

# RADIATION PROTECTION SERVICES, INC.

CONSULTANTS IN HEALTH PHYSICS

P.O. Box 2359

DARIEN, CT 06820

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(201) 254-9080

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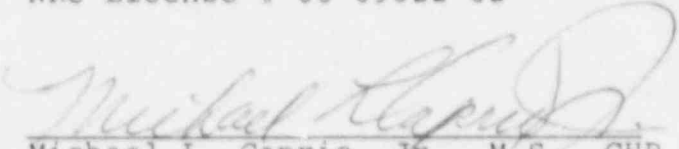
RADIATION PROTECTION  
SERVICES INC  
P. O. Box 2395  
Darien, CT 06820

## TELETHERAPY SOURCE EXCHANGE REPORT

Prepared for: GREENWICH HOSPITAL ASSOCIATION  
1 Perryridge Road  
Greenwich, CT 06810

NRC License # 06-09522-02

Prepared by:

  
Michael L. Caprio, Jr., M.S., CHP  
Certified Health Physicist  
RADIATION PROTECTION SERVICES, INC.

Decemeber 6, 1986

RECEIVED BY LFMS	
Date	12/31/86
Time	201
By	J. Kimbly
Date Completed	12/31/86

**FEE EXEMPT**  
*It survey*

**"OFFICIAL RECORD COPY"**

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REG1 LIC30  
06-09522-02 PDR

DEC 22 1986

TELETHERAPY SOURCE EXCHANGE SURVEY REPORT

- (1) Licensee: Greenwich Hospital Association  
1 Perryridge Road  
Greenwich, CT  
  
License No. 06-09522-02
- (2) Surveyor: Michael L. Caprio, Jr., M.S., CHP  
Certified Health Physicist  
Radiation Protection Services, Inc.  
P.O. Box 2395  
Darien, CT 06820-1295
- (3) Reason of Survey: Installation of new Co-60 source
- (4) Installation date: December 5, 1986
- (5) Survey date: December 6, 1986
- (6) Survey meters used:
- (a) beam measurements - MDH-2025 electrometer  
Model 2025-0.6x ion chamber  
  
calibration date: November 7, 1986  
calibrated by: K & S Associates - RCL  
standard: Cobalt-60
  - (b) environmental surveys:
    - (1) Ludlum Model # 3 GM-meter (SN-43242)  
  
calibration date: May 15, 1986  
calibrated by: Ludlum Measurements, Inc.  
License #: TX-4-1963  
standard: Cesium-137
    - (2) Technical Associates - PUG-1  
  
calibration date: November 7, 1986  
calibrated by: Radiation Protection Services  
standard: Cesium-137
- The procedures used by Radiation Protection Services, Inc. are already on file with the offices of the NRC. Please reference NRC License # 06-20811-01 as issued to Radiation Protection Services, Inc. for these procedures
- (7) Teletherapy unit: Flicker C-8  
SN-6223/127
- (8) Cobalt Source: Neutron Products, Inc.  
NPI-20-4800-W

(9) Source activity: 4720.0 Curies as of 12/5/86

(10) Source output: 4798.8 Rhm as measured with a  
10 x 10 field.

(11) The attached diagram shows the results of the teletherapy source head survey performed along 14-points with the beam in the "off" position. The survey was performed by RPS representatives utilizing the Ludlum #3 GM-meter (SN-43242) at a distance of one (1) meter from the source.

Results show: maximum reading = 6.0 mR/hr @ 1-meter  
average reading = 1.67 mR/hr @ 1-meter

(12) The limits of beam orientation that are permitted by the unit's mechanical and/or electrical interlocks are as follows:

- (a) 32-degrees - Left swivel @ verticle C-arm
- (b) 20-degrees - Right swivel @ verticle C-arm

With the C-arm turned off verticle, there is no combination of C-arm movement and head swivel that allows the primary beam to be directed off the beam stopped with the beam opened to its widest demensions (ie- 24x 24).

- (c) 39-degrees - Back head tilt
- (d) 58-degrees - Front head tilt

It should be noted that NPI representatives left the facility prior to the physicist checking these settings. Originally these settings were 10-degrees - back tilt and 30-degrees front tilt. NPI representative's were notified of this on 9 December 1986 and were requested to return to the facility to correctly set the interlocks.

(13) To determine radiation levels in each area adjacent to the teletherapy facility, a solid lucite phantom, having demensions of 25 x 25 x 21 cm (L x W x H) was placed in the primary beam of the unit at an SAD of 80 cm (d= 10 cm). The field size was adjusted to a 24 x 24 cm square field at this SAD (ie- maximum opening).

The Picker C-8 teletherapy unit was turned to the "on" position and a survey was made to determine the radiation levels in all areas adjacent to the treatment room. Since this unit has rotational capabilities, the environmental survey was performed for each 30-degrees of unit rotation.

To determine the dose per week in adjacent areas to the treatment room, the following factors are required to be defined:

(a) unit workload: 30 patients per day (maximum)  
3.5 minutes treatment per patient  
105 minutes of beam "on" time/day  
8.75 hrs beam "on" time/week

(b) fraction of Rx @ specified beam orientations (f'):

AP (0-degrees)	-	0.37
PA (180-degrees)	-	0.37
RLAT (90-degrees)	-	0.07
LLAT (270-degrees)	-	0.07
other angles	-	0.12

To test for the worst possible situation, the fraction of time that treatment occurs at each specific beam orientation (f') will be assumed to be unity.

(c) occupancy factors (T):

inner walls - radiology	-	T = 1.0
outer walls - courtyard	-	T = 0.25
upstairs - physiotherapy	-	T = 1.0 (at closest point)
below - corridor	-	T = 1

(d) Limits of weekly dose:

controlled areas (C)	=	100 mRem/week
uncontrolled areas (U)	=	10 mRem/week

The attached facility diagrams show those areas that were surveyed.

The following formula was used to convert exposure rate to weekly dose rate:

$$D \text{ (mRem/wk)} = (X \text{ (mR/hr)}) (W) (f') (T)$$

where: D = weekly dose equivalent rate  
X = exposure rate measured in survey  
W = weekly workload in hrs. of beam "on" time  
f' = beam orientation factor (f' = 1.0)  
T = occupancy factor (T = 1.0)

(14) The following tests were performed to determine the operational status of certain safety features of the unit. The tests are described as follows:

(a) Door interlocks: While the unit was operating, the entry door was opened. It was noted that the unit immediately returned to the "off" position. When the door was re-closed, the unit did not return to the "on" position until the key was re-set and unit re-activated.

(b) Independent warning device: A check of the PrimAlert-10 room monitor indicated that this unit is also

operating properly.

(c) "On/Off" Indicators: While the unit was operating, the status of the on/off indicators on the unit; over the entry door; and at the control panel were noted. All warning lights operated in unison with "Green" indicating source "off" and "Red" indicating source "on".

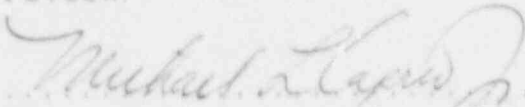
(d) Electrical/mechanical interlocks on unit head: Was previously describes.

(e) Treatment timer: The accuracy of the unit's treatment timer was checked with a stop-watch. The unit's time is acceptably accurate.

(15) Fate of old Cobalt-60 source: The old source - Model # NPI-20-4800-W (SN- T-541) having an activity of 2750 Curies on 1 January 1987 was transferred to Neutron Products, Inc. (License # MD-31-025-03).

(16) Prior to patient treatment, this unit was calibrated in accordance to Title 10, Code of Federal Regulations, Part 35 by Mr. Michael L. Caprio, Jr., M.S., CHP. Mr. Caprio is a qualified expert both due to training and experience and also by the fact that he is certified by the American Board of Health Physics.

A copy of the calibration report is available for NRC review.

  
Michael L. Caprio, Jr., M.S., CHP  
Certified Health Physicist

December 6, 1986

## SHIELDING INTEGRITY SURVEY - TELETHERAPY SOURCE EXCHANGE GHA 12/6/86

AREA	TYPE	Beam orient.	X mR/hr	W Beam-on	f'	T	Dose mRem/week
Wall A	C	0	0.3	8.75 h	1	1	2.6
		30	0.25	"	1	1	2.1
		60	BKG	"	1	1	---
		90	BKG	"	1	1	---
		120	0.04	"	1	1	0.35
		150	0.06	"	1	1	0.53
		180	0.12	"	1	1	1.05
		210	0.25	"	1	1	2.20
		240	0.6	"	1	1	10.50
		270	0.6	"	1	1	5.25
		300	1.0	"	1	1	8.75
		330	1.75	"	1	1	1.75
Wall B	C	0	0.2	8.75 h	1	1	1.75
		30	BKG	"	1	1	---
		60	BKG	"	1	1	---
		90	BKG	"	1	1	---
		120	BKG	"	1	1	---
		150	BKG	"	1	1	---
		180	0.08	"	1	1	0.7
		210	1.0	"	1	1	8.7
		240	4.0	"	1	1	35.0
		270	3.0	"	1	1	26.0
		300	5.0	"	1	1	43.7
Wall C	C	0	0.5	8.75 h	1	1	4.37
Wall D	C	0	0.2	8.75 h	1	1	1.75
		30	1.2	"	1	1	10.50
		60	4.0	"	1	1	35.0
		90	5.0	"	1	1	43.7
		120	5.0	"	1	1	43.7
		150	2.0	"	1	1	17.5
		180	0.2	"	1	1	1.75
		210	BKG	"	1	1	---
		240	BKG	"	1	1	---
		270	BKG	"	1	1	---
		300	BKG	"	1	1	---
		330	BKG	"	1	1	---

APEA	TYPE	Beam orient.	X mR/hr	W Beam-on	f'	T	Dose mRem/week
Wall E	U	0	0.5	8.75 h	1	1	1.09
		58 front tilt	0.06	"	1	1	0.13
Wall F	C	0	BKG	8.75 h	1	1	---
		30	BKG	"	1	1	---
		60	BKG	"	1	1	---
		90	BKG	"	1	1	---
		120	BKG	"	1	1	---
		150	BKG	"	1	1	---
		180	0.4	"	1	1	3.5
		210	0.7	"	1	1	6.1
		240	1.7	"	1	1	14.8
		270	0.9	"	1	1	7.8
		300	0.2	"	1	1	1.75
		330	0.1	"	1	1	0.90
Below	U	0	BKG	8.75 h	1	1	---
		Mantle	BKG	"	1	1	---
Above	U	0	BKG	8.75 h	1	1	---
		30	BKG	"	1	1	---
		60	BKG	"	1	1	---
		90	BKG	"	1	1	---
		120	0.09	"	1	1	0.79
		150	0.25	"	1	1	2.1
		180	0.25	"	1	1	2.1
		210	0.25	"	1	1	2.1
		240	0.09	"	1	1	0.79
		270	BKG	"	1	1	---
		300	BKG	"	1	1	---
		330	BKG	"	1	1	---

SPECIAL BEAM ORIENTATION CONDITIONS (NOTE: f' = actual estimated use for special conditions)

#1- Wall A	C	32-degrees	BKG	8.75 h	0	1	}
B	C	off beam	BKG	"	0	1	
C	C	stop to	0.5	"	0	1	
D	C	LEFT w/	0.8	"	0	1	
E	U	C-arm @	BKG	"	0	1	
F	C	verticle	BKG	"	0	1	
#2- Wall A	C	10-degrees	BKG	8.75 h	0	1	}
B	C	off beam	BKG	"	0	1	
C	C	stop to	0.5	"	0	1	
D	C	LEFT w/	40.0	"	0	1	
E	U	C-arm @	BKG	"	0	1	
F	C	90-degree	BKG	"	0	1	

	AREA		TYPE	Beam orient.	X mR/hr	W Beam-on	f'	T	Dose mRem/week
#3	Wall	A	C	5-degrees	BKG	8.75 h	0	1	---
		B	C	off beam	BKG	"	0	1	
		C	C	stop to	BKG	"	0	1	
		D	C	LEFT w/	1.5	"	0	1	
		E	U	C-arm @	BKG	"	0	1	
		F	C	130-deg	BKG	"	0	1	
#4	Wall	A	C	5-degrees	0.4	8.75 h	0.1	1	0.35
		B	C	off beam	5.0	"	0.1	1	4.37
		C	C	stop to	0.5	"	0.1	1	0.25
		D	C	LEFT w/	BKG	"	0.1	1	---
		E	U	C-arm @	BKG	"	0.1	1	---
		F	C	270-deg	1.3	"	0.1	1	1.14
#5	Wall	A	C	20-degrees	0.16	8.75 h	0.1	1	0.14
		B	C	off beam	0.5	"	0.1	1	0.25
		C	C	stop to	BKG	"	0.1	1	---
		D	C	RIGHT w/	BKG	"	0.1	1	---
		E	U	C-arm @	BKG	"	0.1	1	---
		F	C	verticle	0.05	"	0.1	1	0.04
#6	Wall	A	C	39-degrees	BKG	8.75 h	0	1	---
		B	C	Head tilt	BKG	"	0	1	
		C	C	BACK	60.0	"	0	1	
		D	C		BKG	"	0	1	
		E	U		BKG	"	0	1	
		F	C		BKG	"	0	1	
#7	Wall	A	C	58-degree	1.9	8.75 h	0	1	---
		B	C	Head tilt	BKG	"	0	1	
		C	C	FRONT	BKG	"	0	1	
		D	C		BKG	"	0	1	
		E	U		BKG	"	0	1	
		F	C		0.6	"	0	1	
#8	Wall	A	C	C=90°	0.05	8.75 h	0.1	1	0.04
		B	C	S=90°	BKG	"	0.1	1	---
		C	C	T=58F	BKG	"	0.1	1	---
		D	C		BKG	"	0.1	1	---
		E	U		0.2	"	0.1	1	0.18
		F	C		BKG	"	0.1	1	---



AREA	TYPE	Beam orient.	X mR/hr	W Beam-on	f'	T	Dose mRem/week	
#9	Wall A	C	Mantle	0.04	8.75 h	0.1	1	0.04
	B	C	Set-up	0.5	"	0.1	1	0.25
	C	C		BKG	"	0.1	1	---
	D	C		BKG	"	0.1	1	---
	E	U		BKG	"	0.1	1	---
	F	C		BKH	"	0.1	1	---

Abbreviations: C = controlled area (limit = 100 mRem/week)  
 U = uncontrolled area (limit = 10 mRem/week)  
 BKG = background exposure rate = less than 0.02 mR/hr

For special exposure condition all C-arm angles specified with relation to the verticle (ie- verticle = 0-degre; @ wall "D" = 90-degrees C-arm; @ wall "B" = 270-degrees; @ above = 180-degrees).

OUTSIDE (2nd Floor)

"E"

Room #S-113  
Mammography  
&  
Superficial Rx

"F"

Room #S-110  
Diagnostic  
R&F Room

"D"

Control Area

"B"

"C"

X-ray Department Hallway

FLOOR DIAGRAM - GREENWICH HOSPITAL ASSOCIATION  
Cobalt-60 Teletherapt Room  
Room #S-112

Above: Physiotherapy  
Below: None

Scale:  $\frac{1}{4}" = 1'$

# Figure F-1 TELETHERAPY HEAD SURVEY

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

Top View-Showing  
Orientation  
of Views A through D

Position No.	Radiation Level (mr/hr)
View A	
1	5.0
2	0.8
3	5
4	1.8

View B	
5	1.1
6	1.1
7	1.3
8	1.8

View C	
9	0.9
10	0.9

View D	
11	1.1
12	1.0
13	1.3
14	1.4

Average value 1.67

Maximum value 5.0

Date of survey 12-6-86

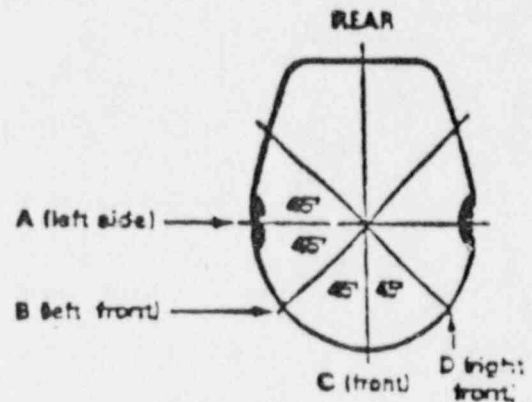
Instrument used Ludlum 45

Manufacturer's  
name & model number  
of teletherapy source \_\_\_\_\_

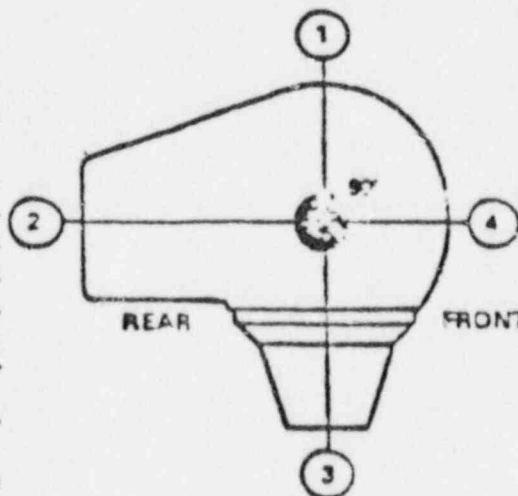
Date of installation \_\_\_\_\_

OUTPUT ☐ RHM.  
☐ RMM.

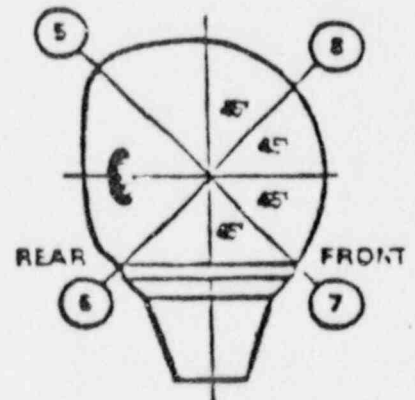
Date of output  
measurement \_\_\_\_\_



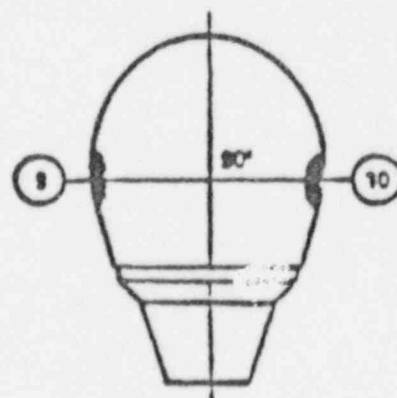
View A-Vertical  
from left side



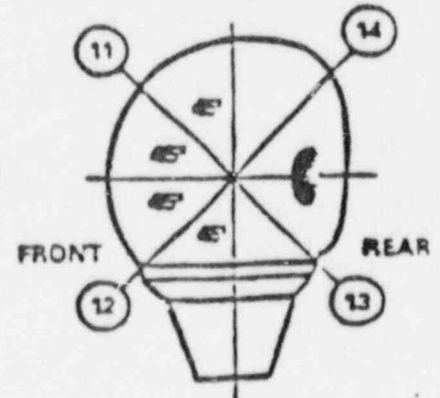
View B-Vertical  
from left front



View C-Vertical  
from front



View D-Vertical  
from right front



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02300  
7/89.

BETWEEN: William O. Miller, Chief  
License Fee Management Branch  
Office of Administration

John E. Glenn, Chief  
Nuclear Materials Section B  
Division of Engineering and  
Technical Programs

RECEIVED  
DEC 31 1986

LICENSE FEE TRANSMITTAL

Teletherapy Survey

A. REGION

1. APPLICATION ATTACHED

Applicant/Licensee: Greenwich Hospital Association

Application Dated: 12/6/86

Control No.: 106571

License No.: 06-09522-02

2. FEE ATTACHED

Amount: 0

Check No.: 0

3. COMMENTS

Signed Brando Blatchek

Date 12/23/86

**FEE EXEMPT**

B. LICENSE FEE MANAGEMENT BRANCH

1. Fee Category and Amount: 7A It survey

2. Correct Fee Paid. Application may be processed for:

Amendment       

Renewal       

License       

Signed S. Kimberley

Date 12/31/86