

PHYSICIANS RADIOLOGY, INC.

ST. LOUIS HILLS RADIOLOGY
6651 CHIPPEWA ST. LOUIS, MISSOURI 63109
PHONE: 647-8893

- RADIOLOGISTS -

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PRACTICE LIMITED TO X-RAY DIAGNOSIS AND RADIATION THERAPY

August 19th, 1980

The Material Licensing Branch
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Re: License # 24-04992-01

Dear Sirs:

In accordance with Conditions 18 & 19 of the Material License #24-04992-01, please find enclosed a copy of the Teletherapy Survey Report following installation of a new Cobalt-60 Source in our Picker Cobalt-60 Therapy Model #6150 on July 29th, 1980.

If you have any questions, please contact the Surveyor, Mr. Fred G. Abrath, Ph.D at the Mallinckrodt Institute of Radiology at 314-454-3638.

Sincerely,

Stuart E. Bundy R.T.
Mr. Stuart E. Bundy R.T.
Chief X-Ray Technician

cc: Director Region III
Glen Ellyn, Illinois 60137

FEE EXEMPT

survey report

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WASHINGTON UNIVERSITY



SCHOOL OF MEDICINE
August 11, 1980

THE EDWARD MALLINCKRODT
INSTITUTE OF RADIOLOGY
DIVISION OF RADIATION ONCOLOGY

RADIATION ONCOLOGY PHYSICS CENTER

James A. Purdy, Ph.D., Director
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Director
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Julia E. Bello, M.S., Clinical
Physicist
Phone: 314-454-3638

Cheryl Ashner, Secretary

TELETHERAPY SURVEY REPORT

- (1) Facility: Physicians Radiology
S. J. Merenda, M.D.
6651 Chippewa
St. Louis, Missouri 63109
- (2) Surveyor: Fred G. Abrath, Ph.D.
Associate Director
Mallinckrodt Institute of Radiology
Physics Section
510 South Kingshighway
St. Louis, Missouri 63110
- (3) Therapy Equipment: Picker Cobalt-60 Therapy Model #6150
Source Activity: 1925 Ci as of Aug. 1, 1980
Source Serial No. 2372
Source Installed July 29, 1980
NRC License: 24-04992-01 Expires: 7/31/84
- (4) Source Installed: July, 1980
- (5) Date of Survey: August 1, 1980
- (6) Instrumentation: Victoreen Model # 444 S.N. 789
Calibrated 10/20/77
Calibration Labs
Keithley Electrometer K602 S.N. 40772A
Data Precision DMM Model 245 S.N. 37071
NEL (0.6cc Farmer) ionization chamber
Model 2505/3A S.N. 1456
Calibrated 9/6/78 Regional Calibration
Laboratory, Houston, Texas

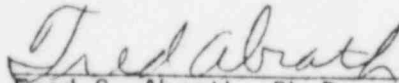
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- (7) Output: 88.7 rad/min for a $10 \times 10 \text{ cm}^2$ field at 60.5 cm from source *1946 Rad/m@1m*
- (8) Teletherapy Head Survey: Average $2.1 \pm 0.2 \text{ mR/hr}$
Max. 3.4 mR/hr
See enclosure
- (9) Beam Orientation Limitations: Interlocks on the head angulations do not allow the radiation to be turned on past 20° counterclockwise from the vertical down position or past 40° clockwise from the vertical down position.
- (10) Beam Control Mechanisms: (a) With beam on opening the entrance door properly returned the source to the beam off position. Upon closing the door the beam did not come on until positive action was taken at the console.
(b) Red/Green lights on the console and above the room door indicate beam on/off conditions in the operator area. Red/green lights on the head indicate on/off at time equal to zero.
- (11) Area Survey: The area around the treatment room was surveyed in accordance with Item V of the Teletherapy Licensing Guide (1975). The readings were taken with the surface of a phantom 60 cm from the source. Measurements were made with the beam at 180° vertical down and at 90° counterclockwise from vertical down. The values reported were the maximum levels found using the survey meter. All measurements were made 1 foot from wall surface.

<u>LOCATION</u>	<u>Max Reading</u>
Console	0.2 mR/hr
South Wall (orthovoltage Room)	0.1 mR/hr
Door of Cobalt Room	0.2 mR/hr
Ceiling	0.1 mR/hr
North Outside Wall	0.1 mR/hr

(12) Comments:

This unit is in compliance with NRC
Regulations referred to in Item V of the
Teletherapy Licensing Guide (1975).



Fred G. Abrath, Ph.D.

Associate Director

Radiation Oncology Physics Center

PICKER X-RAY CORPORATION
WAITE MFG DIV. INC.
RADIATION SURVEY FOR CAT. 583A HEAD

POSITION NO.	SURFACE TO ONE METER	METER READINGS	CORRECTED READINGS
1	72.8cm	1.4	
2	74.4	1.5	
3	76.0	2.1	
4	75.6	3.4	
5	55.5	0.5	
6	75.3	3.2	
7	76.0	2.0	
8	74.4	1.4	

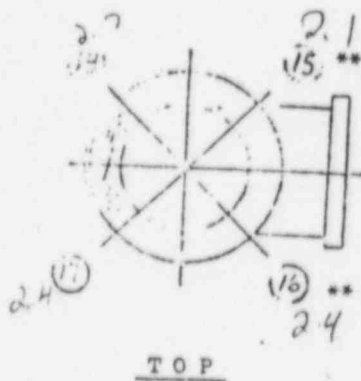
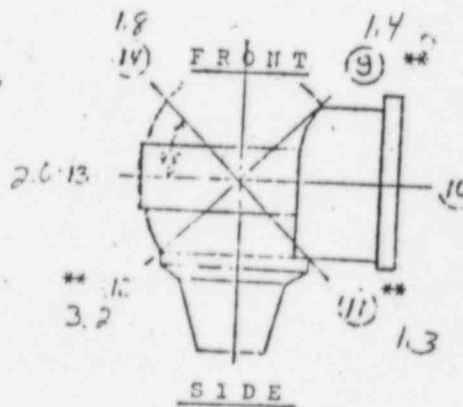
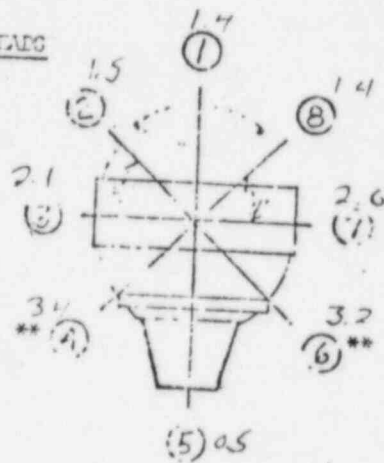
9	74.6	1.4	
10	*		
11	74.4	1.3	
12	75.5	3.2	
13	76.0	2.6	
14	74.6	1.8	

15	76.0	2.1	
16	76.0	2.4	
17	75.0	2.4	
18	75.0	2.7	

TOTAL OF 15 READINGS 35.4

AVERAGE OF 15 READINGS 2.08

mr/hr at one meter from source



* 100 cm to back of "C" arm support

** Measure distances from points shown
Customer Physicians Radiology Inc.

Head Serial No. 583A, #105

Source S.H. 3801 Dia. 1.5 RSH 2007 RSH Date 7/17/80

Date Survey Made July 21, 1980

Instrument Used

Survey Made By Fred Clouth, J. Wells

Model 444, Serial 78, Victor Instrument
Cleveland, OH 44102
Made in U.S.A.

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August 11, 1980

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REPORT ON DOSIMETRY OF RADIATION THERAPY UNIT

1. Institute:

Physicians Radiology
S. J. Merenda, M.D.
6651 Chippewa
St. Louis, Missouri 63109

2. Unit:

Pickar Cobalt-60 Therapy Model #6150
Source Activity: 1925 Ci as of Aug. 1, 1980
Source Serial No. 2372
Source Installed July 29, 1980
NRC License: 24-04992-01 Expires: 7/31/80

3. Report Objectives:

1. General Conditions
2. Check locks, interlocks and warning devices
3. Check distance indicators
4. Check congruence of radiation and light field
5. Check field size dependence
6. Measure shutter error
7. Calibration of source output
8. Recommendations

3.1 General Conditions:

- 3.1.1 The console key switch, start, time-set, and timer on buttons were all operational. The head elevation, collimator rotation, collimator setting controls and indicator operated properly. The reset switch did not function properly. When machine was interrupted it was not necessary to reset, to resume radiation. This was found to be an intermittent problem.

3.2 Locks, Interlocks and Warning Devices:

- 3.2.1 The room door locks. The ^{60}Co room should be kept locked at night.
- 3.2.2 The teletherapy room door interlock shuts off the radiation when the door is opened. Radiation does not return until positive action is taken at the control panel.
- 3.2.3 Interlocks and head angulation do not allow the radiation beam to be turned on unless the head is angled between the angles of 70° and 220° .
- 3.2.4 The teletherapy room is properly posted as containing a radiation hazard.
- 3.2.5 Red and green lights indicate the beam ON/OFF condition. Need to replace green light over door.
- 3.2.6 Emergency instructions are posted in clear view.
- 3.2.7 Notices to employees are posted.
- 3.2.8 A leak test was performed on 8/1/80.
- 3.2.9 Gamma alarm and battery pack function.

3.3 Check Distance Indicators:

The 60 cm mechanical distance indicator was found to be accurate to within 2 mm. The optical indicator for 60 cm was within 2 mm of their proper distances.

3.4 Radiation and Light Field Congruence:

A sheet of TL film was placed at 80.0 cm SSD with a field size of $10 \times 10 \text{ cm}^2$ under 6 mm of lucite. The films were exposed for .10 min. Optical density scans of the radiation field are compared with the light field in the enclosed graphs. Films taken were for: 0° ; $+90^\circ$; -90° collimator setting with the head at 180°

verticle down, and collimator at 0° with the head at 90° CCW. The results of all films were within 2 mm at the 50% density level along all borders.

3.5 Measurement of Field Size Dependence:

The measured field size dependence was within 1.5% of the field size dependence used in the calibration charts provided with this report and with prior reports. A field size dependence graph is included in this report.

3.6 Measurement of Shutter Error in Timer:

The timer error, α , was determined to be $\alpha = + 0.04$ minutes in agreement with previous measurements. That is 0.04 minutes must be subtracted from the timer calculated with the measured dose rates to get the correct timer to set on the machine. This correction has been included in the times given on the calibration charts.

3.7 Calibrate Source Output:

3.7.1 Output calibration was made using a Keithley electrometer (Model 602, S.N. 40772A a Data Precision DMM (Model 245, S.N. 37071, and a NEL (0.6 cc Farmer) ionization chamber (Model 2505/3A, graphite thimble S.N. 1456) with a lucite cap of 4.6 mm wall thickness. The collecting potentials on the thimble was -280 volts. Cobalt-60 exposure calibration factor for this dosimetry system is 47.49 at 22°C and 760 mm mmHg on the 10×10^{-8} coulomb scale. This factor was certified by the Regional Calibration Laboratory, Houston, Texas, on September 6, 1978. The sensitive volume of the chamber was centered at a distance of 65, 80 and 100 cm from the source. A 10×10 field was used as a calibration field size. The temperature was determined using a laboratory thermometer graduated in stpes of 0.2°C . The barometric pressure was determined using an aneroid barometer in which the accuracy had previously been determined by comparison to a Fisher Scientific U.S. Signal Corp. type mercury barometer graduated in steps of 1 mmHg. Temperature was determined using a laboratory thermometer graduated in 0.2°C steps.

3.7.2 * The following is an example of the calculations of absorbed dose on the central axis at 0.5 cm depth in muscle tissue for a 10×10 cm field at 80 cm SSD for the vertical (180°) beam, with the collimator at 0° , with no blocking tray in place, and with trimmers retracted.

<u>Calculation Factors</u>	<u>Value</u>
$\dot{D} = \frac{\overline{Rdg} \times BSF \times C_{TP} \times N_c \times A_{eq} \times f \times In.Sq.}{t + \alpha}$	
\overline{Rdg} = Average reading	1.200
BSF = Backscatter factor for 10 x 10 cm ²	1.036
C_{TP} = Temperature and pressure correction	1.017
N_c = Calibration factor of dosimetry system	47.49
A_{eq} = Attenuation factor of Cobalt-60	.985
f = rads/rotergent factor for Cobalt-60	.957
In.Sq. = Inverse square correction from 60.0 cm to 60.5 cm	$(\frac{60}{60.5})^2$
α = Timer error	0.04
\dot{D} = Absorbed dose rate (rad/min) at 0.5 cm depth for 10 x 10 cm ² at 80 cm SSD	88.7 rads/min

NOTES:

- (1) Temperature-pressure correction factor

$$C_{TP} = \frac{273.16 + t}{295.16} \times \frac{760}{p}$$

- (2) Timer error

$$\frac{R_1}{\text{time} + \alpha} = \frac{R_2}{\text{time} + n\alpha}$$

Where: R_1 = average reading for one minute

R_2 = average reading for one minute with four intervals

3.8 Recommendations:

- 3.8.1 Continue measuring field sizes directly on the patient as the indicators on the head are good only for 60 cm SSD.

Date of Measurements:

8/1/80

Measurements and Report by:

Fred G. Abrath

Fred G. Abrath, Ph.D.

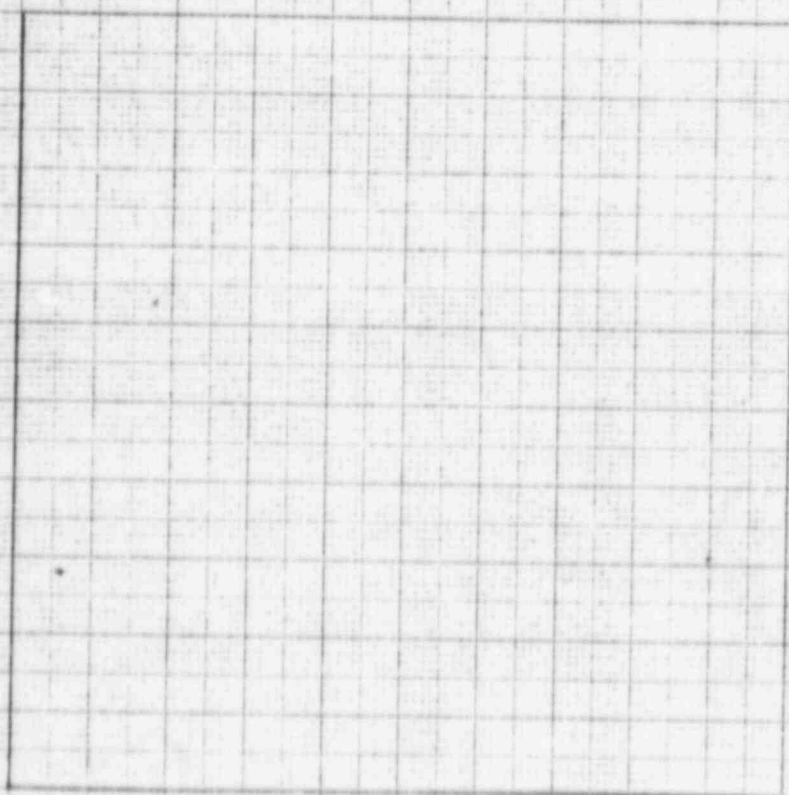
Date sent to Institution:

8/13/80

Associate Director

Radiation Oncology Physics Center

CANTRY AT 270°



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16-2 11 N 100 TO THE CENTERED IN A 10000

COLLIMATOR AT 90°

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461510

K₀E 10 N 10 TO THE CENTIMETER 10 N 20 CM
NEUTRON RADIATION CO. MADE IN U.S.A.

461510

WE 27 X 27 TO THE CENTER, TEN 10 X 10 X 10
NUMBER OF ENCAPSULATED SEEDS

Dose Rate (rad/min)

DOSE RATE
VS
FIELD SIZE
PICKER # 6150A

98
96
94
92
90
88
86
84
82
80

5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

SIDE OF SQUARE FIELD (cm)

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