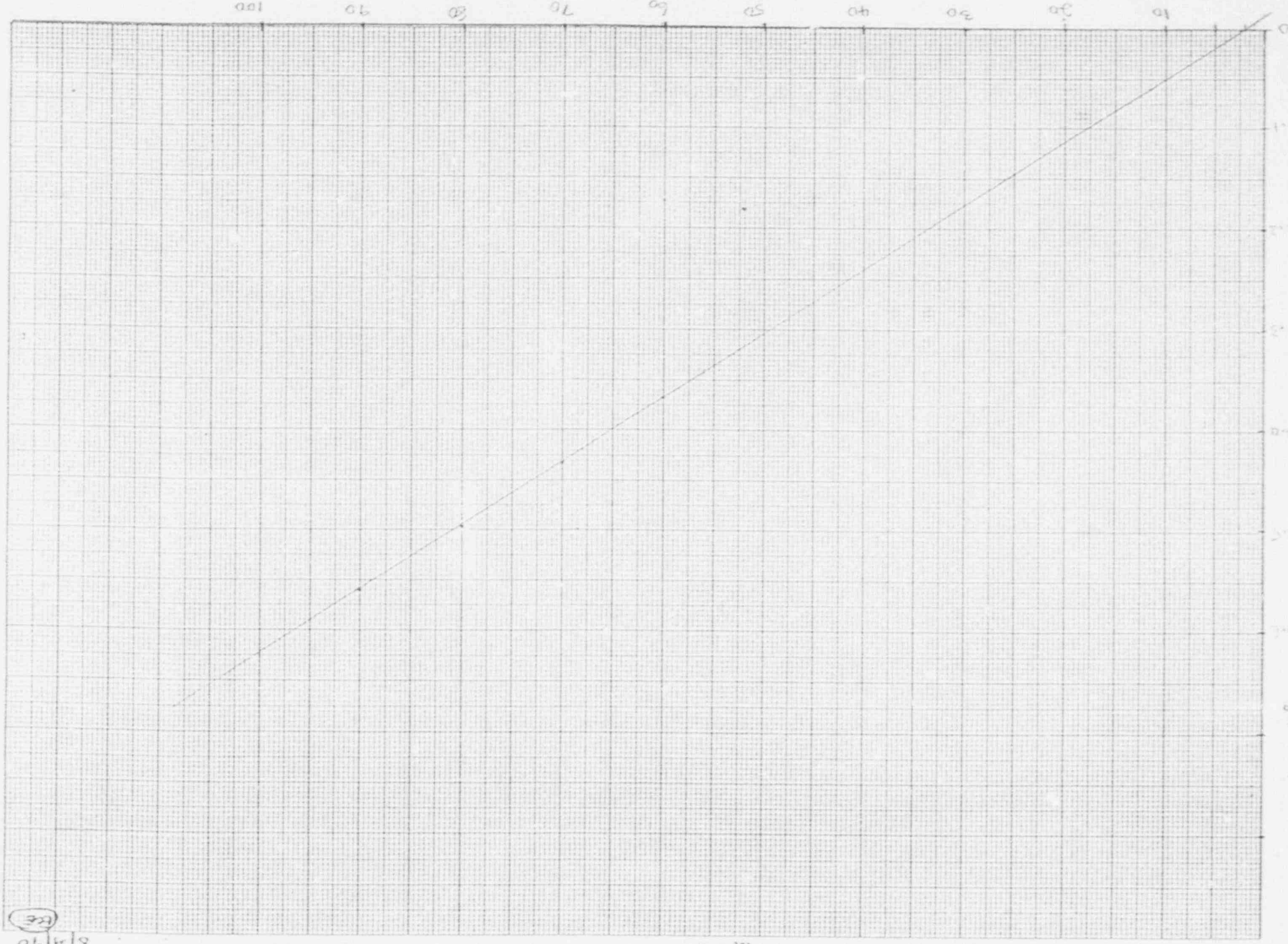


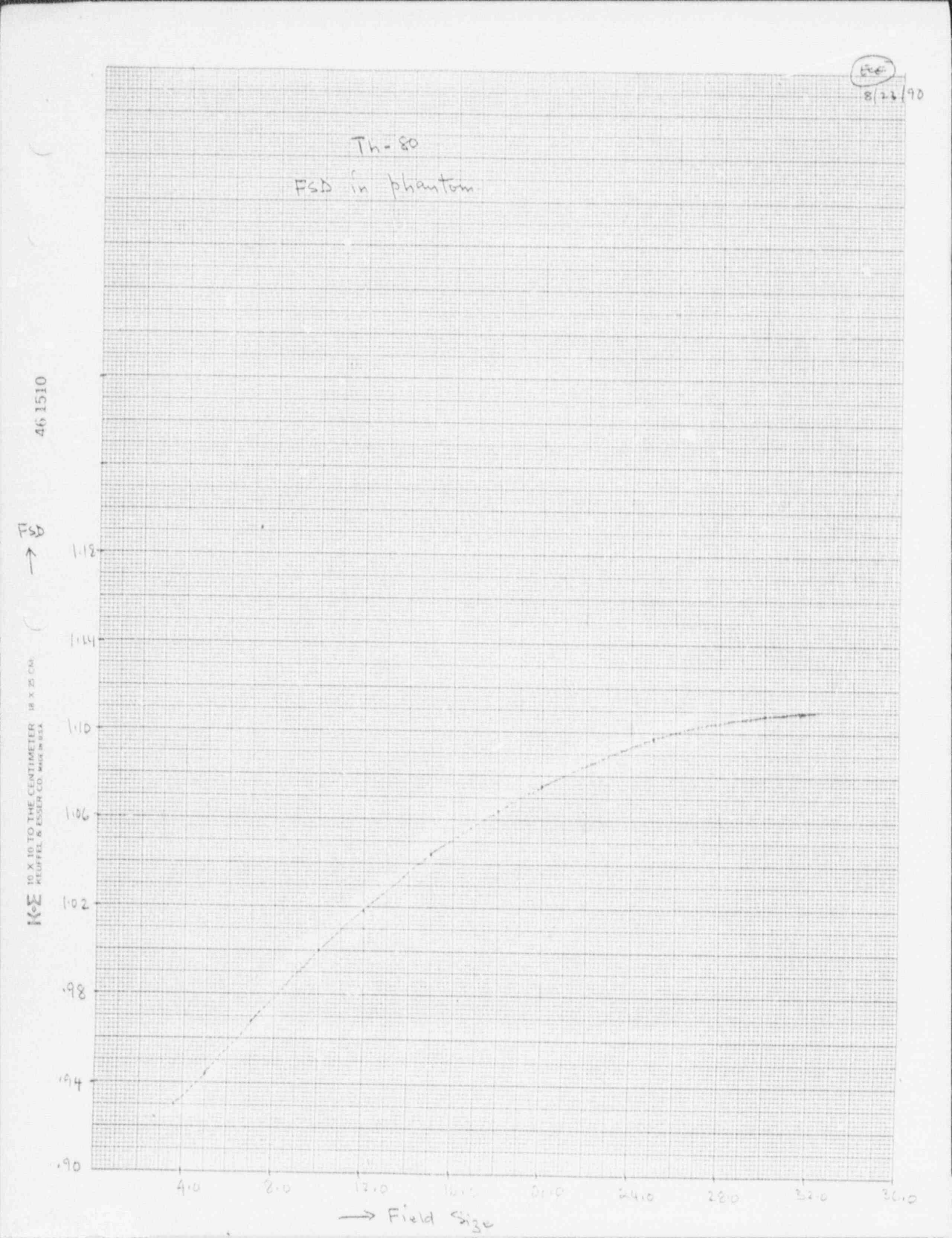
Instrument used Keithley 36150
S/N 18075, Last Cal Date: 8/19/89

Curies & Date 4010 9/1/90

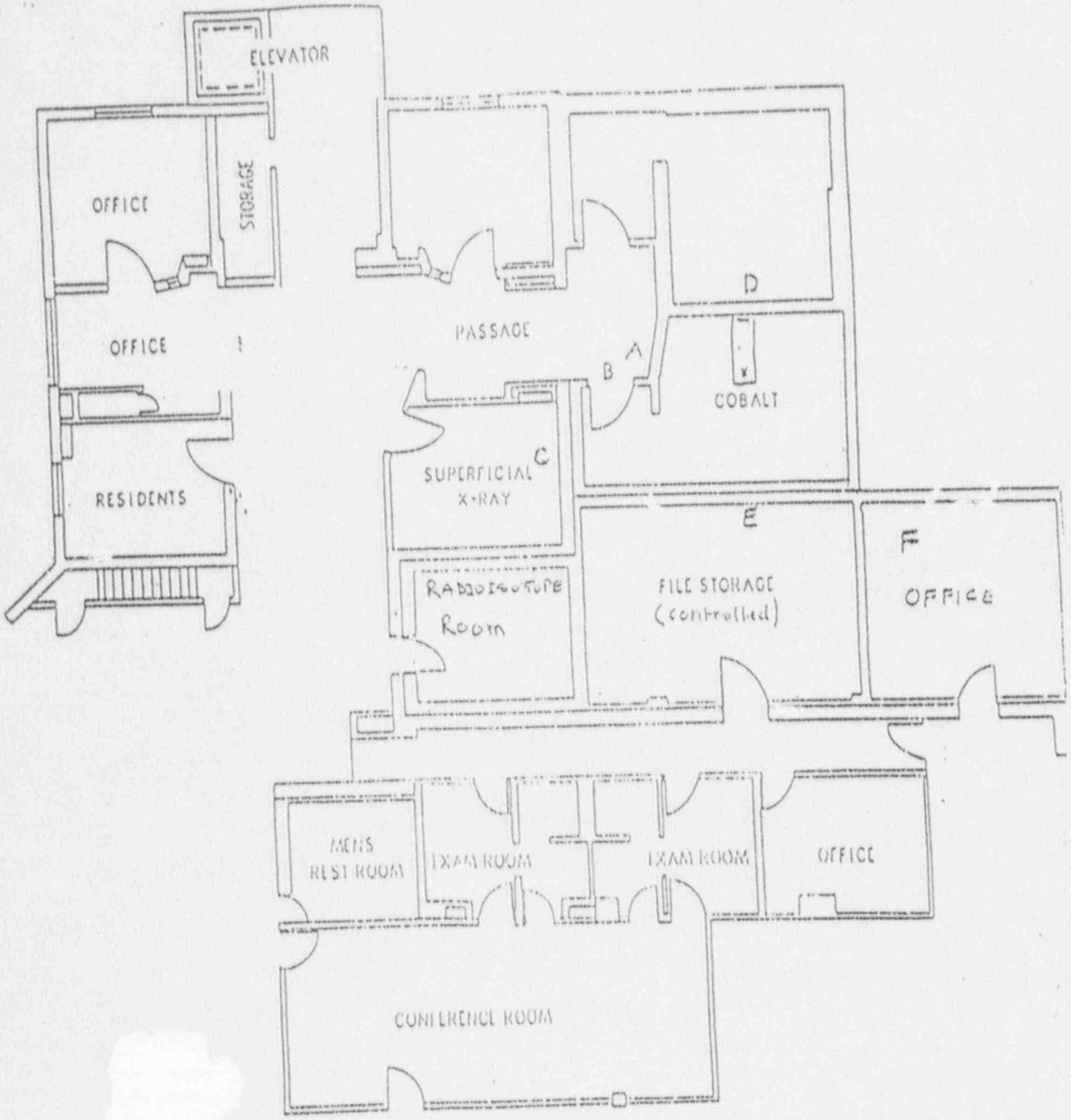
Manufacturer's name & model # of teletherapy unit AECL: Theratron-80
S/N 141

Done: 8/18/98



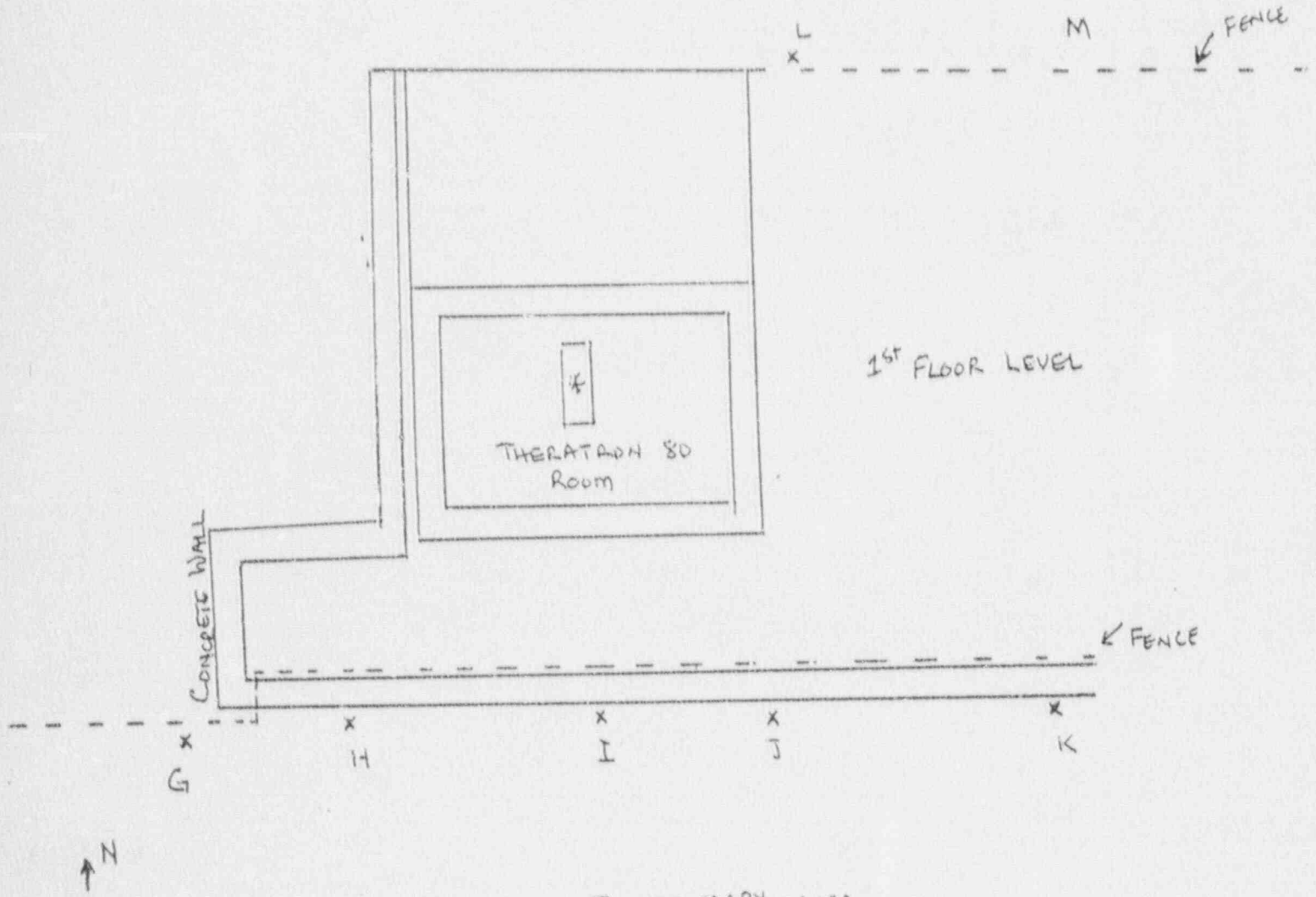

8/22/90
Th-80
FSD in phantom
46 1510
FSD
1.18
1.14
1.10
1.06
1.02
.98
.94
.90
4.0
8.0
12.0
16.0
20.0
24.0
28.0
32.0
36.0
Field Size
10 X 10 TO THE CENTIMETER 18 X 25 CM.
KEUFFEL & ESSER CO. MADE IN U.S.A.

ELLIS FISCHEL STATE CANCER CENTER

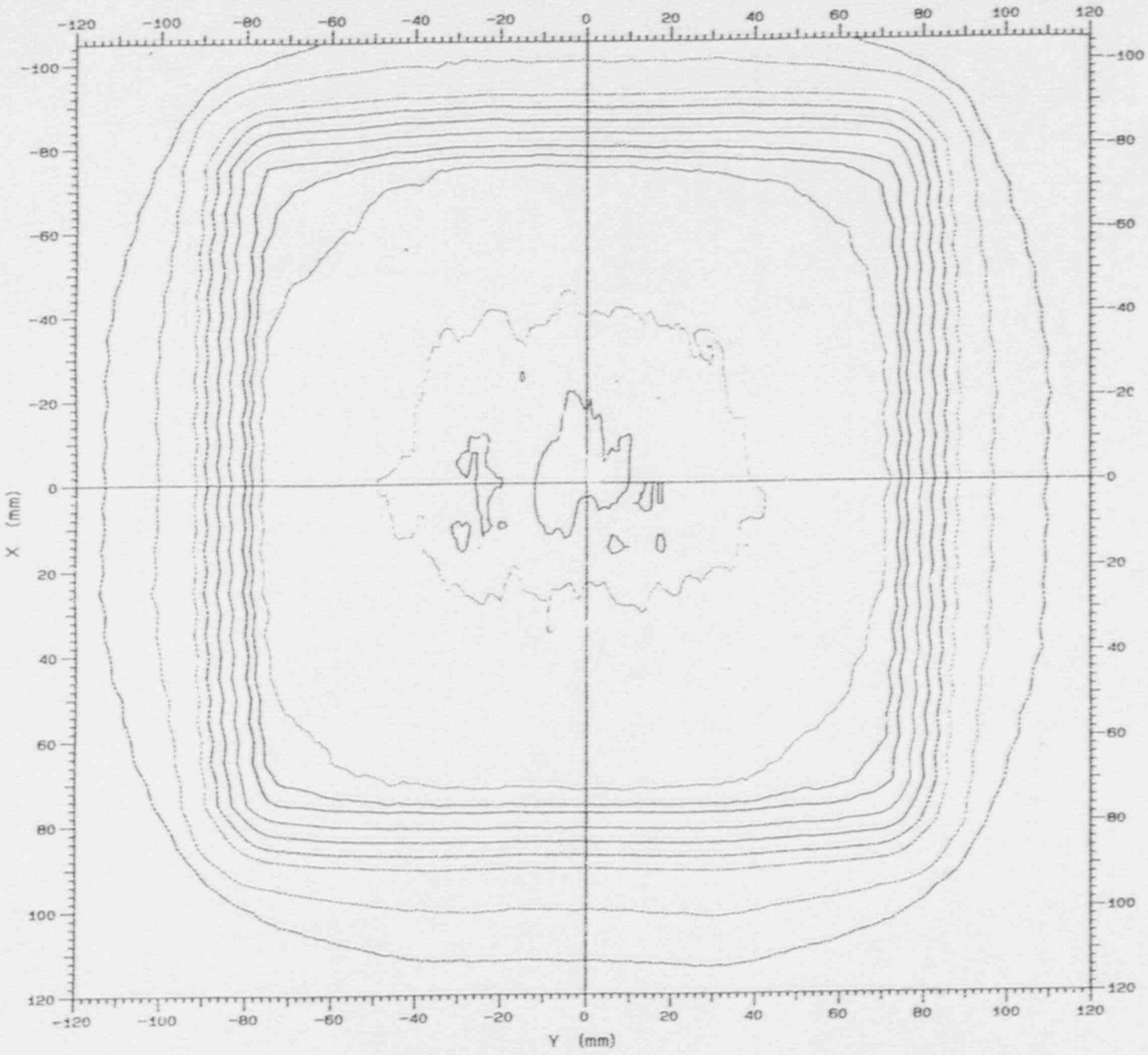


RADIATION THERAPY - FIRST FLOOR

ELLIS FISCHEL STATE CANCER CENTER



ROOF ABOVE TELETHERAPY AREA



LEGEND

Th80-21x21/6-y/21/8/90

Machine descr..	THERATRON 80
Energy.....	1.25
Modality.....	Photon
Data Type.....	Film
Src Surf Dist..	800 mm.
Field Size.....	At Surface
left.....	105 mm.
right.....	105 mm.
gantry.....	105 mm.
couch.....	105 mm.
Date scanned...	21 Aug 90
Scale factor...	1.000 : x.000
Software vers..	1.25d

102
100
95
90
85
80
70
60
50
40
30
20
10

TELETHERAPY SOURCE CERTIFICATION

This certifies that the cobalt-60 source:

Model Number: NPI-20-5400W

Serial Number: T-1064

Containing 4010 curies as of: 9/1/90

was fabricated by Neutron Products, Inc. in accordance with NPI specification P-4 per Drawing Number A20005 and was leak tested by the helium pressure test and found to be leak free on 8-10-90. The source was wipe tested and the removable activity was 1020 and .0201, microcuries respectively, from the inner and outer encapsulations, respectively.

Performed by and certified to by:

Jeffrey W. Corun

Jeffrey W. Corun, Manager
Hot Cell Operations

Reviewed and approved by:

Wayne J. Costley

Wayne J. Costley
Quality Assurance Manager

8/13/90

Date

neutron products inc

22301 Mt. Ephraim Road • P. O. Box 68 • Dickerson, Maryland 20842 USA • 301/349-5001
TWX: 710-828-0542 • FAX: 301/349-5007

TELETHERAPY SOURCE TRANSFER

This is to certify that a cobalt-60 source:

Model Number: NPI-20-5400W
Serial Number: T-1064
Containing 4010 curies as of 9/1/90

and which has been determined by helium pressure test and by wipe test to be leak free, has been installed in a teletherapy unit described as follo s:

Manufacturer: AECL
Model Number: Theratron 80
Serial Number: 141

This source is hereby transferred from Neutron Products' Radioactive Materials License MD-31-025-03 to Ellis Fischel State Cancer Center's License No. 24-00481-04.

This will also certify that a cobalt-60 source described as follows:

Model Number: NPI 20 5400 W
Serial Number: T-617
Containing 2025 curies as of 9-1-90

has been determined by a wipe test to be leak free and has been removed from the above teletherapy unit and transferred from Ellis Fischel State Cancer Center's License No. 24-00481-04 to Neutron Products' License MD-31-025-03.

We have witnessed the inspection and operation of the above teletherapy unit after completion of the installation by Neutron Products, Inc. and have found the unit to be operating properly and safely.

Emmanuel Ekwelundu

Date 8/17/90

Leslie E. Forest
Neutron Products, Inc.

Date Aug. 17, 1990

neutron PRODUCTS inc

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TWX: 710-828-0542 • FAX: 301/349-5007

Facility Address:

Ellis Fischel State Cancer Center
15 Business Loop 70 West
Columbia, Missouri 65203

Revision Date
July 25, 1983

INSPECTION CHECK LIST

Unit: Theratron 80 Serial Number: 141

	Operation	Prior to Transfer*	Subsequent to Transfer**
	1. Determine Operating History	X ✓	
	2. Head Movement	X ✓	X ✓
	3. Electrical and Mechanical Source Condition-Indicator Check	X ✓	X ✓
	4. Manual Source/Shutter Return	X ✓	X ✓
	5. Timer	X ✓	X ✓
	6. Source Holder/Shutter Movement Check	X ✓	X ✓
	7. Pneumatic Activating System	X ✓	X ✓
N/A	8. Mercury Shutter System	X ✓	X
	9. Stand and Stretcher		X ✓
	10. Protective Source Housing, Beam-Off Leakage (Confirm Measured by Medical Physicist)		X
	11. Source-Surface Distance (SSD)		X ✓
	12. Beam Orientation	X ✓	X ✓
	13. Congruence of Light and Radiation Fields		X ✓
	14. Full Calibration (Confirm Performed by Medical Physicist)		X ✓
	15. Facility Door Interlock	X ✓	X ✓
N/A	16. Teletherapy Units with Moving Source Drawer	X ✓	X ✓
N/A	17. Teletherapy Units with Moving Shutter Blocks	X	X
N/A	18. Teletherapy Units with Rotating Shutter	X	X
	19. Indicator Light	X ✓	X ✓
	20. Emergency Shutoffs	X ✓	X ✓
	21. Collimator	X ✓	X ✓

Note: *Circle all items not meeting attached criteria.
**Circle all items not meeting attached criteria after servicing.

Signed: Leslie L Konert Date: Aug 17, 1990

NEUTRON PRODUCTS INC

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REPORT OF "FIVE YEAR" INSPECTION

This is to certify that the Atomic Energy of Canada Ltd. (AECL)
teletherapy unit, Model Theratron 80, Serial Number 141,
containing a cobalt-60 source, Model NPI-20-5400W, Serial Number T-1064
and located at Ellis Fischel State Cancer Center, 115 Business Loop 70 West,
Columbia, Missouri, 65203
was inspected on Aug 17, 1990 by Leslie Forrest
in accordance with the requirements of Maryland License MD-31-025-03 for a "5 year inspection" to provide assurance of the proper function of the source drive mechanism.

Signed Leslie L. Forrest Date Aug 17, 1990

The following parts were replaced:

2- Neon Diode Lamps.
1- Timer Decal

The following Non-Standard Service was performed:

CUSTOMER'S COPY

neutron products inc CONTROL NO. 90211

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