

GEORGE W. CALLENDINE, JR., PH. D.
AND ASSOCIATES
CONSULTING RADIOLOGIC PHYSICS
803 OXFORD STREET
WORTHINGTON, OHIO 43085
(614) 885-6187

RADIOLOGIC PHYSICS DIVISION OF
CARTER, SCHWARTZ & SCHMIDT, INC.

DEPARTMENT PLANNING
EQUIPMENT SPECIFICATION
SYSTEMS ANALYSIS
HAZARD AND QUALITY CONTROL

July 31, 1985

RECEIVED BY LFMB	
Date	8/9/85
Log	dyg
By	[Signature]
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Action Compl	[Signature]

Material Licensing Branch
Office of Nuclear Material
Safety and Safeguards
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Re: Medical Center Hospital, Chillicothe, OH.
License No. 34-11852-02

Gentlemen:

Enclosed you will find a Survey Report summarizing my radiation survey and calculations of the cobalt teletherapy unit following replacement of the Cobalt-60 source at the above referenced hospital.

If you have any questions concerning this survey, do not hesitate to contact me by telephone (614/885-6187) or in writing at the address listed above.

Sincerely yours,

George W. Callendine

GWC:mt

Enclosure

cc: James Manchester, M. D.
Judy Hines, R.T. C.T.
P. J. Lyons (Neutron Prod.)
U.S.N.R.C., Glen Ellyn, IL

8511190010 851001
REG3 LIC30
34-11852-02 PDR

tele survey
FEE EXEMPT

U.S. NUC.
LIC. FEE MGMT. BRANCH

85 AUG-9 P2:02

RECEIVED

19136

GEORGE W. CALLENDINE, JR., PH. D.
AND ASSOCIATES

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TELETHERAPY SURVEY REPORT

1. LICENSEE: Medical Center Hospital
272 Hospital Road Box 708, Chillicothe, OH 45601

License No: 34-11852-02
2. SURVEYOR: George W. Callendine, Jr., Ph.D.
803 Oxford Street, Worthington, OH 43085
3. REASON FOR SURVEY: Installation of new Cobalt-60 teletherapy source
4. COMPLETION OF INSTALLATION: June 27, 1985
5. SURVEY DATE: June 28, 1985
6. RADIATION DETECTION INSTRUMENTATION:
 - .1 Calibration Meter - Victoreen Model 550; calibrated February 15, 1985 by AAPM certified calibration laboratory.
 - .2 Survey Meter - Victoreen Model 470A; calibrated August 1, 1984 with a source of radium which had been calibrated traceable to the National Bureau of Standards.
7. TELETHERAPY UNIT: Atomic Energy of Canada, Ltd.
Model No. THERATRON-765
8. TELETHERAPY SOURCE: Neutron Products, Inc.
Model No. NPI-20-3600W
9. SOURCE ACTIVITY: 3890 curies, as of June 1, 1985
10. PRIMARY BEAM: The unit was calibrated to have an exposure of 135.6R per minute at a source chamber distance of 65 cm for a 10 cm x 10 cm field. A full calibration was performed on the unit at the time of installation of the source.
11. SOURCE HEAD SURVEY: The maximum and average radiation levels measured at 1 meter from the source in the "Off" position are 1.2mR per hour and 0.73 mR per hour respectively (see enclosed worksheet).

Page -2

12. BEAM ORIENTATION LIMITS: The beam will operate in any orientation when positioned towards the beamstopper. When the head is rotated away from the beamstopper it can be rotated 84 degrees in the clockwise position (facing towards the West) and 75 degrees in the counter-clockwise position (beam facing towards the East. These are electrical stops. The unit has no movement in the swivel (In or Out) position.
13. RADIATION SURVEY METHOD: Radiation levels in adjacent areas were measured during radiation of a phantom.
- .1 Phantom: 30 cm x 30 cm x 30 cm polystyrene block
 - .2 Source-to-Phantom Distance: Source axis distance = 65 cm
 - .3 Field Size: 25 cm x 25 cm
14. ADJACENT AREA EXPOSURE LEVELS: Attached are plan views of the teletherapy room and adjacent areas. Each has the beam direction indicated, along with the exposure levels measured at the maximum position along each wall, overhead or below.
- The beam directions are chosen to indicate the exposure levels with the beam in the most common orientation (0 degrees or down) and also in those orientations which produce the maximum exposure levels at the various locations.
15. PERSONNEL EXPOSURE ESTIMATES: A computation sheet is attached which shows the calculations for exposure estimates to individuals who might be located in critical areas. The calculations assume beam "On" times at least double those actually experienced in our statistical evaluation of the clinical practice. Calculations indicate that no individual will be exposed to more than 10 mR per week.
- Five years experience monitoring the personnel exposure levels supports these computations.
16. SAFETY SYSTEMS: A report is attached indicating the proper operation of all safety systems. The method of test is described under Procedures in License No. 34-16779-01.

It is my professional opinion that the unit is operating safely and correctly.

Respectfully submitted,

George W. Callendine, Jr., Ph.D
Consulting Radiologic Physicist

GWC:mt

Enclosures

GEORGE W. CALLENDINE, JR., PH. D.
CONSULTING RADIOLOGIC PHYSICIST
803 OXFORD STREET
WORTHINGTON, OHIO 43085
(614) 885 6173

CERTIFICATION OF TELETHERAPY PERFORMANCE

Location: MEDICAL CENTER HOSPITAL Room 60 CO Date 06-28-85
CHILICOTHE OHIO Unit:
Mfg. AECL Model TH 765

Signs Posted: AEC Form 3 YES Emergency Procedures YES
Door: Caution, High Radiation Area YES Radioactive Materials YES
Head: Radioactive Materials YES
Other: NA

Patient Monitoring: View Window OK Mirror NA Aural OK
CCTV OK Other NA

Door Interlock(s): Door to Room OK Other NA

Machine Interlocks: Power On/Off OK Timer On/Off OK Key OK
Emergency Bar OK Other NA

Warning Lights:

	Control	Door	Room	Head	Other
Green	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	<u>Room Monitor</u> <u>SATISFACTORY WITH A.C. KIT</u>
Red	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	
White					

Beam Limiting Stops: Adequate Yes
Electrical CW 24°; CCW 76° Mechanical —

Treatment Timing Device: Terminate Exp. @ Zero YES Accuracy -6.628×10^{-3} min.

Source Head Survey: @ Surface ≤ 10.5 -mR/Hr ; @ One Meter ≤ 1.2 -mRhm

Wipe Test: Source Area ≤ 0.005 -uCi; Collimator ≤ 0.005 -uCi; Housing ≤ 0.005 -uCi

Area Survey: NO INDIVIDUALS WILL BE EXPOSED TO OVER 10 mR/WEEK

Output Calibration: 135.6 -R/Min @ SCD = 65 -cm & WxH = 10 -cm x 10 -cm

Comments:

This unit conforms with presently accepted performance standards of radiation hazard control: Yes ☒ No ☐

1. LIGHT/RADIATION CONSEQUENCE WITHIN 2mm

2. METER: CALIBRATION - VICTOREEN MODEL 550 - CALIB. 02-15-85.

Respectfully submitted,

George W. Callendine

CO-60 TELETHERAPY ROOM SURVEY

HEAD
COLLIMATOR
SOURCE

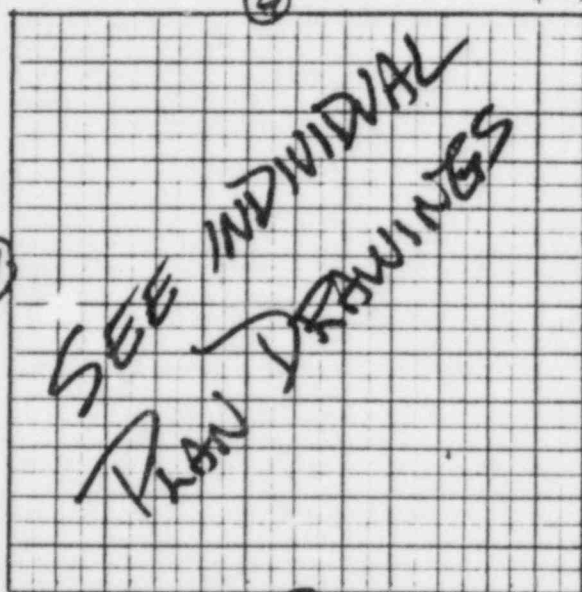
Mfg	Model	Serial
AECL	TH 765	8
NPI	NPI-20-3600W	T 767

Diameter 2 -cm: _____ -Rhmon Date _____
Specified 3890 -Ci on Date 06-01-85

I. Room:

PLAN

CONSTRUCTION DETAILS



BARRIER	
Walls - a	
b	
c	
d	
Door	
Control	
Window	
Ceiling	
Floor	

II. MEASUREMENTS: See Next Sheet

III COMMENTS: (1) SURVEY METER: VICTOREEN 470 A; SN 829; CALIBRATED 08-01-84
(2) PHANTOM 30x30x30 cm POLYSTYRENE PLACED ON TREATMENT Couch

(3) NEW SOURCE

(4) ANGLE = 0° - BEAM DOWN; OTHER ANGLES MEASURED CLOCKWISE

(5) ANGLES 50° AND 310° RESULT IN MAXIMUM ADJACENT AREA EXPOSURE

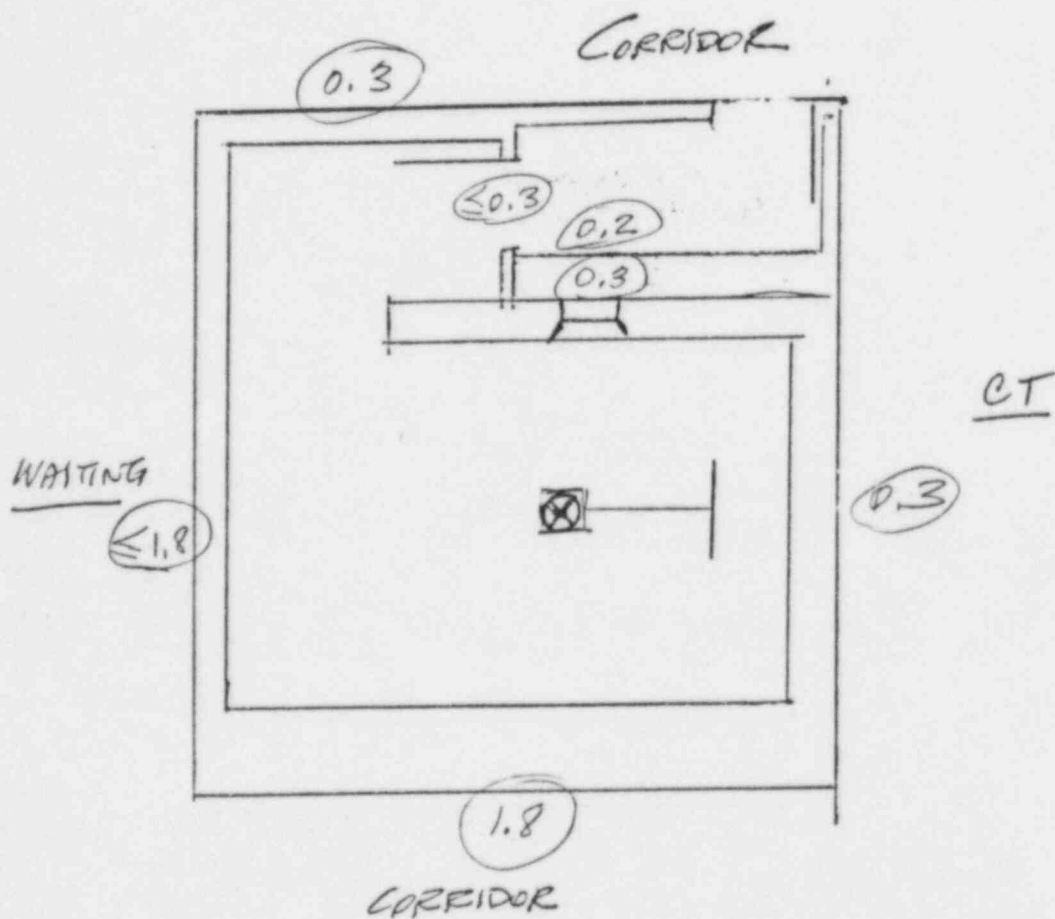
(6) ALL VALUES ARE MAXIMUM ESTIMATES; ACTUAL BEAM-ON TIME IS LESS THAN HALF TIMES INDICATED.

SIGNATURE:

George W. Callendine, Jr.

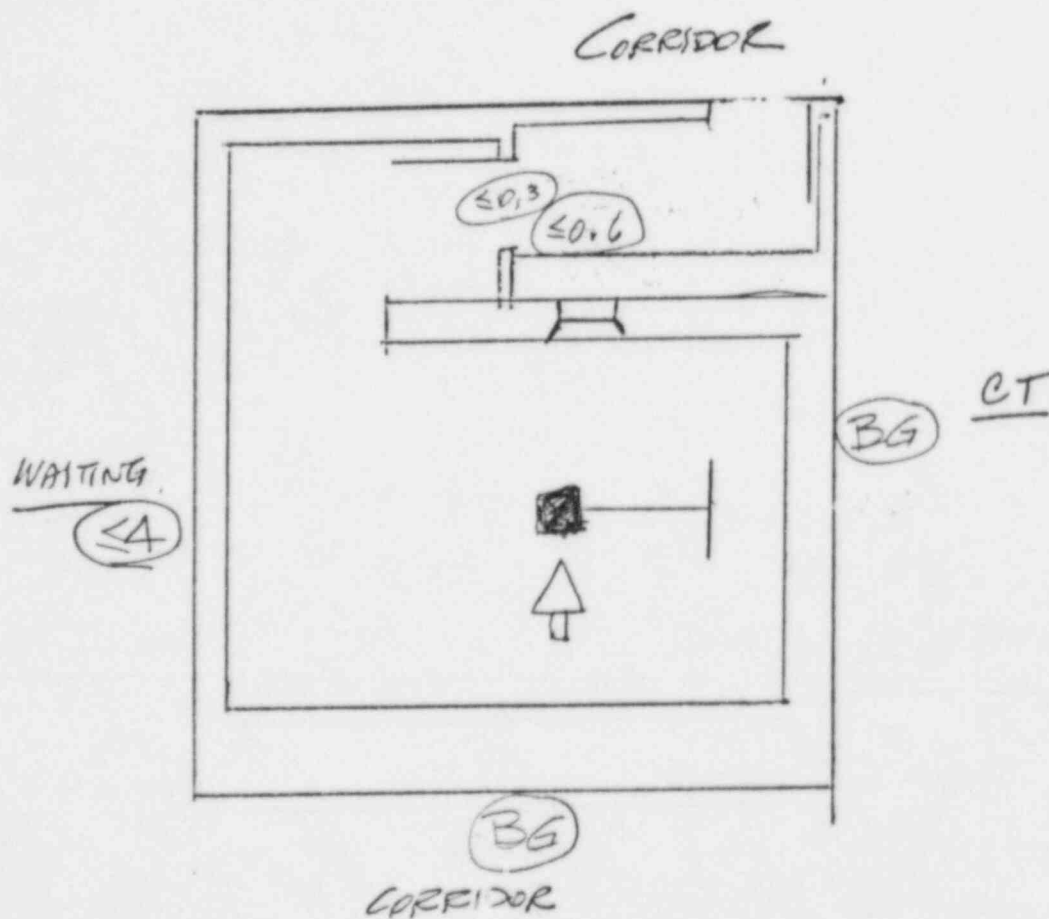
II. MEASUREMENTS:

BARRIER	ADJACENT ROOM FUNCTION	BEAM		IN/OUT	FIELD SIZE Dimensions at F.F.D.	OCCUPANCY	30"x30"x30" PLY STYRENE	METER		BARRIER		EST. HOUR per Week this Beam	EST. mR/wk.		COMMENTS
		Direction	Distance					Abx. Factor	In Grook Equiv.	Reading mR/hr	Location		This Beam	This Barrier	
WALL	CONTROL	0		IN	25x25			a	0.3			10	3		EXPOSE
		50							2.0			2	4		
		310							0.3			2	0.6		
		90							0.6			4	2.4	10.0	
WALL	CT	0		IN				b	0.3			10	3		4.6
		50							0.2			2	0.4		
		310							0.2			2	0.4		
		90							0.2			4	0.8	4.6	
WALL	COPYROOM	0		IN				c	1.8			10	18		5
		50							0.2			2	0.4		
		310							0.3			2	0.6		
		90							0.2			4	0.8	19.8	
WALL	WAITING	0		IN		1/4		d	1.8			10	18		9.2
		50							0.6			2	1.2		
		310							2.7			2	5.4		
		90							3.0			4	12	36.6	
WALL	WAITING	0		IN		1/4		e	0.8			10	8		7.7
		50							2.8			2	5.6		
		310							0.6			2	1.2		
		90							4.0			4	16	30.8	



ROOF LESS THAN 2 mR/hr WITH BEAM IN ANY DIRECTION.

GEORGE W. CALLENDINE, JR., PH. D. CONSULTING RADIOLOGIC PHYSICIST 803 OXFORD STREET WORTHINGTON, OHIO 43085 (614) 885-6187	CO-60 TELETHERAPY		BEAM .8
	RADIOLOGY		STOPPER IN
	MEDICAL CENTER HOSPITAL		PHANTOM IN
	CHILlicoTHE OHIO		



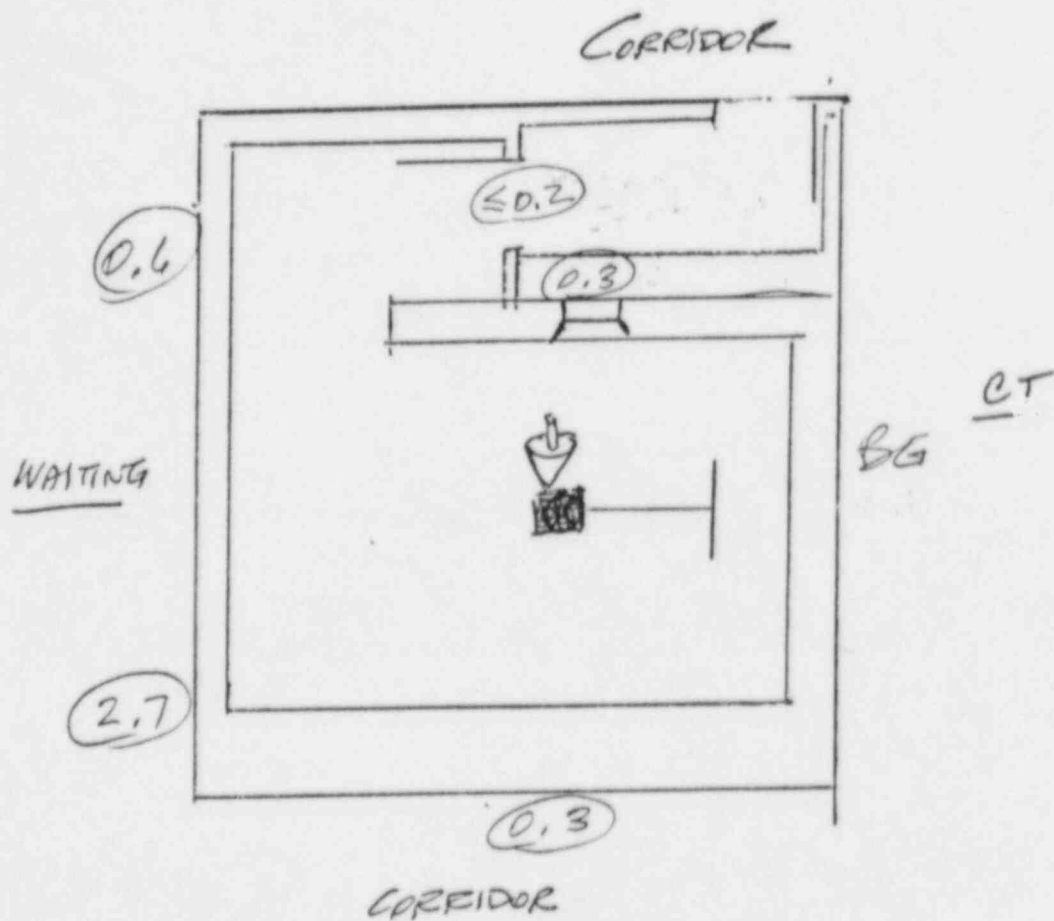
ROOF LESS THAN 2 mR/hr WITH BEAM IN ANY DIRECTION.

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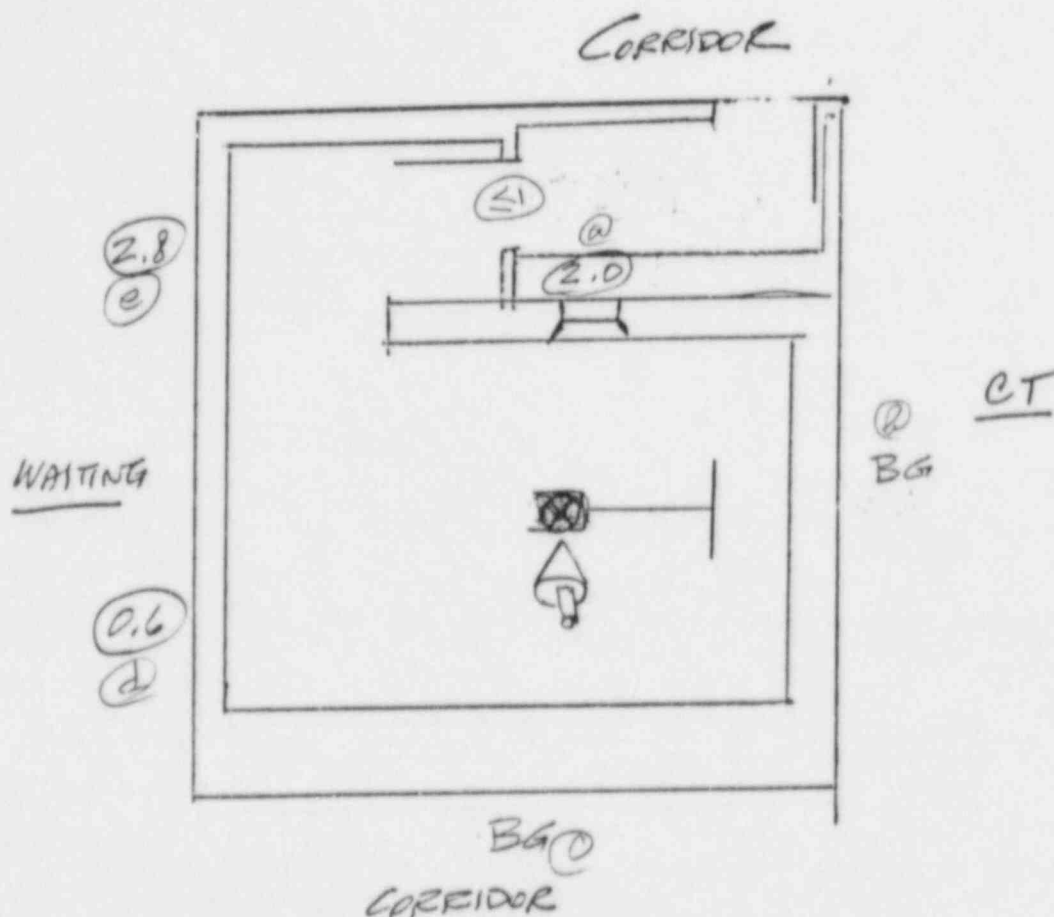
CO-60 TELETHERAPY
RADIOLOGY
MEDICAL CENTER HOSPITAL
CHILlicoTHE OHIO

BEAM 90°
STOPPER IN
PHANTOM IN



ROOF LESS THAN 2 mR/hr WITH BEAM IN ANY DIRECTION.

GEORGE W. CALLENDINE, JR., PH. D. CONSULTING RADIOLOGIC PHYSICIST 803 OXFORD STREET WORTHINGTON, OHIO 43085 (614) 885-6187	CO-60 TELETHERAPY		BEAM 310°
	RADIOLOGY		STAPEL IN
	MEDICAL CENTER HOSPITAL		PHANTOM IN
	CHILlicoTHE OHIO		



ROOF LESS THAN 2 mR/hr WITH BEAM IN ANY DIRECTION.

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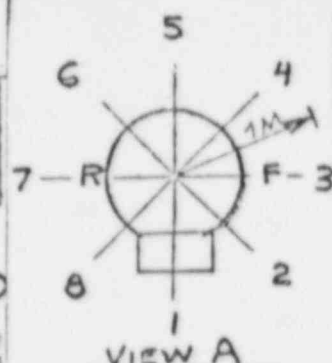
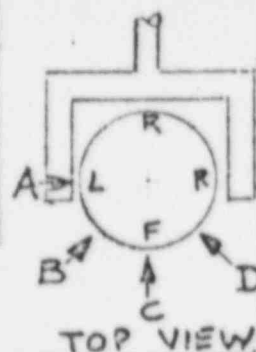
CO-60 TELETHERAPY
RADIOLOGY

MEDICAL CENTER HOSPITAL
CHILlicoTHE OHIO

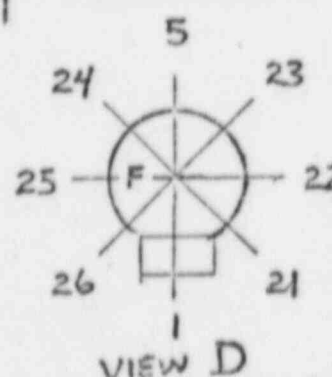
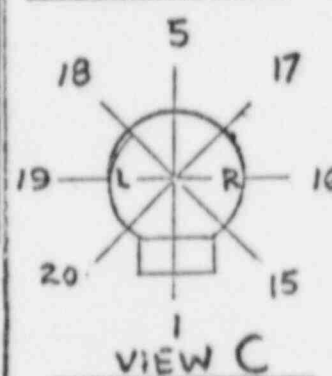
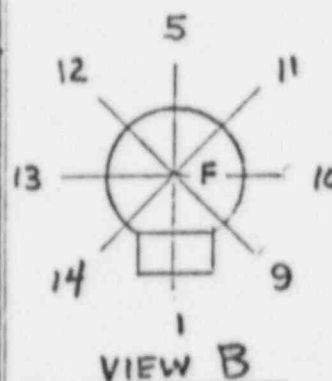
BEAM 50°
STOPPER IN
PHANTOM IN

	Mfg.	Model	Serial
UNIT	AECL	TH 765	8
HEAD			
COLLIMATOR			
SOURCE	N.P.I.	NDI-20-3600A	T-767

Diameter = 2 cm : Wipe Test ≤ 0.05 - μ ci
 Spec's: Date 06-01-85: -Rhm: 3890 - Ci



Pos. NO.	Surface	mR/hr	1-Meter	Pos. NO.	Surface	mR/hr	1-Meter
1	5.2	0.9		15	4.3	0.8	
2	0.2	0.2		16	4.0	0.8	
3	3.2	2.4		17	3.4	0.6	
4	0.8	0.5		18	3.2	0.6	
5	10.5	1.0		19	4.0	0.5	
6	1.4	0.4		20	3.6	0.6	
7	NA	NA		21	4.5	1.1	
8	4.0	1.2		22	2.8	0.7	
9	0.2	0.4		23	1.8	0.7	
10	0.7	0.4		24	1.6	0.7	
11	1.5	0.7		25	1.0	0.3	
12	2.3	0.7		26	1.2	0.3	
13	3.8	0.9					
14	4.2	0.8					
				20.32	18.2	Totals	
				4.7	0.73	Average	
				10.5	1.2	Maximum	



COMMENTS:

SURVEY METER: VICTOREEN 470A SN 829

* COLLIMATOR OPEN: 0.8 mR/hr @ SURFACE @ (AXIS)

George W. Callendine, Jr., Ph.D.
 803 Oxford Street
 Worthington, Ohio
 43085

(614) 885-6187

TELETHERAPY
 RADIOLOGY
 MEDICAL CENTER HOSPITAL
 COLUMBIA, OHIO

NEW
 SOURCE

06-28-85

TELETHERAPY SOURCE TRANSFER

This is to certify that a cobalt-60 source:

Model Number: NPI-20-3600W
Serial Number: T-767
Containing 3890 curies as of 6/1/85

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: AECL
Model Number: Theratron 765
Serial Number: 8

This source is hereby transferred from Neutron Products' Radioactive Materials License MD-31-025-03 to **Medical Center Hospital's Radioactive Materials License Number 34-11852-02.**

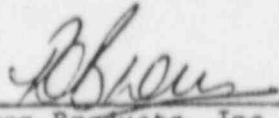
This will also certify that a cobalt-60 source described as follows:

Model Number: NPI-20-3600W
Serial Number: T-428
Containing 1680 curies as of 6/1/85

has been determined by a wipe test to be leak free and has been removed from the above teletherapy unit and transferred from **Medical Center Hospital's Radioactive Materials License Number 34-11852-02** 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.

Date _____



Neutron Products, Inc.
Date 6-28-85

NEUTRON PRODUCTS inc

TELETHERAPY SOURCE CERTIFICATION

This certifies that the cobalt-60 source:

Model Number: NPI-20-3600W

Serial Number: T-767

Containing 3890 curies as of: 6/1/85

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 June 25, 1985. The source was wipe tested and the removable activity was .040, and .0008 microcuries 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:

Marvin M. Turkanis
Marvin M. Turkanis
Vice President

6/26/85
Date

NEUTRON PRODUCTS inc

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

This is to certify that the Atomic Energy of Canada (AECL)
teletherapy unit, Model Theratron 765, Serial Number 8
located at Medical Center Hospital, Rt. 159 & 23, Chillicothe, Ohio, 45601
_____ was inspected and serviced on
6.27.85. by Russ Brown. to assure
the proper function of the source exposure mechanism as authorized
by Maryland License MD-31-025-03.

Signed RBrown Date 6.28.85.

Parts: Detent pin is source coupling.
Light conductor reel should be replaced
in the near future.

Nonstandard Service: Control makes loud humming when
operated in the vertical movement.
Has been with the unit from
new and has been looked at by
GE but, said find nothing wrong.

Facility Address:

Revision Date
July 25, 1983

Medical Center Hospital
Rt. 159 & 23
Chillicothe, Ohio, 45601

INSPECTION CHECK LIST

Unit: Th-765

Serial Number: 8

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)	Adjusted low pressure safety switch.
8. Mercury Shutter System	X	N/A
9. Stand and Stretcher		(X) See Sep 1982 report.
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
16. Teletherapy Units with Moving Source Drawer	X	X
17. Teletherapy Units with Moving Shutter Blocks	X	N/A
18. Teletherapy Units with Rotating Shutter	X	N/A
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:

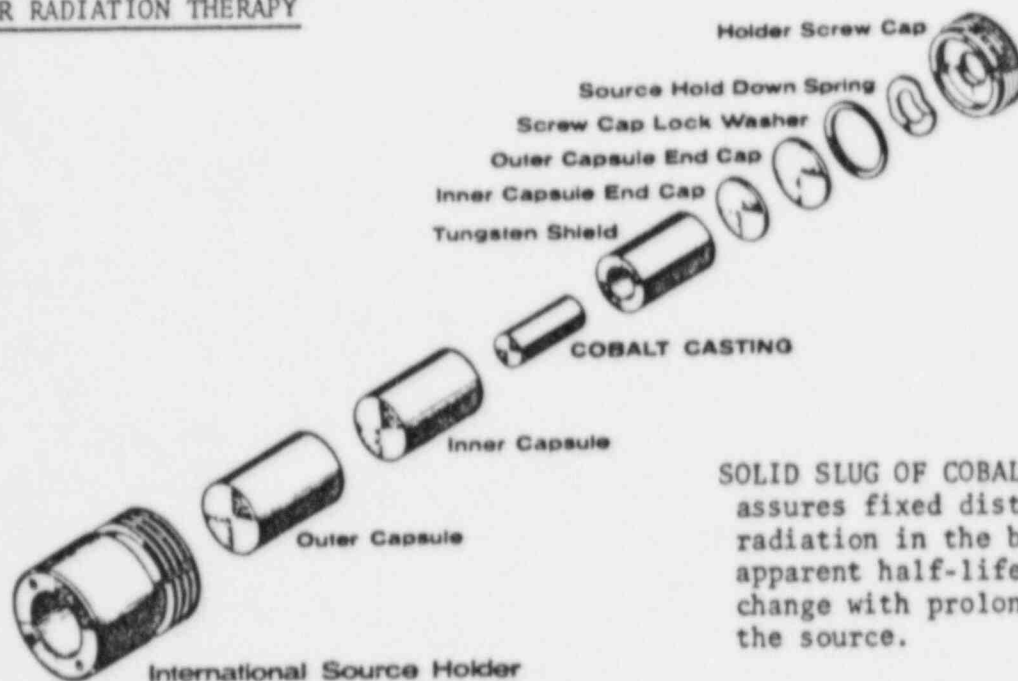
[Signature]

Date:

6-28-83

NEUTRON PRODUCTS inc

COBALT-60 SOURCES
FOR RADIATION THERAPY



SOLID SLUG OF COBALT-60
assures fixed distribution of
radiation in the beam; the
apparent half-life will not
change with prolonged use of
the source.

DOUBLE ENCAPSULATION, with or without internal heavy metal shield, is fabricated, seal-welded, leak-tested, and checked for external contamination to highest standards.

Source capsule holder is provided for any teletherapy machine, including INTERNATIONAL CAPSULE (as shown), SHIELDED DRAWER, or other holder as appropriate.

NEUTRON PRODUCTS sources and fabrication procedures have been approved for standard applications in beam therapy units. Licensed personnel provide installation and radiation surveys.

Prices quoted on request will cover FULL SERVICE --- shipping, rigging, installation, routine maintenance, removal and disposal of turn-in source. Special maintenance, calibration, leakage field surveys, reports to regulatory agency, and other services may be ordered.

For further information
please write or call:

NEUTRON PRODUCTS inc

22301 Mt. Ephraim Rd
P. O. Box 68
Dickerson, MD 20842
(301) 349-5001

19136