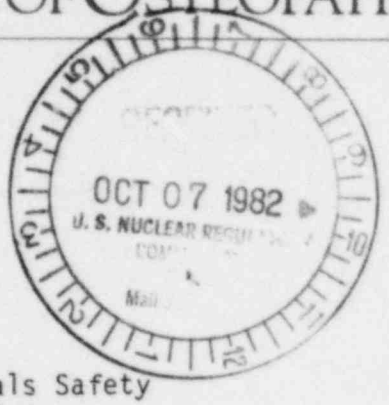
5200 South Ellis Avenue
Chicago, Illinois 60615

Administration (312)947-4774

CHICAGO COLLEGE OF OSTEOPATHIC MEDICINE



September 30, 1982

Patricia Vacca
Materials Licensing Branch
Division of Fuel Cycle & Materials Safety
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

RE: Teletherapy Survey Report, NRC License #12-04390-02

Dear Ms. Vacca:

Enclosed please find the Physicists Survey Report required by our license following the source replacement on September 3, 1982.

Also enclosed is a report of "Five Year Inspection" by Neutron Products, and other documents relative to the source exchange.

If there are any questions regarding this report please contact me.

Sincerely yours,

D Van Voorhis

Donald Van Voorhis
Administrator

enclosures

Amend.

RECEIVED BY LFMB
Date 10/15/82
Log
By
Orig. To
Action Compl.
T. J. Sweeney

COPIES SENT TO OFF. OF INSPECTION AND ENFORCEMENT

FEE EXEMPT

12750

TELETHERAPY SURVEY REPORT

Table I

1 Institution: Name Chicago Osteopathic Hospital

Address 5200 S. Ellis Avenue

City Chicago State Ill Zip 60615

N.R.C. License # 12-04390-02

2 Surveyor: Name C. R. Griffith

Address 1141 Hohlfelder Road

City Glencoe State IL Zip 60022

Certification Amer. Board of Radiology

3 Teletherapy Unit: Mfr Picker Model C-9 Serial 252

Teletherapy Source: Mfr Neutron Products Model NPI-20-3000W

4 Date of Source Installation 9-3-82 - Installation Completed

5 Date of Survey 9-3-82

6 Survey Instruments:

	Mfr	Model	Cal. Date	Cal Method
(Survey)	Victoreen	440	5-13-82	Health Physics Assoc. Chicago
(Calibration)	Victoreen	660	6-25-80	Cleveland R.C.L.
	Intercomparison		6-9-82	Current R.C.L. Victoreen 570
	~~Scheduled for calibration~~		~~10-26-82~~	~~K&S Associates A.D.C.L.~~ Nashville, Tennessee

7 Source Strength: Curies 3080 Date 10-1-82

8 Output: ~~R/min~~ RADS RADS/min 72.4 at 80 cm for ~~10x10~~ field on 9-5-82

9 Leakage Radiation: See Table II

10 Beam Orientation Limits & Method of Limitation

Unit rotates 360°. Machine operation is restricted so head is always directed to beam stop. There is no yolk or head rotation. Motor is disconnected.

11 Maximum Radiation Levels, Adjacent Areas, Rotation With Beam Stop (see Table IIIA)

~~12 Maximum Radiation Levels, Adjacent Areas Without Beam Stop (See Table IIIB)~~

13 Check List, Mechanical Functions:

a) Door Interlock OK See attached protocol

b) Source "on-off" indicators; mechanical OK, lights OK See attached protocol

c) Beam Stops functioning properly OK

d) Timer functions properly OK See attached protocol

e) Room monitor OK

22750

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

Position No.		Radiation Level (mR/hr)
View A	1	1.7
	2	1.0
	3	2.0
	4	1.5
View B	5	0.7
	6	1.0
	7	1.1
	8	0.5
View C	9	0.6
	10	0.6
View D	11	1.0
	12	1.2
	13	1.1
	14	0.8

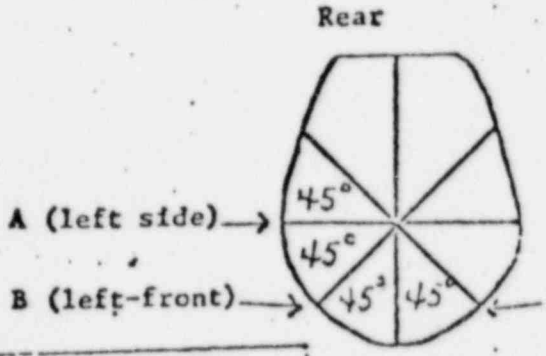
Average value 1.06

Maximum value 2.0

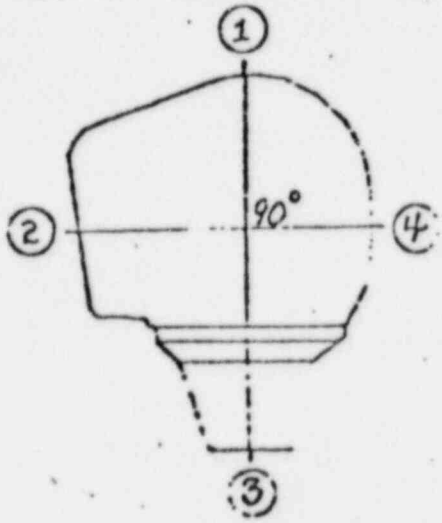
Instrument used
Victoreen 440
Calibrated 5-13-82
RHM 3072
Curies & Date 3080 10-1-82

Manufacturer's name & model # of teletherapy unit Picker C-9

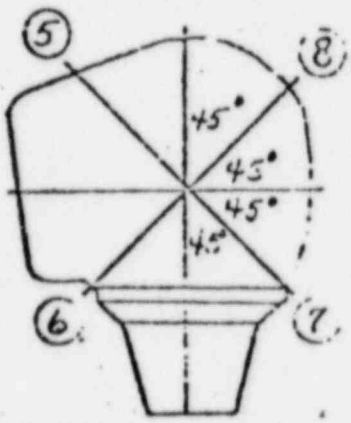
Top View - Showing orientation of Views A through D



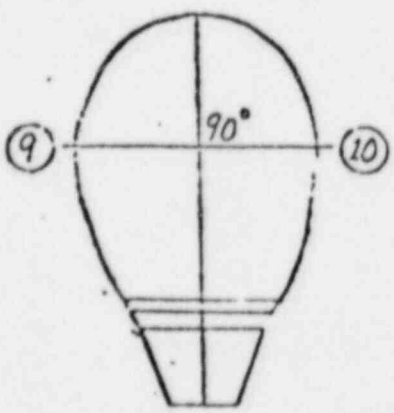
View A - Vertical from left side



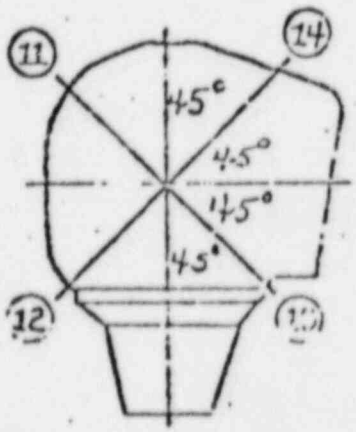
View B - Vertical from left-front



View C - Vertical from front



View D- Vertical from right-front



New Source

CHICAGO OSTEOPATHIC HOSPITAL

CHICAGO, ILL.

MONTH 9 SEPTEMBER

YEAR: 1982

OUTPUT (RAD/MIN) SSD = 80cm

FIELD SIZE	
4x4	67.2
5x5	68.4
6x6	69.5
7x7	70.3
8x8	71.1
9x9	71.7
10x10	72.4
11x11	72.9
12x12	73.4
13x13	73.9
14x14	74.3
15x15	74.7
16x16	75.1
17x17	75.5
18x18	75.8
19x19	76.2
20x20	76.5
21x21	76.8
22x22	77.1
23x23	77.4
24x24	77.6
25x25	77.9
26x26	78.1
27x27	78.4
28x28	78.6
29x29	78.8
30x30	79.0
31x31	79.2
32x32	79.4
33x33	79.6
34x34	79.8
35x35	80.0

Table III A

(A for rot. unit with beam stop,

B for no beam stop)

MAXIMUM EXPOSURES ADJACENT AREAS

A Barrier	B MPD mR/hr	C Type Occ	D Pos. of Max	E Max mR/hr
Floor		ON GRADE		
Door		C	9:00	3.5
Window		C	9:00	3.5
Control		C		M
N- AG BC		C	10:00	M 1.8
E- EFG		BELOW GRADE		
W- AB CD		C NC	10:00	1.8 M
S- DE		NC	1:00 5:00	0.5
Ceiling		NC	8;00	0.5

M ≤ 0.2 mR/hr

Notes:

A. Reference barriers as submitted On Architect's Drawing

B. MPD applicable to area

C. Type of occupancy (C - Controlled; NC - non-controlled)

D. and E see supplement tables III A5 for readings at all positions of beam at each barrier

TABLE III A 5 (A rot., B without beam stop)

EXPOSURE FOR BARRIER Door & Window .

Beam Orientation	Max. Reading
12:00	M mR/hr
1:00	M
2:00	M
3:00	M
4:00	M
5:00	0.6
6:00	1.2
7:00	1.5
8:00	2.0
9:00	3.5
10:00	2.5
11:00	0.5

Note: Readings taken with large beam on realistic phantom

M = < 0.25 mR/hr.

TABLE III A S (A rot., B without beam stop)

EXPOSURE FOR BARRIER Control .

Beam Orientation	Max. Reading
12:00	M mR/hr
1:00	M
2:00	M
3:00	M
4:00	M
5:00	M
6:00	M
7:00	M
8:00	M
9:00	M
10:00	M
11:00	M

Note: Readings taken with large beam on realistic phantom

TABLE III A S (A rot., B without beam stop)

EXPOSURE FOR BARRIER Wall AG .

Beam Orientation	Max. Reading
12:00	M mR/hr
1:00	M
2:00	M
3:00	M
4:00	M
5:00	M
6:00	M
7:00	M
8:00	M
9:00	M
10:00	M
11:00	M

Note: Readings taken with large beam on realistic phantom

TABLE III A 5 (A rot., B without beam stop)

EXPOSURE FOR BARRIER Wall BC .

Beam Orientation	Max. Reading
12:00	M mR/hr
1:00	M
2:00	M
3:00	M
4:00	M
5:00	M
6:00	M
7:00	0.6
8:00	M
9:00	M
10:00	1.8
11:00	1.0

Note: Readings taken with large beam on realistic phantom

M = < 0.25 mR/hr.

TABLE III A S (A rot., B without beam stop)

EXPOSURE FOR BARRIER Wall AB .

Beam Orientation	Max. Reading
12:00	M mR/hr
1:00	M
2:00	M
3:00	M
4:00	M
5:00	M
6:00	M
7:00	0.5
8:00	0.5
9:00	0.5
10:00	1.8
11:00	1.0

Note: Readings taken with large beam on realistic phantom

M = < 0.25 mR/hr.

TABLE III___S (A rot., B without beam stop)

EXPOSURE FOR BARRIER WALL CD .

Beam Orientation	Max. Reading
12:00	M _____ mR/hr
1:00	M _____
2:00	M _____
3:00	M _____
4:00	M _____
5:00	M _____
6:00	M _____
7:00	M _____
8:00	M _____
9:00	M _____
10:00	M _____
11:00	M _____

Note: Readings taken with large beam on realistic phantom

TABLE III A S (A rot., B without beam stop)

EXPOSURE FOR BARRIER Wall DE .

Beam Orientation	Max. Reading
12:00	M mR/hr
1:00	.0.5
2:00	0.5
3:00	M
4:00	0.5
5:00	0.5
6:00	M
7:00	M
8:00	M
9:00	M
10:00	M
11:00	M

Note: Readings taken with large beam on realistic phantom

M = < 0.25 mR/hr.

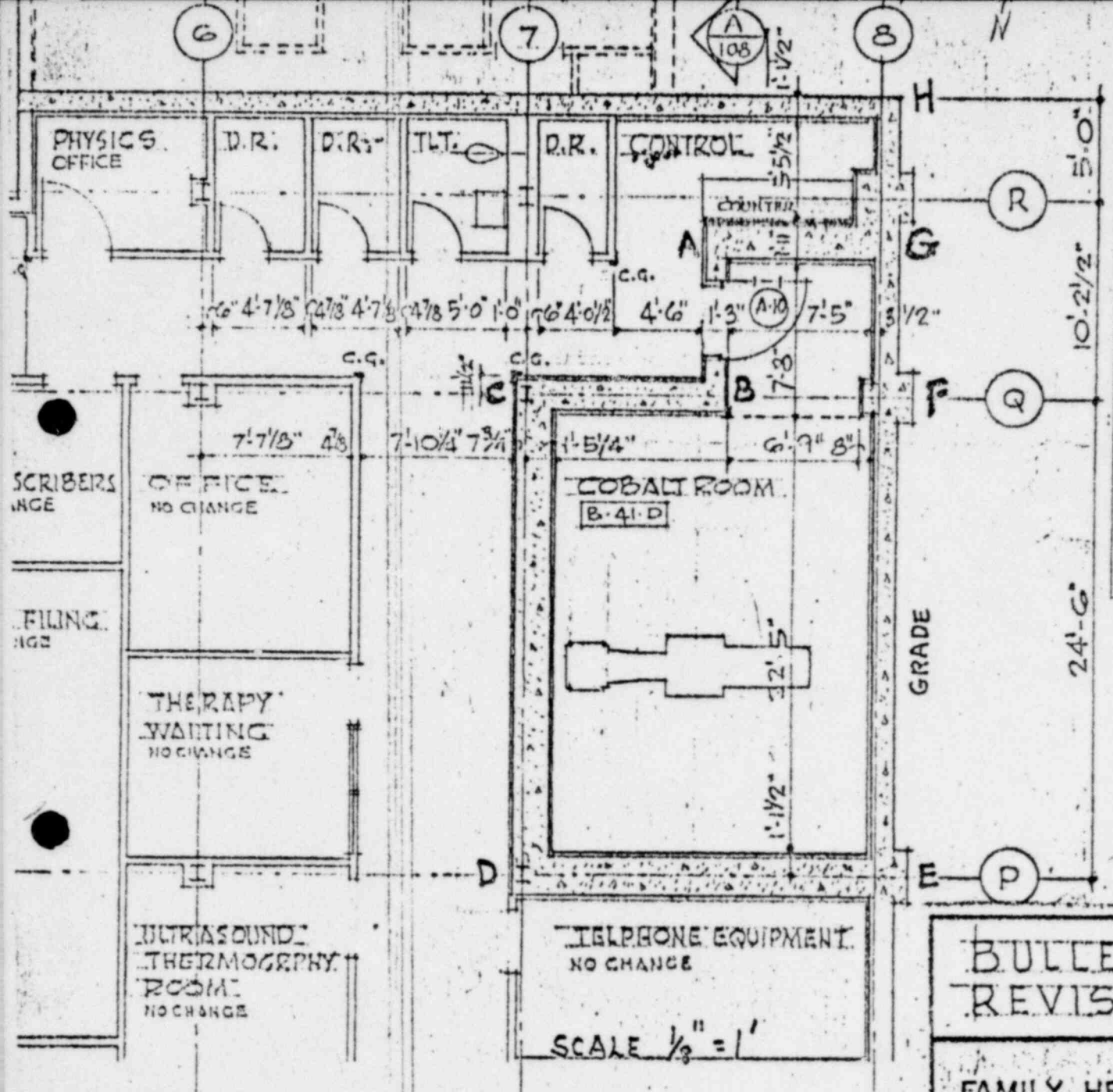
TABLE III A 5 (A rot., B without beam stop)

EXPOSURE FOR BARRIER Ceiling .

Beam Orientation	Max. Reading
12:00	M mR/hr
1:00	M
2:00	M
3:00	M
4:00	M
5:00	M
6:00	0.3
7:00	0.3
8:00	0.5
9:00	M
10:00	M
11:00	M

Note: Readings taken with large beam on realistic phantom

M = < 0.25 mR/hr.



COBALT ROOM B
B-41-D

BARRIER	DESCRIPTION	TOTAL REQUIRED LEAD OR CONCRETE MM IN (#147)
GA	CONTROL	18.
	FLOOR	GRADE
	CEILING (P-Q)	24
BC	MAZE	20
CD	CORRIDOR	22
DE	EQUIPMENT	28.
EF	GRADE	---
FH	GRADE	---
GH	GRADE	---
	DOOR GA.	3
	CEILING (Q-RH)	16

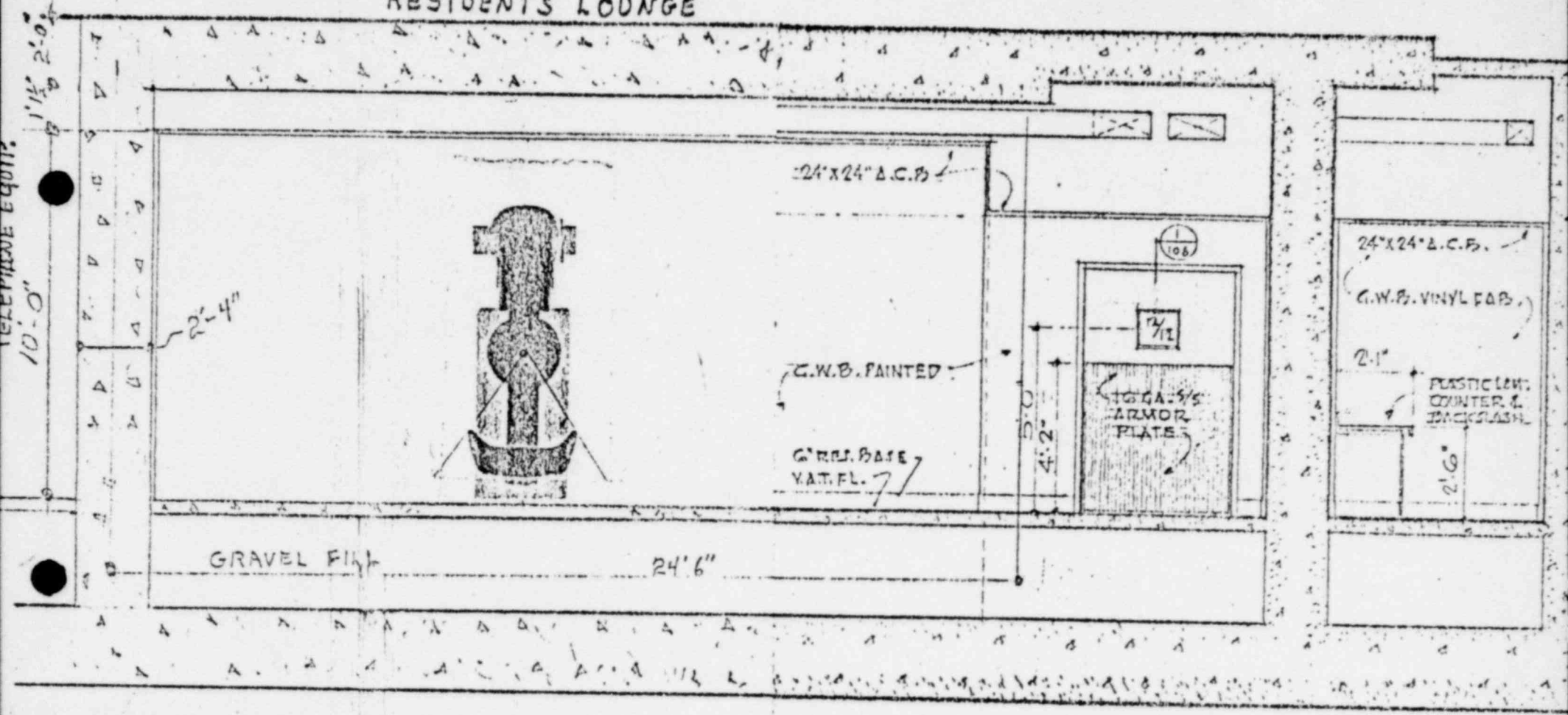
BULLETIN NO. 12.
REVISIONS TO COBALT ROOM

NEW
FAMILY, HEALTH CARE OUTPATIENT CLINIC
FOR
CHICAGO COLLEGE OF OSTEOPATHIC MEDICINE
CHICAGO ILLINOIS

SCHMIDT, GARDEN & ERIKSON

STUDENT
RESIDENTS LOUNGE

PART PLAN BASEMENT



COBALT ROOM SECTION A/108 SCALE 1/4"=1'-0"

PAGE 2

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AMERICAN BOARD OF HEALTH PHYSICS
AMERICAN BOARD OF RADIOLOGY
1161 HOHLFELDER ROAD
GLENCOE, ILLINOIS 60022
AREA 312 835-4433

PROTOCOL

TESTING OF "ON-OFF" INDICATORS OF GAMMA-BEAM TELETHERAPY UNITS

The test shall consist of the following steps:

i) begin with the power off

ii) turn on the power and activate unit (but not beam)

iii) check all indicators on control, above door, on unit and monitor (if a monitor is available).

iv) if all indicators indicate beam is "off" enter room with radiation detecting device (i.e. survey meter or chirpee). Note: the detecting device is not needed if an independent monitor is installed.

v) determine whether the radiation levels are consistent with the beam being off.

vi) exit room, close door

vii) activate beam

viii) repeat iii)

ix) turn beam off

x) repeat iii)

Units whose behaviour fully comply with the items below are designated "OK"

NCRP Report #33 item 4.2.1(d) 5 "There *shall* be on the housing and on the control panel a warning device that plainly indicates whether the beam is 'ON' or 'OFF'."

ANSI N449-1974 item 4.1.1 "Electrical and Mechanical Source Condition indicators should accurately reflect the 'on-off' condition or position of the radioactive source."

ANSI N449.1-1978 item 4.2 "Source-condition Indicator (see 4.1.1 in ANSI N449-1974 (1)). The operability of 'on' and 'off' position indicators at the control console and on the machine head and stand shall be confirmed visually. The patient viewing system (closed circuit television or mirror) should be used for treatment room source 'on' condition checks."

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GLENCOE, ILLINOIS 60022
AREA 312 835-4433

PROTOCOL

TESTING DOOR INTERLOCK OF GAMMA BEAM TELETHERAPY UNITS

The test shall consist of the following steps:

i) turn the teletherapy unit "ON"

ii) open the door

iii) ascertain whether the beam is on or off

iv) close the door

v) without touching the control panel determine whether the beam is on or off.

Units whose behaviour fully comply with the items below are designated "OK"

NCRP Report #33, item 4.2.2(d)8: "When the door to the treatment room is openned, the beam control mechanism shall automatically and rapidly return to the OFF position where it shall remain until the door is again closed and the machine is manually reactivated from the control panel."

ANSI N449-1974 "4.1.2 Facility Door Interlock. The electrical interlock on the entrance door to the teletherapy room shall cause the radiation beam control mechanism to automatically and rapidly returns to the "off" position. The machine control mechanism shall require manual reactivation from the control panel before resuming exposure."

ANSI N449.1-1978 "4.3 Door Interlock (see 4.1.2 in ANSI (1)). The test of the interlock shall be carried out by bringing the source to the "on" position, opening the door to break the interlock, and observing the sequence required to bring the source back to the "on" position. The interlock switch shall be adjusted such that any position other than the fully closed position of the door will break the circuitry and cause the source to return return to the safe condition. The machine control mechanism shall require manual reactivation from the control console before resuming exposure."

NRC Teletherapy Licenses, standard clause #17B "Each entrance to the teletherapy room shall be equipped with an electrical interlock system that will turn the teletherapy machine's primary beam of radiation off immediately upon opening of any entrance door. The interlock system shall be connected in such a manner that the teletherapy machine's primary beam of radiation cannot be turned on until all treatment room entrance doors are closed and the beam "on-off" control is reset at the control panel.

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AREA 312 835-4433

PROTOCOL FOR CHECKING TREATMENT TIMER AND TIMER CORRECTION FACTOR

METHOD USED

☐

4.14.1 *Time Correction Term, Alpha (α).* The dosimeter with equilibrium cap is placed at the center of the field and the source turned "on" for a single irradiation (R_1). The dosimeter is zeroed and left at the same location for multiple irradiations before being read out (R_2). The total set times for single long and multiple short exposures need not be the same, but equality helps minimize errors due to instrument nonlinearity and operator error in setting times. The mathematical relationship used to calculate α, the time correction term, is:

$$\frac{R_1}{t_1 + \alpha} = \frac{R_2}{t_2 + n\alpha} \qquad \text{(Eq 1)}$$

$$\alpha = \frac{t_1 R_2 - t_2 R_1}{nR_1 - R_2}. \qquad \text{(Eq 2)}$$

When $t_1 = t_2$,

$$\alpha = \frac{t(R_2 - R_1)}{nR_1 - R_2} \qquad \text{(Eq 3)}$$

where

- α = effective time difference due to source "on—off" and timer "on—off" mechanisms
- R_1 = average of dosimeter readings for set time t_1
- R_2 = average of dosimeter readings for set time t_2 (n cumulative irradiations)
- t_1 = time for single long irradiation
- t_2 = time for cumulative irradiation
- n = number of irradiations during cumulative irradiation

The true time for the single long irradiation is $(t_1 + \alpha)$, where the time error may be positive or negative. If α is positive, the net irradiation time is longer than the timer setting; and vice versa. The time-corrected radiation intensity would be $R_1/(t_1 + \alpha)$.

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AREA 312 835-4433

METHOD USED

☒

4.14.2 *Time Correction Term, Epsilon (ϵ).* The epsilon method utilizes the same principles as the alpha method but expresses the error in a slightly different manner. This method is a special case of that described in 4.14.1 where $n=2$ and $t_1=t_2$.

$$R_T = 2R_1 - R_2 \qquad \text{(Eq 4)}$$

$$\alpha = \frac{t(R_2 - R_1)}{R_T} \qquad \text{(Eq 5)}$$

where

ϵ = time error associated with the combined starting and stopping of the timer–source exposure mechanisms
R_1 = average of dosimeter readings for a single set time t
R_2 = average of dosimeter readings, each reading an accumulation over two irradiations of set time $t/2$
t = time for single long irradiation
R_T = dosimeter reading corrected for time error

The time-corrected radiation intensity would be $R_T/t = (2R_1 - R_2)/t$; and epsilon is used as a numerical expression of time error. If ϵ is positive, the net irradiation time is longer than the timer setting; and vice versa.

☐

4.14.3 *Serial Irradiation and Plotting.* A number of irradiations, using times from very short through much longer intervals, are made and the integrated readings plotted against the respective irradiation times. A straight line fit of the data points and extrapolation to zero time may be done using linear regression analysis or informal drawing of the line which appears to fit the points. The measurements can be performed only within the established linearity range of the measuring instrument.

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GLENCOE, ILLINOIS 60022
AREA 312 835-4433

METHOD USED

☒

4.14.4 *Stop Watch.* A stop watch may be used to measure the elapsed time versus the clock time on the machine as well as source transit time "off" to "on" and "on" to "off." This should be done for several set irradiation times and repeated with the difference in stop watch and machine timer noted.

ANSI
N449.1-1978

TIMER OPERATIONAL CHECK

Set timer to one minute activate unit. Allow timer to terminate exposure verify that source has returned to safe position, i.e. green light on control, green light in room, and wall mounted radiation monitor.

Verify that unit cannot be reactivated until a new time has been selected.

TELETHERAPY SOURCE CERTIFICATION

This certifies that the cobalt-60 source:

Model Number NPI-20-3000W
Serial Number: T-578
Containing 3080 curies as of 10/1/82

was fabricated by Neutron Products, Inc. in accordance with NPI specification P-4 per Drawing Number A200057 and was leak tested by the helium pressure test and found to be leak free on 8-31-82. The source was wipe tested and the removable activity was .0018 and .0007 microcuries from the inner and outer encapsulations, respectively.

Performed by and certified to by:

Jeffrey W. Corum

Jeffrey W. Corum, Manager
Hot Cell Operations

Reviewed and approved by:

Marvin M. Turkanis

Marvin M. Turkanis
Vice President

Date 8-31-82

NEUTRON PRODUCTS INC

TELETHERAPY SOURCE TRANSFER

This is to certify that a cobalt-60 source:

Model Number: NPI-20-3000W
Serial Number: T-578
Containing 3080 curies as of 10/1/82

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 follows:

Manufacturer: Picker
Model Number: C9
Serial Number: 252

This source is hereby transferred from Neutron Products' Radioactive Materials License MD-31-025-03 to Chicago Osteopathic Hospital's License _____.

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

Model Number: P3802A
Serial Number: PX12062
Containing 1630 curies as of 8-31-82

has been determined by a wipe test to be leak free and has been removed from the above teletherapy unit and transferred from Chicago Osteopathic Hospital's License _____ 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.

Charles R. Smith
Date 9-3-82

E. E. Lenz
Neutron Products, Inc.
Date 9-3-82

NEUTRON PRODUCTS INC

REPORT OF INSPECTION AND SERVICING
("FIVE YEAR INSPECTION" REPORT)

This is to certify that the Picker teletherapy unit, Model C9, Serial Number 252 located at Chicago Osteopathic Hospital, 5200 South Ellis, Chicago, Illinois 60615 was inspected and serviced on 9-3-82 by E. F. Finn to assure the proper function of the source exposure mechanism as authorized by Maryland License MD-31-025-03.

Signed E F Finn Date 9-3-82

Parts: NEW SOURCE WHEEL BEARINGS
DRIVE BELT AND RETURN SPRING

Nonstandard Service:

neutron products inc

INSPECTION CHECK LIST

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 NA	X NA
8. Mercury Shutter System	X NA	X NA
9. Stand and Stretcher		X ✓
10. Protective Source Housing, Beam-Off Leakage		X ✓ G
11. Source-Surface Distance (SSD)		X ✓
12. Beam Orientation	X ✓	X ✓
13. Congruence of Light and Radiation Fields		X ✓
14. Full Calibration		X ✓ G
15. Facility Door Interlock	X ✓	X ✓
16. Teletherapy Units with Moving Source Drawer	X NA	X NA
17. Teletherapy Units with Moving Shutter Blocks	X NA	X NA
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.

neutron PRODUCTS inc

12750