

## MATERIALS LICENSE

Amendment No. 25

Pursuant to the Atomic Energy Act of 1954, as amended, the Energy Reorganization Act of 1974 (Public Law 93-438), and Title 10, Code of Federal Regulations, Chapter I, Parts 30, 31, 32, 33, 34, 35, 39, 40 and 70, and in reliance on statements and representations heretofore made by the licensee, a license is hereby issued authorizing the licensee to receive, acquire, possess, and transfer byproduct, source, and special nuclear material designated below; to use such material for the purpose(s) and at the place(s) designated below; to deliver or transfer such material to persons authorized to receive it in accordance with the regulations of the applicable Part(s). This license shall be deemed to contain the conditions specified in Section 183 of the Atomic Energy Act of 1954, as amended, and is subject to all applicable rules, regulations and orders of the Nuclear Regulatory Commission now or hereafter in effect and to any conditions specified below.

Licensee		In accordance with letter dated November 24, 1989,
1. Massachusetts General Hospital		3. License number 20-03814-14 is amended in its entirety to read as follows:
2. Department of Radiation Medicine Fruit Street Boston, Massachusetts 02114		4. Expiration date November 30, 1997
		5. Docket or Reference No. 030-00239
6. Byproduct, source, and/or special nuclear material	7. Chemical and/or physical form	8. Maximum amount that licensee may possess at any one time under this license
A. Cobalt 60	A. Teletherapy sealed sources (AECL Model C-146 or C-151)	A. 18,000 curies (2 sources of not more than 9,000 curies each)
9. Authorized use		
A. One source in a AECL Theratron 780 teletherapy unit for the treatment of humans. One source in its shipping container to be in possession of the licensee as necessary to the replacement of the source in the teletherapy unit only.		

## CONDITIONS

10. Location of use: Fruit Street, Boston, Massachusetts.
11. Radiation Safety Officer: Reginald Brian Woodleigh
12. Licensed material listed in Item 6 above is authorized for use by, or under the supervision of, the following individuals for the materials and uses indicated:

Authorized UsersMaterial and Use

Daniel Flynn, M.D.	35.600
Paul O'Kunieff, M.D.	35.600
Christopher C. Willett, M.D.	35.600
Francis S. Pardo, M.D.	35.600
Simon N. Powell, M.D.	35.600

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PDR ADOCK 03000289  
C PDR

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**MATERIALS LICENSE  
SUPPLEMENTARY SHEET**

License number

20-03814-14

Docket or Reference number

030-00239

Amendment No. 25

(12. continued)

**CONDITIONS**

Authorized Users

Material and Use

Allan F. Thornton, Jr., M.D.

35.600

Anthony L. Zietman, M.D.

35.600

B. Teletherapy Physicist: Joseph Leong, Ph.D. or an individual who meets the requirements of 35.961.

13. Pursuant to 10 CFR Part 40, "Domestic Licensing of Source Material", the licensee is authorized to possess, use, transfer, and import up to 999 kilograms of uranium contained as shielding material in the teletherapy units authorized by this license.

14. The licensee is exempted from decommissioning financial assurance requirements for possession of licensed material in sealed sources in quantities greater than the limits in 10 CFR 30.35(d) for the purpose of source changes only. This exemption is granted for no more than 30 days for any one source change.

15. Except as specifically provided otherwise in this license, the licensee shall conduct its program in accordance with the statements, representations, and procedures contained in the documents, including any enclosures, listed below. The Nuclear Regulatory Commission's regulations shall govern unless the statements, representations, and procedures in the licensee's application and correspondence are more restrictive than the regulations.

- A. Application dated November 24, 1989
- B. Letter dated February 7, 1990
- C. Letter dated April 24, 1990
- D. Letter dated April 21, 1992
- E. Letter dated September 23, 1992, Item 3 only

For the U.S. Nuclear Regulatory Commission

Original Signed By:

Thomas K. Thompson

By

Nuclear Materials Safety Branch  
Region I

King of Prussia, Pennsylvania 19406

Date

NOV 09 1992

NOV 09 1992

License No. 20-03814-14  
Docket No. 030-00239  
Control No. 111662

Massachusetts General Hospital  
ATTN: Reginald Brian Woodleigh  
Radiation Safety Officer  
Department of Radiation Medicine  
Fruit Street  
Boston, Massachusetts 02114

Dear Mr. Woodleigh:

Please find enclosed the renewal of your NRC Material License.

Please review the enclosed document carefully and be sure that you understand all conditions. If there are any errors or questions, please notify the Region I Material Licensing Section, (215) 337-5053, so that we can provide appropriate corrections and answers.

Please be advised that you must conduct your program involving licensed radioactive materials in accordance with the conditions of your NRC license, representations made in your license application, and NRC regulations. In particular, please note the items in the enclosed, "Requirements for Materials Licensees."

Since serious consequences to employees and the public can result from failure to comply with NRC requirements, the NRC expects licensees to pay meticulous attention to detail and to achieve the high standard of compliance which the NRC expects of its licensees.

You will be periodically inspected by NRC. A fee may be charged for inspections in accordance with 10 CFR Part 170. Failure to conduct your program safely and in accordance with NRC regulations, license conditions, and representations made in your license application and supplemental correspondence with NRC will result in prompt and vigorous enforcement action against you. This could include issuance of a notice of violation, or in case of serious violations, an imposition of a civil penalty or an order suspending, modifying or revoking your license as specified in the General Policy and Procedures for NRC Enforcement Actions, 10 CFR Part 2, Appendix C.

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ML 10

Massachusetts General Hospital

-2-

We wish you success in operating a safe and effective licensed program.

Sincerely,

Original Signed By:  
Thomas K. Thompson

Thomas K. Thompson  
Senior Health Physicist  
Nuclear Materials Safety Branch  
Division of Radiation Safety  
and Safeguards

Enclosures:

1. Amendment No. 25
2. Requirements for Materials Licensees
3. Requirements for Medical Licensees
4. NRC Forms 3 and 313
5. Draft Teletherapy Guide

*TkT*  
DRSS:RI  
Thompson/cmm

11/6 /92



DEPARTMENT OF RADIOLOGY  
Division of Radiological  
Sciences and Technology

Director:  
EDWARD W. WEBSTER, Ph.D.  
Professor of Radiology (Physics)



Mailing Address: 030-01867  
Massachusetts General Hospital  
Boston, Massachusetts 02114  
(617) 726-8326/3078

December 19, 1991

*Free  
survey after  
installation*

U. S. Nuclear Regulatory Commission  
Region I  
475 Allendale Road  
King of Prussia, PA 19406

Subject: Radiation Safety following  
installation of Micro-Selectron  
HDR Iridium-192 therapy unit  
under License No. 20-03814-80

Attn: Dr. John Kinneman

Dear Dr. Kinneman,

I enclose the survey report performed on December 4, 1991 on the above device by Thomas Mauceri, Certified in the Physics of Radiotherapy by the American Board of Radiology. The survey was made before the commencement of treatment with this unit. Since the unit is housed in an existing room designed for Cobalt-60 teletherapy, the exposure rates outside the room are very low and well within the maximum levels for unrestricted areas.

We are anxious to know whether a new survey is needed following each Iridium-192 source replacement which occurs every 3 months (4 times per year). We believe that under the above circumstances of very low exposure rates such repeated surveys of the same unit with a new source of the original activity would be unnecessary. However we await the advice of your office regarding your policy.

Yours sincerely,

E. W. Webster, Ph.D., Chairman  
Radiation Safety Committee

EWV/bh

Enc. Report plus copy

cc: T. Mauceri  
P. Biggs, Ph.D.  
E. R. Epp, Ph.D.

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12/27/91

**Radiation Survey of the Nucletron Mico-Selectron**  
(Located in the AECL Eldorado 78 Cobalt-60 room)  
**at**  
**Massachusetts General Hospital**

1. Institution possessing and using the source  
Massachusetts General Hospital, Fruit Street, Boston, Massachusetts.  
NRC license #20-03814-80, Amendment #46.
2. Person conducting the survey  
Thomas Mauceri, M.S., Department of Radiation Oncology, Massachusetts  
General Hospital, Boston, MA, 02114.
3. Installation of the first Iridium-192 source for a High Dose Rate (HDR)  
application.
4. Date of installation  
11-20-91
5. Date of Survey  
12-4-91
6. Survey instrumentation
  - a. Victoreen Thyac III, Model 490, SN 3034, Calibrated 12-4-91.
  - b. Victoreen , Model 450, SN 519, Calibrated 12-4-91.

Calibration instrumentation

  - a. NEL (Farmer) Chamber Model 2571, SN 1780, Delrin Buildup Cap SN 1780.  
Last calibrated 10-25-91.
  - b. Keithly Digital Dosimeter Model 35614, SN 33262. Last Calibrated 7-9-90.
7. Manufacturer and Model  
Nucletron  
Micro-Selectron HDR
8. Manufacturer and Model # of Source  
Mallinckrodt Diagnostica (Holland)  
Source # 532
9. Source strength at time of installation  
9.2786 Ci
10. The activity of the source was calculated from measured data utilizing an  
exposure rate constant of  $4.66 \text{ (R-cm}^2\text{)/(mCi-hr)}$ . The measurements were  
performed at a distance of 10 cm in air.
11. Radiation levels were measured around the HDR unit at positions  
indicated in Figure I. These readings were less than 4.0 mR/hr at the surface  
and less than 1.3 mR/hr at 10 cm.

12. NA

13. Radiation survey setup

- a. The source was driven from the HDR unit to a position 11 ft from wall A, 4 ft from wall D and to a height of 4 ft (see Figures II + III).
- b. The source was unattenuated for all measurements.

14. Floor plan and cross section of HDR facility indicating restricted and unrestricted areas (Figures II + III).

15. The maximum radiation level in areas adjacent to the HDR facility are shown in Table I. Measurements were done at heights of 6 ft., 4 ft. and 1 in. along walls C and D. The same measurement criteria were used for the entrance door. Measurements along wall A were done at the level indicated in Figure III. Measurements for the floor above the HDR facility were done on the surface of the floor. The maximum Radiation level measured, 0.8 mR/hr, was at the surface of the door at the level of the floor. Given an on time of 12 min per patient for 5 patients per week or 1 hr per week (Part D. 1. of Amendment Proposal). The exposure would not exceed 2 mR in any hour or 100 mR in any seven days. The exposure rate measured at any other area did not exceed 0.02 mR/hr, this is approximately background for the MGH Radiation Oncology Department.

16. Radiation safety interlocks

The following interlocks were tested and found to be operational.

a. Key switch mode selector, selects which radiation device will operate (HDR or Cobalt-60) and locks the other out of usage.

b. Entrance door interlock, prevents the HDR Unit from operating when door is open. If the door is opened when the HDR Unit is operating, the source will return to its storage safe.

c. Emergency Stop buttons on HDR Unit and HDR Console, causes the source to return to its storage safe when buttons are depressed during HDR operation. Operation may resume only after a key switch has been reset.

d. Emergency off buttons on walls B and D, will not allow the HDR Unit to operate when depressed and will cause the source to return to its storage safe if depressed while the unit is operating.

e. Interrupt button on HDR Console, will cause the source to return to its storage safe while the HDR Unit is in operation. The start button can then be depressed and patient treatment will resume where it was interrupted.

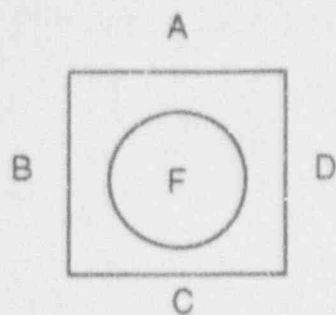
f. Indicator lights, a yellow light on the HDR console blinks while the the source is in transit, once the source reaches its treatment position the light remains on but does not blink. When the source returns to the safe a green light labeled "safe" remains on. In addition there are green (source in safe) and red (source out of safe) warning lights mounted directly over the entrance door.

17. A full inspection of the HDR Unit including interlocks was performed by a licenced employee of the Nucletron Corporation, before the source was installed.
18. A wipe test, leak test and source integrity test were performed by Mallinckrodt Diagnostica, Holland, on 10-28-91. The source passed all tests.

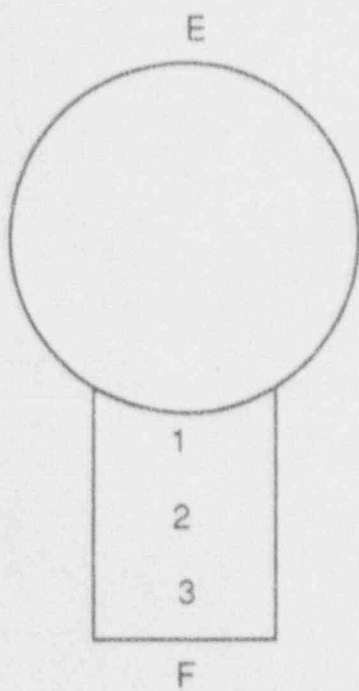


FIGURE 1

HDR UNIT



Front View



Top View

		mR/hr	
Position		Surface	10 cm from surface
A	1	1.6	1.3
	2	2.3	
	3	2.6	
B	1	1.3	1.3
	2	4.0	
	3	2.7	
C	1	1.3	0.8
	2	1.5	
	3	1.2	
D	1	1.3	1.3
	2	2.7	
	3	2.0	
E		1.1	0.8
F		0.9	0.7

Figure II Floor Plan HDR Facility

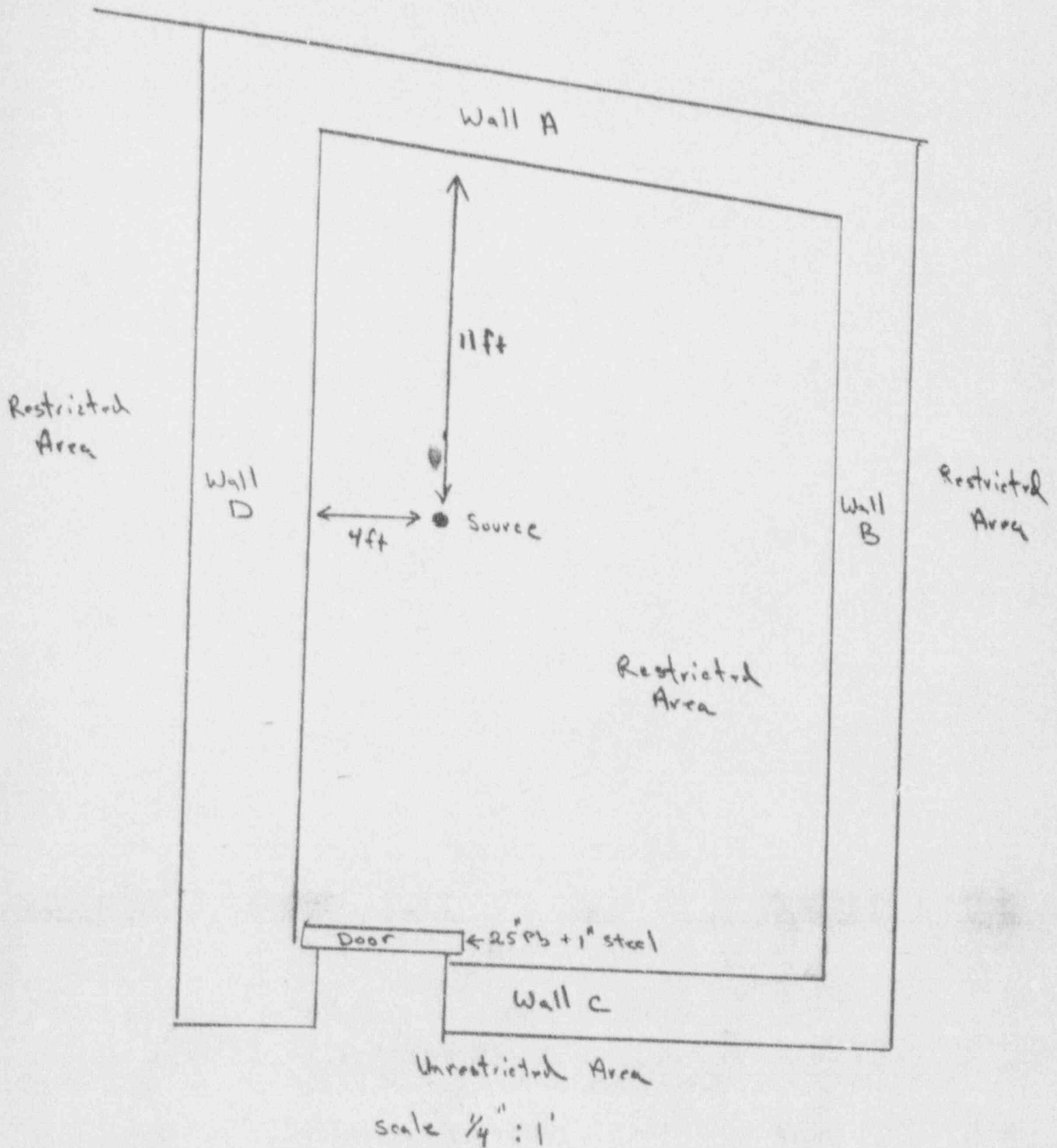


Fig III Cross Section HDR Facility

Unrestricted Area

Floor Above HDR Unit

Unoccupied Crawl Space

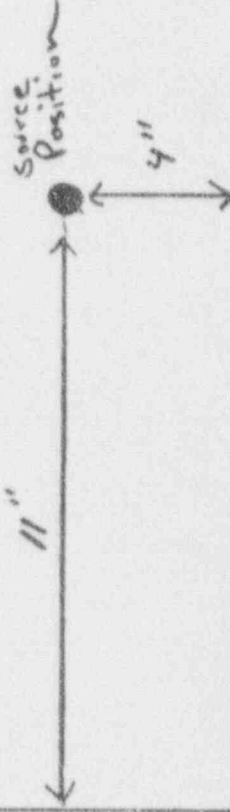
Unrestricted Area  
Level of  
Wall A  
Survey

Wall A

Below Ground

Wall C

Restricted Area



Drawing Not To Scale

TABLE I

Wall A	0.01 mR/hr
Wall B	0.01 mR/hr
Wall C	0.02 mR/hr
Wall D	0.02 mR/hr
Entrance Door	0.8 mR/hr
Floor Above HDR Facility	0.01 mR/hr



## DEPARTMENT OF RADIOLOGY

Division of Radiological  
Sciences and Technology

Director:

EDWARD W. WEBSTER, Ph.D.

Professor of Radiology (Physics)



Mailing Address:

Massachusetts General Hospital

Boston, Massachusetts 02114

(617) 726-8326/3078

April 24, 1990

U. S. Nuclear Regulatory Commission  
Region I  
475 Allendale Road  
King of Prussia, PA 19406

License No. 20-03814-14  
Docket #030-00239

Gentlemen,

In accordance with Amendment No. 23 to the above license issued January 11, 1990 and specifically with Condition 16, a radiation survey has been made of our Cobalt-60 Teletherapy Unit, AECL Model 780.

On April 6, 1990 a new source was installed in the above unit. A recalibration and a complete radiation survey were performed on April 7, 1990 by Joseph Leong, Ph.D. (Certified in Therapeutic Radiological Physics 1984). Enclosed is his report approved by myself this day.

As noted at the end of the report, a full inspection and servicing of the teletherapy unit was performed by licensed personnel from Therapy Services, Inc., Frederick, MD in conformity with the 5-year requirement for this service. Please note that this service was performed previously on January 16, 1990 at the time of relocation of the unit within the Hospital (see report submitted February 7, 1990).

Yours sincerely,

APR 27 1990  
E. W. Webster

E. W. Webster, Ph.D., Chairman  
Radiation Safety Committee  
(Acting Radiation Safety Officer)

EWW/bh

Enc. Summary Report by J. Leong, Ph.D.

cc: J. Leong, Ph.D.  
P. Biggs, Ph.D.  
H. Suit, M.D.

Radiation Survey of Theratron-780 Cobalt-60  
at  
Massachusetts General Hospital  
Boston, Massachusetts

1. Institution Possessing and Using the Source  
Massachusetts General Hospital, Fruit Street, Boston,  
Massachusetts.  
NRC License No: 20-03814-14 Amendment No. 23
2. Person Conducting the Survey  
Joseph Leong, Ph.D., Massachusetts General Hospital
3. Installation of a new source.
4. Date of Installation: April 6, 1990
5. Date of Survey: April 7, 1990
6. Survey Instrumentation:
  - a. Victoreen Thyac III, Model 490, SN 5500  
Last calibrated: February 23, 1990
  - b. Victoreen Model 450, SN 519  
Last calibrated: February 23, 1990
  - c. Victoreen Model 470, SN 179  
Last calibrated: February 23, 1990

Calibrations of the meters were done for the range .1 mR/hr to 50 mR/hr by placing the meters at known distances from a standard radium source.

Output Calibration Instrumentation:

- a. NEL (Farmer) Chamber Model 2571 (0.6 cc, AE plastic,  
Serial # 221, Delri Buildup Cap, #221  
Last calibrated: August 3, 1988.
- b. Keithley Digital Dosimeter Model 35614, Serial # 13256  
Last calibrated: August 3, 1988.

The above two instruments were calibrated at the Accredited Dosimetry Calibration Laboratory at the M. D. Anderson Hospital and Tumor Institute.

7. Manufacturer and Model Number of Teletherapy Unit  
Atomic Energy of Canada Limited  
Theratron-780
3. Manufacturer and Model Number of Source  
Theratronics International Limited

Source Type: C-146

9. Source strength at the time of installation: 7547 curies.
10. The measured output of the source installed in the teletherapy head was determined to be 199.7 R/min at 80 cm for a 10 cm x 10 cm field on April 7, 1990.
11. The unit was wrapped with Kodak TL film for overnight to locate head leakage. No substantial leakage was found except for the area around the opening where the source drawer rod protrudes (position 4 in View A of Figure 1) when the source is in the "ON" position. The maximum and average radiation levels measured at one meter from the source with the teletherapy source in the "OFF" position are shown in Figure 1.
12. Description of the limits of beam orientation  
The Theratron-780 is a rotational unit with an integral beam absorber. The electrical **OFF SHIELD** interlock prevented movement of the source to the ON position unless the beam was completely intercepted by the beam absorber or was directed towards the floor within  $\pm 30^\circ$  of vertical.
13. Radiation Survey Setup
  - a. A 30cm x 30cm x 30cm polystyrene phantom was used.
  - b. Source-to-phantom distance was 80cm SAD.
  - c. The field size used was 35cm x 35cm.
14. Drawings of teletherapy facility. See attached figures.
15. The maximum radiation level in each area adjacent to the teletherapy facility with a 30 cm thick phantom in the primary beam is summarized in Table I.

The Theratron-780 has an output of approximately 189.7 cGy/min at 80 cm isocenter. Estimating that the weekly workload is 80,000 cGy in patient at isocenter the "Beam-On" time is about 7.03 hours per week. Table I lists the "Beam-On" exposure levels measured for specified gantry angulation (Figure 4 shows the orientation of the machine for various gantry angles and does not represent the angles where measurements were made.) at various locations near the treatment room (Figures 2 and 3) and the derived % maximum permissible exposure (% MPE) adopting the 7.03 hours/week "Beam-On" estimate. The maximum permissible exposures for restricted (C) and unrestricted (U) areas are taken to be 100 mR/week and 10 mR/week, respectively and 2 mR in any one hour. A use factor of 1.0 and an occupancy factor of 1.0 are assumed throughout.

Table I lists worst case exposures - that is, fraction of maximum permissible exposure is based on a worst case orientation of the beam for the weekly or hourly period

involved. Levels were measured for all gantry angles at 15° intervals.

For all unrestricted areas the exposure levels were all less than 7.2% of the maximum allowed per week and less than 0.9% of the maximum allowed per one hour. For all the restricted areas the levels were found to be less than 2.1% of the maximum allowed per week and less than 2.6% of the maximum allowed per one hour.

A crawl space is located above the ceiling of the treatment room and below the first floor of the tumor clinic (see Figure 3). Access to this crawl space is controlled. It would be from an area in direct line of sight of the operator and warning notices are posted requiring operator's permission for access. Moreover, the access to this area is extremely difficult and involves dismantling a major section of ceiling directly above the operator and therefore could not go unnoticed.

16. Radiation Safety Interlocks

The following interlocks are installed and were checked and found to be operating correctly:

- a) Door Safety Interlock and Electric Eye Interlock. Machine goes from "Beam-On" to "Beam-Off" when the door is opened and/or when the electric eye is interrupted. The electric eye controls access to the treatment room with a light beam situated about two feet from the door. The source can be returned to the ON position only by operation of control panel controls.
- b) Source "ON-OFF" Indicators. A red light labeled "BEAM-ON" lights up on the console when the source is in the "Beam-On" position. A green light labeled "BEAM-OFF" is lit when the source is retracted to the "Beam-Off" position. Similar sets of red and green lights are located at the entrance doorway. The source drawer rod is also monitored by closed circuit television.
- c) Beam Stopper Interlock (Off Shield Interlock). The OFF Shield interlocks prevent movement of the source to the ON position unless the beam is completely intercepted by the beam stopper or is directed towards the floor within  $\pm 30^\circ$  of vertical.
- d) Teletherapy Treatment Timing Device. The mechanical timer error was determined by taking single and multiple exposures. The timer error is -0.003 minute, i.e., the actual time of irradiation falls short of the set time by 0.003 minute. The mechanical timer was found to be linear up to 5 minutes.

17. A full inspection and service of the unit was completed by

\* On April 6 1990



licensed personnel from the Theratronics International Limited, 649 Second Street Pike, Southampton, PA 18966.

18. A wipe test was performed by wiping the collimator jaws near the source housing with cotton swabs. Sample count rates were not significantly different from the background rate. Samples were counted in a sodium iodide 3cm x 3cm crystal (Bicron Model 3m3/3, SN S-468) connected to counting equipment by Ortec (Pre-amp Model 276; SN 783; Amp Model 472, SN 765; and High voltage supply Model 456H, SN 125).

*Approved:*

*J W Webster 4/24/90*

Acting Radiation Safety Officer

TABLE 1

Point	Location	Exposure Rate mR/hr	Gantry Angle Fig. 4	Occupancy Type	Percent of Maximum Permissible Exposure <sup>1</sup>	
					C 100 mR/wk U 10 mR/wk	2mR/hr <sup>2</sup>
1	Doorway at Electric Eye					
	Eye Level	0.3	90°	C	2.1	2.6
	(Off-shield)	0.3		C	2.1	2.6
	Gonad Level	0.2	90°	C	1.4	1.8
	(Off-Shield)	0.2		C	1.4	1.8
	Floor Level	0.2	90°	C	1.4	1.8
	(Off-Shield)	0.2		C	1.4	1.8
2	Corridor	<0.1	ALL°	C	<0.7	<0.9
3	Examination Room	<0.1	ALL°	U	<7.2	<0.9
4	Control Console	<0.1	ALL°	C	<0.7	<0.9
	(Off-Shield)	<0.1		C	<0.7	<0.9
5	Cable Tray Penetration	0.2	ALL°	C	1.4	1.8
	(Off-Shield)	0.4		C	2.8	3.5
6	South Wall	<0.1	ALL°	C	<0.7	<0.9
	(Off-Shield)	<0.1		C	<0.7	<0.9
7	West Wall	<0.1	ALL°	C	<0.7	<0.9
8	Access Hatch in W. Wall	<0.1	ALL°	C	<0.7	<0.9
9	East Wall	<0.1	307°	C	<0.7	<0.9
	(Off-Shield)	<0.1		C	<0.7	<0.9
10	Access Hatch in E. Wall	<0.1	307°	C	<0.7	<0.9
	(Off-Shield)	<0.1		C	<0.7	<0.9
11	Sidewalk on Blossom St.	<0.1	ALL° <sup>3</sup>	U	<7.2	<0.9
12	Tumor Clinic	<0.1	ALL°	U	<7.2	<0.9
13	Exam Rooms Above Air Conditioning Duct Cut-Outs	<0.1	ALL°	U	<7.2	<0.9
14	Service Closet	<0.1	ALL°	U	<7.2	<0.9

All measurements made with Thyac III survey meter with machine collimators wide open.

(Off-shield) configuration as shown in Figure 5. (Also with phantom on other side of gantry.)

<sup>1</sup>Estimates are based on the assumption that the worst case condition obtains for the entire week or hour over which the exposure is averaged.

<sup>2</sup>Using "beam-On" of 7.03 hours/40 hours (1 week), the average "Beam-On" per hour is 0.176 hours or 11 minutes. Use factor of 1 is assumed.

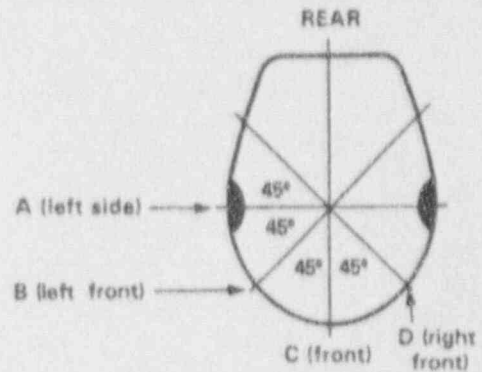
<sup>3</sup>Machine rotating continuously.

# Figure 1 TELETHERAPY HEAD SURVEY

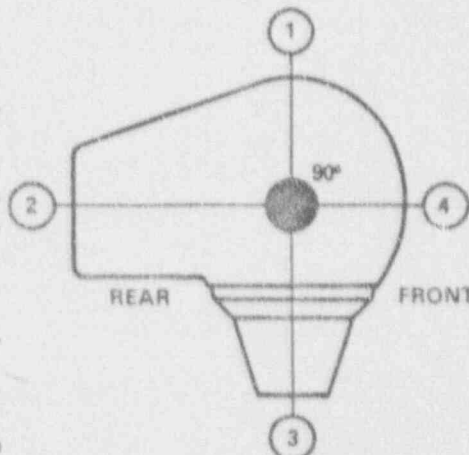
(Source in "OFF" position.  
Measurements taken one meter  
from source)

Top View-Showing  
orientation  
of Views A through D

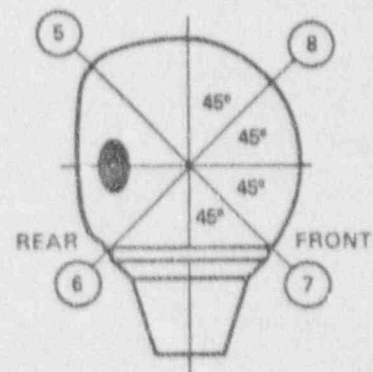
Position No.	Radiation Level (mR/hr)
View A	1 <u>1.8</u>
	2 <u>1.5</u>
	3 <u>1.5</u>
	4 <u>5.2</u>
View B	5 <u>.2</u>
	6 <u>.5</u>
	7 <u>.1</u>
	8 <u>.1</u>
View C	9 <u>1.3</u>
	10 <u>1.5</u>
View D	11 <u>.1</u>
	12 <u>.1</u>
	13 <u>.2</u>
	14 <u>.2</u>
Average value	<u>1.02</u>
Maximum value	<u>5.2</u>



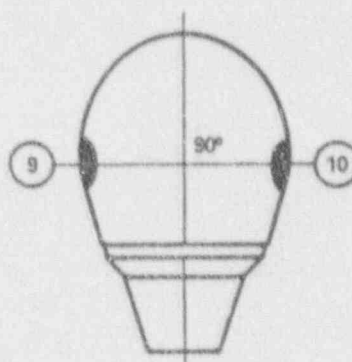
View A-Vertical  
from left side



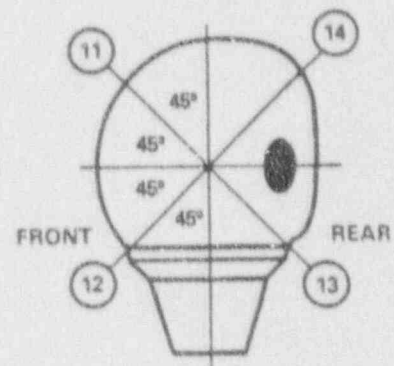
View B-Vertical  
from left front



View C-Vertical  
from front



View D-Vertical  
from right front



Date of survey 4/7/90

Instrument used Victoreen 450

Manufacturer's name & model number of teletherapy source Theratronics C-146

Date of installation 4/6/90

OUTPUT 128 ☐ RHM  
☐ RMM

Date of output measurement 4/6/90

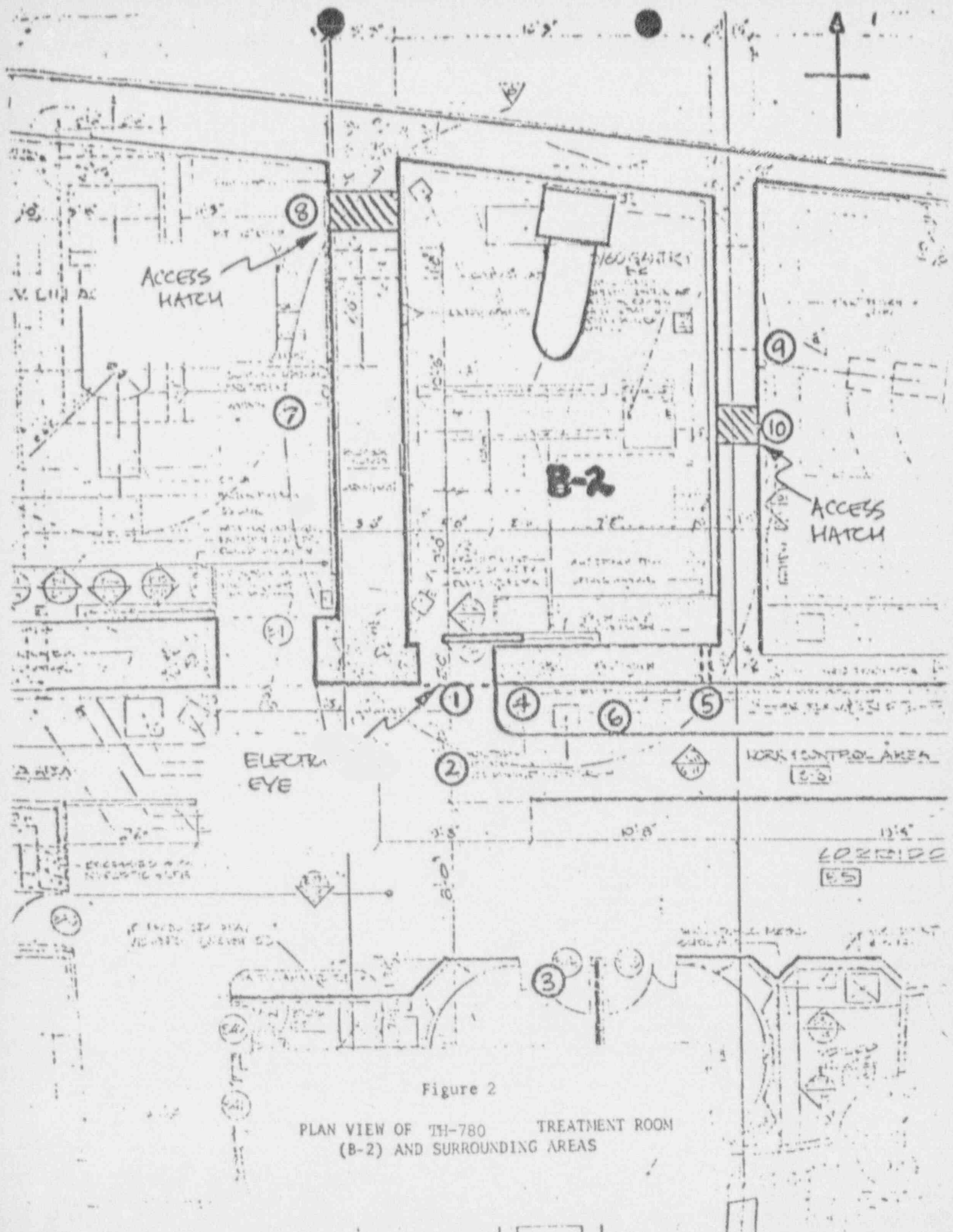


Figure 2

PLAN VIEW OF TH-780 TREATMENT ROOM  
(B-2) AND SURROUNDING AREAS



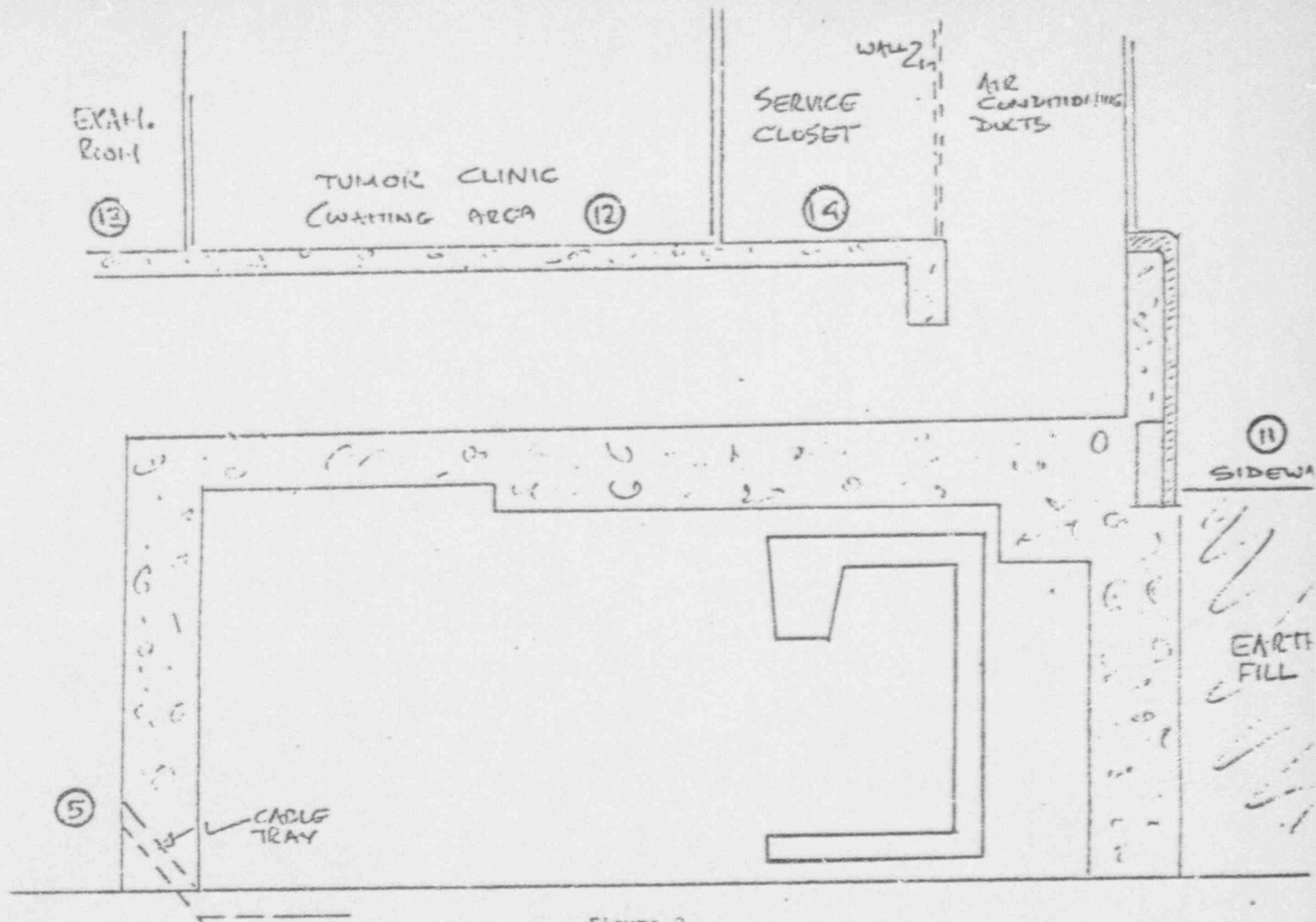
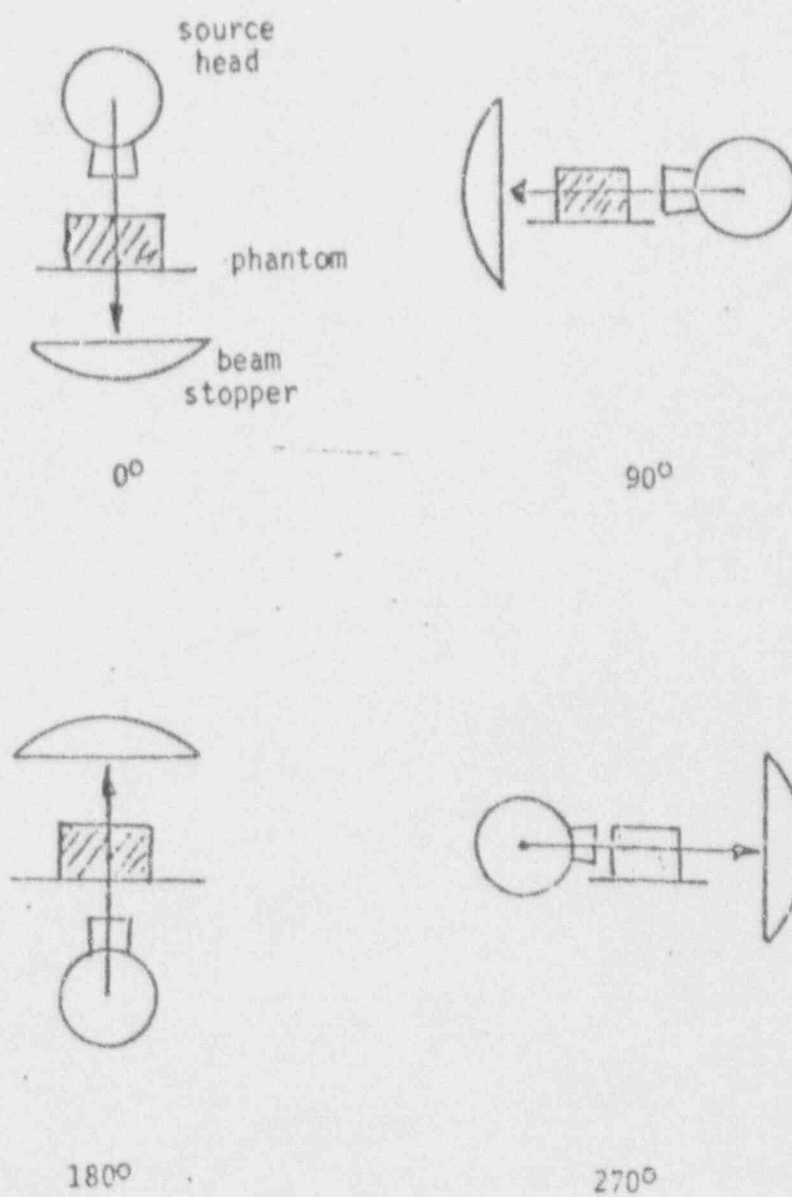


Figure 3

ELEVATION OF TH-780 TREATMENT ROOM  
(B-2) AND SURROUNDING AREAS

FIGURE 4

GANTRY ANGULATION (SEEN FROM CONTROL AREA)



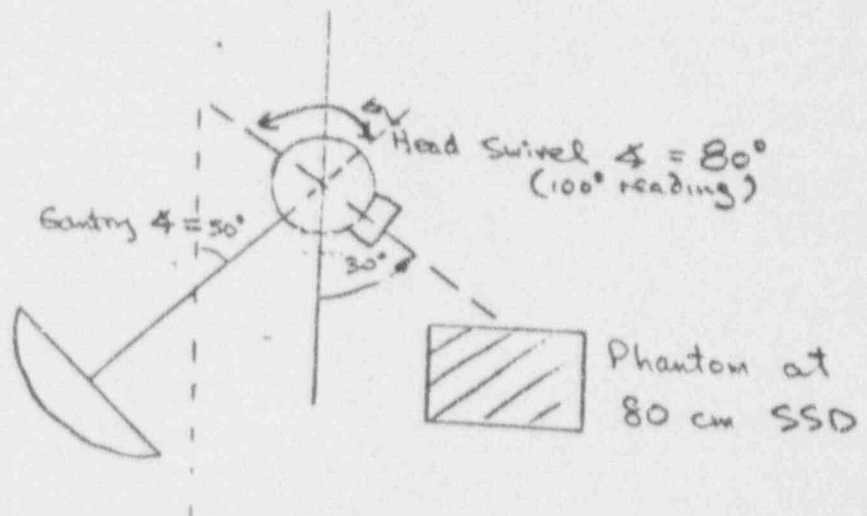


Figure 5.  
off - Shield Configuration

## DEPARTMENT OF RADIOLOGY

Division of Radiological  
Sciences and Technology

Director:

EDWARD W. WEBSTER, Ph.D.

Professor of Radiology (Physics)



Mailing Address:

Massachusetts General Hospital  
Boston, Massachusetts 02114  
(617) 726-8326/3078

030-00239

April 21, 1992

U. S. Nuclear Regulatory Commission  
Region I  
475 Allendale Road  
King of Prussia, PA 19406

Attention: Dr. John Kinneman

Re: Renewal of License No. 20-03814-14  
(Teletherapy)

Dear Dr. Kinneman,

On November 24, 1989 we submitted an application for the renewal of the above license which was due to expire on December 31, 1989 and has since been extended under Control Number 111662.

Since we have not yet received a renewal license from the Commission, we would like to add several new users who are all certified in Radiation Therapy (Radiation Oncology) by acceptable certifying bodies under 10CFR35.940 and 960. These physicians have joined the staff of our Department of Radiation Oncology since our renewal submission in November 1989. We believe, since the renewal is still in process, that these names can be added without submission of a fee additional to our original renewal fee of \$350 submitted with the above renewal application.

The names to be added are as follows, and forms 313 Supplement A regarding the training of these persons are attached. [These are in addition to Drs. Flynn, Okunieff and Willett whose names were submitted in 1989 and are still members of the above Department.]

<u>Name</u>	<u>Certified in Radiation Oncology</u>	<u>Date</u>
Francisco S. Pardo, M.D.	American Board of Radiology	July 1990
Simon N. Powell, M.D.*	Royal College of Radiologists (UK)	May 1988
Allan F. Thornton, Jr., M.D.	American Board of Radiology	June 1987
Anthony L. Zietman, M.D.*	Royal College of Radiologists (UK)	Sept. 1981

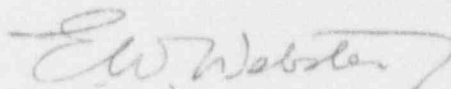
\*signifies that a copy of the UK diploma is attached.

U. S. Nuclear Regulatory Commission  
Region I, Attn: Dr. John Kinneman  
Page 2  
April 21, 1992

As already indicated in Amendment #24 the RSO for this license is Reginald Brian Woodleigh, M.M.Sc.

We trust that the above request and information will be added to our original renewal request.

Yours sincerely,

A handwritten signature in cursive script, appearing to read "E.W. Webster".

Edward W. Webster, Ph.D., Chairman  
Radiation Safety Committee

EWV/bh

cc: H. D. Suit M.D.  
M. Spicer, Administration  
R. B. Woodleigh, RSO



**SUPPLEMENT A**  
**TRAINING AND EXPERIENCE**  
**PROPOSED AUTHORIZED USER OR RADIATION SAFETY OFFICER**

1. NAME OF PROPOSED AUTHORIZED USER OR RADIATION SAFETY OFFICER <div style="font-size: 1.2em; font-family: cursive;">FRANCISCO S. PARDO</div>		2. STATE OR TERRITORY IN WHICH LICENSED TO PRACTICE MEDICINE (if physician) <div style="font-size: 1.2em; font-family: cursive;">MASS; CALIF.</div>	
3. CERTIFICATION			
SPECIALTY BOARD <div style="font-size: 1.2em; font-family: cursive;">AMERICAN BOARD OF RADIOLOGY RADIATION ONCOLOGY</div>	CATEGORY	MONTH AND YEAR CERTIFIED <div style="font-size: 1.2em; font-family: cursive;">July 1990</div>	
4. TRAINING RECEIVED IN BASIC RADIOISOTOPE HANDLING TECHNIQUES (To be completed by institution providing training)			
FIELD OF TRAINING	LOCATION AND DATE(S) OF TRAINING	TYPE AND LENGTH OF TRAINING	
RADIATION PHYSICS AND INSTRUMENTATION	UCSF MGT	LECTURE/LABORATORY COURSE (Hours)	FORMAL SUPERVISED OUT/LABORATORY EXPERIENCE (Hours)
RADIATION PROTECTION	UCSF MGT	>12	>12
MATHEMATICS PERTAINING TO THE USE, MEASUREMENT, AND SHIELDING OF RADIOACTIVE SOURCES	UCSF MGT	>12	>12
RADIATION BIOLOGY	UCSF MGT	>12	>12
5. EXPERIENCE WITH RADIOACTIVE MATERIALS* (Actual use of radioisotopes or equivalent experience)			
ISOTOPE	MAXIMUM AMOUNT FOR ANY SINGLE APPLICATION	WHERE EXPERIENCE WAS GAINED	DURATION OF EXPERIENCE
35S	5 mCi	UCSF; MGT	Continuing on-going
32P	1 mCi	UCSF; MGT	
TYPE OF USE <div style="font-size: 1.2em; font-family: cursive;">Experimental</div>			

- \*Experience with sealed radioactive sources under the supervision of qualified instruction should include:
- 1. Review of initial source calibration and periodic check measurements of radioactivity levels
  - 2. Initial source calibration of sealed sources other than radiotherapy sources that are used for treatment purposes
  - 3. Calibration of ion chambers and survey meters
  - 4. Location of treatment plans and treatment times for ... and brachytherapy
  - 5. Knowledge of appropriate radiation safety, quality control, and emergency procedures for handling and using sealed sources

6. I CERTIFY THAT THE INFORMATION PRESENTED ABOVE IS TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF (Signature of program supervisor)

TYPED OR PRINTED NAME  

FRANCISCO S. PARDO

NAME OF INSTITUTION  

MASS. GEN. HOSP / HARVARD MEDICAL SCHOOL

MAILING ADDRESS  

COX CANCER CENTER-3

CITY  

BOSTON

STATE  

MA

ZIP CODE  

02114

RADIOACTIVE MATERIALS LICENSE NUMBER  

20-03814-14

DATE  

2/23/92

WARNING: 18 U.S.C. Section 1001, Act of June 25, 1949, 62 Stat. 749, makes it a criminal offense to make a willfully false statement or representation to any department or agency of the United States as to any matter within its jurisdiction.

> 12 means that greater than 12 semester hours completed

**SUPPLEMENT A**  
**TRAINING AND EXPERIENCE**  
**PROPOSED AUTHORIZED USER OR RADIATION SAFETY OFFICER**

1. NAME OF PROPOSED AUTHORIZED USER OR RADIATION SAFETY OFFICER <div style="font-size: 1.2em; font-family: cursive;">SIMON N POWELL</div>		2. STATE OR TERRITORY IN WHICH LICENSED TO PRACTICE MEDICINE (If physician) <div style="font-size: 1.2em; font-family: cursive;">MASSACHUSETTS</div>	
<b>3. CERTIFICATION</b>			
SPECIALTY BOARD	CATEGORY	MONTH AND YEAR CERTIFIED	
<div style="font-size: 1.2em; font-family: cursive;">Royal College of Radiology (see attached).</div>	<div style="font-size: 1.2em; font-family: cursive;">FELLOW (FRCR)</div>	<div style="font-size: 1.2em; font-family: cursive;">May 1983</div>	
<b>4. TRAINING RECEIVED IN BASIC RADIOISOTOPE HANDLING TECHNIQUES (To be completed by institution providing training)</b>			
FIELD OF TRAINING	LOCATION AND DATE(S) OF TRAINING	TYPE AND LENGTH OF TRAINING	
RADIATION PHYSICS AND INSTRUMENTATION	<div style="font-size: 1.2em; font-family: cursive;">LONDON, 1985-8</div> <div style="font-size: 1.2em; font-family: cursive;">UK</div>	LECTURE/LABORATORY COURSE (Hours)	
RADIATION PROTECTION		FORMAL SUPERVISED DJT/LABORATORY EXPERIENCE (Hours)	
MATHEMATICS PERTAINING TO THE USE, MEASUREMENT, AND SHIELDING OF RADIOACTIVE SOURCES			
RADIATION BIOLOGY			
<b>5. EXPERIENCE WITH RADIOACTIVE MATERIALS* (Actual use of radioisotopes or equivalent experience)</b>			
ISOTOPE	MAXIMUM AMOUNT FOR ANY SINGLE APPLICATION	WHERE EXPERIENCE WAS GAINED	DURATION OF EXPERIENCE
		<div style="font-size: 1.2em; font-family: cursive;">ROYAL MARSDEN HOSP</div> <div style="font-size: 1.2em; font-family: cursive;">LONDON,</div> <div style="font-size: 1.2em; font-family: cursive;">UK</div>	<div style="font-size: 1.2em; font-family: cursive;">1984-85</div>
*Experience with sealed radioactive sources under the supervision of qualified instructors should include:			
1. Review of initial source calibration and periodic spot check measurements of teletherapy units		A. Preparation of treatment plans and treatment times for brachytherapy	
2. Initial source calibration of sealed sources other than teletherapy sources that are used for treatment purposes		B. Knowledge of appropriate radiation safety, quality control, and emergency procedures for handling and using sealed sources	
3. Calibration of ion chambers and survey meters			
6. I CERTIFY THAT THE INFORMATION PRESENTED ABOVE IS TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF (Signature of program administrator)			DATE
<div style="font-size: 1.2em; font-family: cursive;">Simon N. Powell, M.D.</div>			<div style="font-size: 1.2em; font-family: cursive;">4/6/92</div>
TYPED OR PRINTED NAME <div style="font-size: 1.2em; font-family: cursive;">Massachusetts General Hospital</div>			DATE
NAME OF INSTITUTION <div style="font-size: 1.2em; font-family: cursive;">Dept. of Radiation Oncology</div>			
MAILING ADDRESS <div style="font-size: 1.2em; font-family: cursive;">Fruit Street - Cox 3</div>			
CITY <div style="font-size: 1.2em; font-family: cursive;">Boston,</div>	STATE <div style="font-size: 1.2em; font-family: cursive;">MA</div>	ZIP CODE <div style="font-size: 1.2em; font-family: cursive;">02114</div>	RADIOACTIVE MATERIALS LICENSE NUMBER <div style="font-size: 1.2em; font-family: cursive;">20-03814-14</div>
WARNING 18 U.S.C. Section 1001, Act of June 25, 1948, 62 Stat. 749, makes it a criminal offense to make a willfully false statement or representation to any department or agency of the United States as to any matter within its jurisdiction.			

# The Royal College of Radiologists

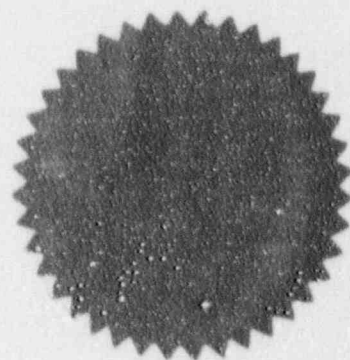


*Simon Nicholas Powell*  
*has this day been admitted*  
*a Fellow of*  
*The Royal College of Radiologists*

*Erin Davies* President.

*John Williams* Warden.

*Vis. Williams* Registrar.



*London*

*20th May, 1988*

**SUPPLEMENT A**  
**TRAINING AND EXPERIENCE**  
**PROPOSED AUTHORIZED USER OR RADIATION SAFETY OFFICER**

1. NAME OF PROPOSED AUTHORIZED USER OR RADIATION SAFETY OFFICER <b>Allan F. Thornton, Jr.</b>		2. STATE OR TERRITORY IN WHICH LICENSED TO PRACTICE MEDICINE (If physician) <b>Massachusetts, Michigan</b>	
<b>3. CERTIFICATION</b>			
SPECIALTY BOARD <b>American <del>College</del> Board of Radiology</b>	CATEGORY <b>Therapeutic Radiology</b>	MONTH AND YEAR CERTIFIED <b>6/87</b>	
<b>4. TRAINING RECEIVED IN BASIC RADIOISOTOPE HANDLING TECHNIQUES (To be completed by institution providing training)</b>			
FIELD OF TRAINING	LOCATION AND DATE(S) OF TRAINING	TYPE AND LENGTH OF TRAINING	
RADIATION PHYSICS AND INSTRUMENTATION		LECTURE/LABORATORY COURSE (Hours)	FORMAL SUPERVISED OUT/LABORATORY EXPERIENCE (Hours)
RADIATION PROTECTION			
MATHEMATICS PERTAINING TO THE USE, MEASUREMENT, AND SHIELDING OF RADIOACTIVE SOURCES			
RADIATION BIOLOGY			
<b>5. EXPERIENCE WITH RADIOACTIVE MATERIALS* (Actual use of radioactive isotopes or equivalent experience)</b>			
ISOTOPE	MAXIMUM AMOUNT FOR ANY SINGLE APPLICATION	WHERE EXPERIENCE WAS GAINED	DURATION OF EXPERIENCE      TYPE OF USE
131 I	20 mCi	Rush Medical Institute Health	4 years      Lab
32 P	"	"	"
132 I	100 mCi	Univ. of Michigan Princess Margaret Hosp.	4 years      Patient 3 years      "
*Experiences with sealed radioactive sources under the supervision of qualified instructors should include:			
1. Review of initial source calibration and periodic check mass, amounts of radioactivity, etc.		4. Preparation of treatment plans and treatment times for brachytherapy.	
2. Initial source calibration of sealed sources other than brachytherapy sources that are used for treatment purposes.		5. Knowledge of appropriate radiation safety, quality control, and emergency procedures for handling and using sealed sources.	
3. Calibration of ion chambers and survey meters.			
6. I CERTIFY THAT THE INFORMATION PRESENTED ABOVE IS TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF (Signature of program administrator)			4/6/92
Allan F. Thornton, Jr., M.D.			DATE
TYPED OR PRINTED NAME			
Massachusetts General Hospital			
NAME OF INSTITUTION			
Dept. of Radiation Oncology			
MAILING ADDRESS			
Fruit Street - Cox 3			
CITY	STATE	ZIP CODE	RADIOACTIVE MATERIALS LICENSE NUMBER
Boston,	MA	02114	20-03814-14
WARNING: 18 U.S.C. Section 1001, Act of June 25, 1948, 62 Stat. 749, makes it a criminal offense to make a willfully false statement or representation to any department or agency of the United States in any matter within its jurisdiction.			



**SUPPLEMENT A**  
**TRAINING AND EXPERIENCE**  
**PROPOSED AUTHORIZED USER OR RADIATION SAFETY OFFICER**

1. NAME OF PROPOSED AUTHORIZED USER OR RADIATION SAFETY OFFICER <b>ANTHONY L. ZIETMAN</b>		2. STATE OR TERRITORY IN WHICH LICENSED TO PRACTICE MEDICINE (if physician) <b>RADIATION THERAPY</b>	
<b>3. CERTIFICATION</b>			
SPECIALTY BOARD	CATEGORY	MONTH AND YEAR CERTIFIED	
<b>RADIATION ONCOLOGY</b>	<b>FELLOWSHIP ROYAL COLLEGE RADIOLOGISTS (FELLOW ROYAL COLLEGE OF RADIOLOGISTS) F.R.C.R.</b>	<b>SEPT 1991</b>	
4. TRAINING RECEIVED IN BASIC RADIOISOTOPE HANDLING TECHNIQUES (To be completed by institution providing training)			
FIELD OF TRAINING	LOCATION AND DATES OF TRAINING	TYPE AND LENGTH OF TRAINING	
		LECTURE/LABORATORY COURSE (Hours)	FORMAL SUPERVISED OUT/LABORATORY EXPERIENCE (Hours)
RADIATION PHYSICS AND INSTRUMENTATION			
RADIATION PROTECTION	Massachusetts General Hospital	80 hour course	multiple procedures as rad. onc. resident
MATHEMATICS PERTAINING TO THE USE, MEASUREMENT, AND SHIELDING OF RADIOACTIVE SOURCES	+ Middlesex Hospital	150 hour course	
RADIATION BIOLOGY	London		
5. EXPERIENCE WITH RADIOACTIVE MATERIALS (Actual use of radioisotopes or equivalent experience)			
ISOTOPE	MAXIMUM AMOUNT FOR ANY SINGLE APPLICATION	WHERE EXPERIENCE WAS GAINED	DURATION OF EXPERIENCE
Iridium Cesium Cobalt		multiple procedures while radiation oncology resident over 3 years	
<small>*Experience with sealed radioactive sources (brachytherapy, teletherapy, etc.) should include:</small> <div style="display: flex; justify-content: space-between;"> <div style="width: 48%;"> 1. Review of isotope calibration and density gradient measurements of brachytherapy units  2. Actual source calibration of sealed sources other than teletherapy sources that are used for treatment purposes  3. Calibration of ion chambers and survey meters </div> <div style="width: 48%;"> 4. Preparation of treatment plans and treatment times for brachytherapy units  5. Knowledge of appropriate isotope safety, quality control, and emergency procedures for handling and using sealed sources </div> </div>			
6. I CERTIFY THAT THE INFORMATION PRESENTED ABOVE IS TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF (Signature of program submitter) <b>Anthony L. Zietman, M.D.</b>			DATE <b>4/6/92</b>
TYPED OR PRINTED NAME <b>Massachusetts General Hospital</b>			
NAME OF INSTITUTION <b>Dept. of Radiation Oncology</b>			
MAILING ADDRESS <b>Fruit Street - Cox 3</b>			
CITY <b>Boston,</b>	STATE <b>MA</b>	ZIP CODE <b>02114</b>	RADIOACTIVE MATERIALS LICENSE NUMBER <b>20-03814-14</b>
WARNING: 18 U.S.C. Section 1001, Act of June 25, 1948, 62 Stat. 741, makes it a criminal offense to make a willfully false statement or representation to any department or agency of the United States as to any matter within its jurisdiction.			



# The Royal College of Radiologists



Anthony Laurence Zietman

has this day been admitted

a Fellow of

The Royal College of Radiologists

Dean

President.

Richard G. Vaux

Warden.

John Warr

Registrar.



London

OFFICIAL RECORD COPY ML 10

15th November 1991  
111662

DEPARTMENT OF RADIOLOGY  
Division of Radiological  
Sciences and Technology  
Director  
EDWARD W. WEBSTER, Ph.D.  
Professor of Radiology (Physics)



Mailing Address:  
Massachusetts General Hospital  
Boston, Massachusetts 02114  
(617) 726-8326/3078

February 7, 1990

U. S. Nuclear Regulatory Commission  
Region I  
475 Allendale Road  
King of Prussia, PA 19406

License No. 20-03814-14  
Docket #030-00239

Gentlemen,

In accordance with Amendment No. 23 to the above license issued January 11, 1990 and specifically with Condition 17, a radiation survey has been made of our Cobalt-60 Teletherapy Unit, AECL Model 780.

Following our letter to you dated September 20, 1989 which described our plans to relocate this unit by transferring it from an adjacent room, we have received your approval for the relocation. The relocation was accomplished under contract with Therapy Services, Inc., 6143 Jefferson Pike, Frederick, MD, 21701, on January 16, 1990. The Cobalt-60 source was not removed during this transfer; it remained undisturbed within its housing. The radiation survey and recalibration which is reported to you herewith was performed on the same day as the unit transfer. Also on this day, a full inspection servicing of the units was performed by the company noted above.

Yours sincerely,

E. W. Webster, Ph.D, Chairman  
Radiation Safety Committee

EWV/bh  
Enc. Summary Report by J. Leong, Ph.D.  
Certified Radiological Physicist

cc: J. Leong, Ph.D.  
P. Biggs, Ph.D.  
H. Suit, M.D.

FEB 12 1990

Radiation Survey of Theratron-780 Cobalt-60  
at  
Massachusetts General Hospital  
Boston, Massachusetts

1. Institution Possessing and Using the Source  
Massachusetts General Hospital, Fruit Street, Boston,  
Massachusetts.  
NRC License No: 20-03814-14 Amendment No. 23
2. Person Conducting the Survey  
Joseph Leong, Ph.D., Massachusetts General Hospital
3. Relocation of teletherapy unit. The source was not removed  
from the head during the transfer.
4. Date of Installation: January 16, 1990
5. Date of Survey: January 16, 1990
6. Survey Instrumentation:

- a. Victoreen Thyac III, Model 490, SN 5500  
Last calibrated: August 17, 1989
- b. Victoreen Model 450, SN 519  
Last calibrated: October 26, 1989
- c. Victoreen Model 470, SN 179  
Last calibrated: July 24, 1989

Calibrations of the meters were done for the range .1 mR/hr  
to 50 mR/hr by placing the meters at known distances from a  
standard radium source.

Output Calibration Instrumentation:

- a. NEL (Farmer) Chamber Model 2571 (0.6 cc, AE plastic,  
Serial # 221, Delri Buildup Cap, #221  
Last calibrated: August 3, 1988.
- b. Keithley Digital Dosimeter Model 35614, Serial # 13256  
Last calibrated: August 3, 1988.

The above two instruments were calibrated at the Accredited  
Dosimetry Calibration Laboratory at the M. D. Anderson  
Hospital and Tumor Institute.

7. Manufacturer and Model Number of Teletherapy Unit  
Atomic Energy of Canada Limited  
Theratron-780
8. Manufacturer and Model Number of Source

Atomic Energy of Canada Limited  
Source Type: C-146

9. Source strength at the time of installation: 4163 curies.
10. The measured output of the source installed in the teletherapy head was determined to be 112.6 R/min at 80 cm for a 10 cm x 10 cm field on January 16, 1990.
11. The maximum and average radiation levels measured at one meter from the source with the teletherapy source in the "OFF" position are shown in Figure 1.
12. Description of the limits of beam orientation  
The Theratron-780 is a rotational unit with an integral beam absorber. The electrical OFF SHIELD interlock prevented movement of the source to the ON position unless the beam was completely intercepted by the beam absorber or was directed towards the floor within  $\pm 30^\circ$  of vertical.
13. Radiation Survey Setup
  - a. A 30cm x 30cm x 30cm polystyrene phantom was used.
  - b. Source-to-phantom distance was 80cm SAD.
  - c. The field size used was 35cm x 35cm.
14. Drawings of teletherapy facility. See attached figures.
15. The maximum radiation level in each area adjacent to the teletherapy facility with a 30 cm thick phantom in the primary beam is summarized in Table I.

The Theratron-780 has an output of approximately 107 cGy/min at 80 cm isocenter. Estimating that the weekly workload is 80,000 cGy in patient at isocenter the "Beam-On" time is about 12.46 hours per week. Table I lists the "Beam-On" exposure levels measured for specified gantry angulation (Figure 4 shows the orientation of the machine for various gantry angles and does not represent the angles where measurements were made.) at various locations near the treatment room (Figures 2 and 3) and the derived % maximum permissible exposure (% MPE) adopting the 12.46 hours/week "Beam-On" estimate. The maximum permissible exposures for restricted (C) and unrestricted (U) areas are taken to be 100 mR/week and 10 mR/week, respectively and 2 mR in any one hour. A use factor of 1.0 and an occupancy factor of 1.0 are assumed throughout.

Table I lists worst case exposures - that is, fraction of maximum permissible exposure is based on a worst case orientation of the beam for the weekly or hourly period involved. Levels were measured for all gantry angles at 15° intervals.

For all unrestricted areas the exposure levels were all less

than 12.5% of the maximum allowed per week and less than 1.6% of the maximum allowed per one hour. For all the restricted areas the levels were found to be less than 1.2% of the maximum allowed per week and less than 1.6% of the maximum allowed per one hour except in areas outside the entrance door and in the adjacent room along the east wall where the levels were found to be between 1.2%-3.7% of the maximum allowed per week and between 1.6%-4.7% of the maximum allowed per one hour.

A crawl space is located above the ceiling of the treatment room and below the first floor of the tumor clinic (see Figure 3). Access to this crawl space is controlled. It would be from an area in direct line of sight of the operator and warning notices are posted requiring operator's permission for access. Moreover, the access to this area is extremely difficult and involves dismantling a major section of ceiling directly above the operator and therefore could not go unnoticed.

16. Radiation Safety Interlocks

The following interlocks are installed and were checked and found to be operating correctly:

- a) Door Safety Interlock and Electric Eye Interlock. Machine goes from "Beam-On" to "Beam-Off" when the door is opened and/or when the electric eye is interrupted. The electric eye controls access to the treatment room with a light beam situated about two feet from the door. The source can be returned to the ON position only by operation of control panel controls.
- b) Source "ON-OFF" Indicators. A red light labeled "BEAM-ON" lights up on the console when the source is in the "Beam-On" position. A green light labeled "BEAM-OFF" is lit when the source is retracted to the "Beam-Off" position. Similar sets of red and green lights are located at the entrance doorway. The source drawer rod is also monitored by closed circuit television.
- c) Beam Stopper Interlock (Off Shield Interlock). The OFF Shield interlocks prevent movement of the source to the ON position unless the beam is completely intercepted by the beam stopper or is directed towards the floor within  $\pm 30^\circ$  of vertical.
- d) Teletherapy Treatment Timing Device. The mechanical timer error was determined by taking single and multiple exposures. The timer error is -0.01 minute, i.e., the actual time of irradiation falls short of the set time by 0.01 minute. The mechanical timer was found to be linear up to 5 minutes.

17. A full inspection and service of the unit was completed by



licensed personnel from the Therapy Services Incorporated,  
6143 Jefferson Pike, Frederick, MD 21701.

18. A wipe test was performed by wiping the collimator jaws near the source housing with cotton swabs. Sample count rates were not significantly different from the background rate. Samples were counted in a sodium iodide 3cm x 3cm crystal (Bicron Model 3m3/3, SN S-468) connected to counting equipment by Ortec (Pre-amp Model 276; SN 783; Amp Model 472, SN 765; and High voltage supply Model 456H, SN 125).

*Approved:*  
*E.W. Webster,*  
*Radiation Safety Officer*  
*2/5/90.*

FEB 12 1990

TABLE 1

Point	Location	Exposure Rate mR/hr	Gantry Angle Fig. 4	Occupancy Type	Percent of Maximum Permissible Exposure <sup>1</sup>	
					C 100 mR/wk U 10 mR/wk	2mR/hr <sup>2</sup>
1	Doorway at Electric Eye					
	Eye Level	0.2	90°	C	2.5	3.1
	(Off-shield)	0.2		C	2.5	3.1
	Bonad Level	0.15	90°	C	1.9	2.3
	(Off-Shield)	0.1		C	1.2	1.6
	Floor Level	0.2	90°	C	2.5	3.1
	(Off-Shield)	0.2		C	2.5	3.1
2	Corridor	<0.1	ALL*	C	<1.2	<1.6
3	Examination Room	<0.1	ALL*	U	<12.5	<1.6
4	Control Console	<0.1	ALL*	C	<1.2	<1.6
	(Off-Shield)	<0.1		C	<1.2	<1.6
5	Cable Tray Penetration	<0.1	ALL*	C	<1.2	<1.6
	(Off-Shield)	<0.1		C	<1.2	<1.6
6	South Wall	<0.1	ALL*	C	<1.2	<1.6
	(Off-Shield)	<0.1		C	<1.2	<1.6
7	West Wall	<0.1	ALL*	C	<1.2	<1.6
8	Access Hatch in W. Wall	<0.1	ALL*	C	<1.2	<1.6
9	East Wall	0.3	307°	C	3.7	4.7
	(Off-Shield)	0.2		C	2.5	3.1
10	Access Hatch in E. Wall	0.15	307°	C	1.9	2.3
	(Off-Shield)	0.1		C	1.2	1.6
11	Sidewalk on Blossom St.	<0.1	ALL**	U	<12.5	<1.6
12	Tumor Clinic	<0.1	ALL*	U	<12.5	<1.6
13	Exam Rooms Above Air Conditioning Duct Cut-Outs	<0.1	ALL*	U	<12.5	<1.6
14	Service Closet	<0.1	ALL*	U	<12.5	<1.6

All measurements made with Thyac III survey meter with machine collimators wide open.

(Off-shield) configuration as shown in Figure 5. (Also with phantom on other side of gantry.)

<sup>1</sup>Estimates are based on the assumption that the worst case condition obtains for the entire week or hour over which the exposure is averaged.

<sup>2</sup>Using "beam-On" of 12.58 hours/40 hours (1 week), the average "Beam-On" per hour is 0.314 hours or 19 minutes. Use factor of 1 is assumed.

<sup>3</sup>Machine rotating continuously.

Fig. 1  
(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	0.7
2	0.6
3	0.7
4	3.7

View B 5	0.2
6	0.4
7	0.1
8	0.1

View C 9	0.4
10	0.4

View D 11	0.1
12	0.1
13	0.2
14	0.2

Average value 0.56

Maximum value 3.7

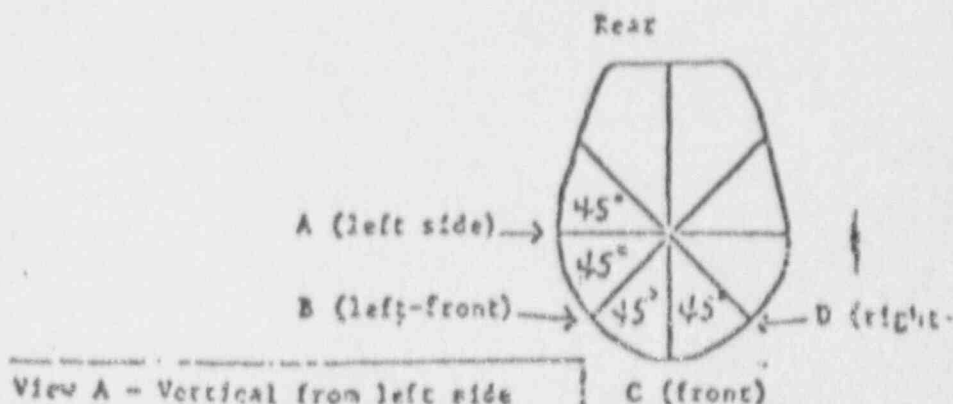
Instrument used Victoreen

Thyac III SN:5500  
RH 6821  
Circles 6612

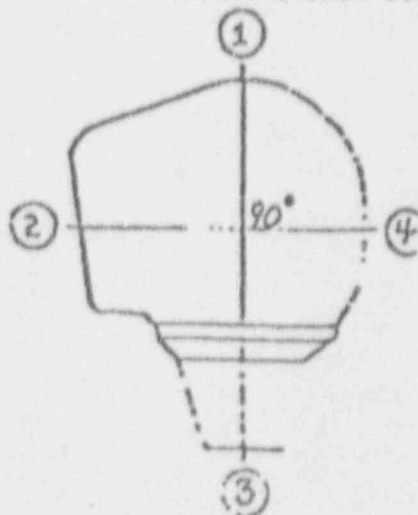
Date July 11, 1986

Manufacturer's  
name & model #  
of teletherapy  
unit Atomic Energy of Canada, Ltd

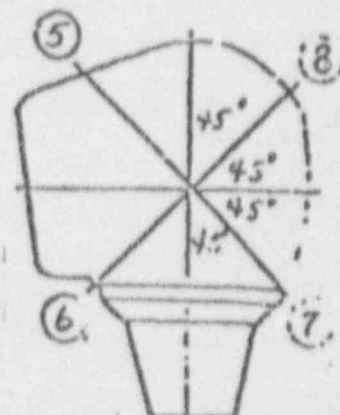
Theratron 780



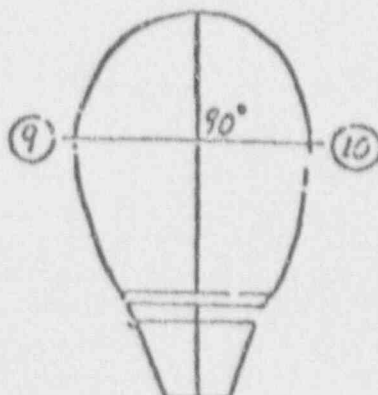
View A - Vertical from left side



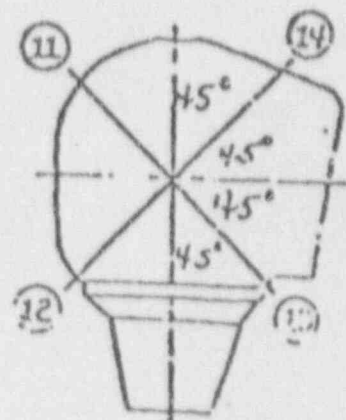
View B - Vertical from left-front



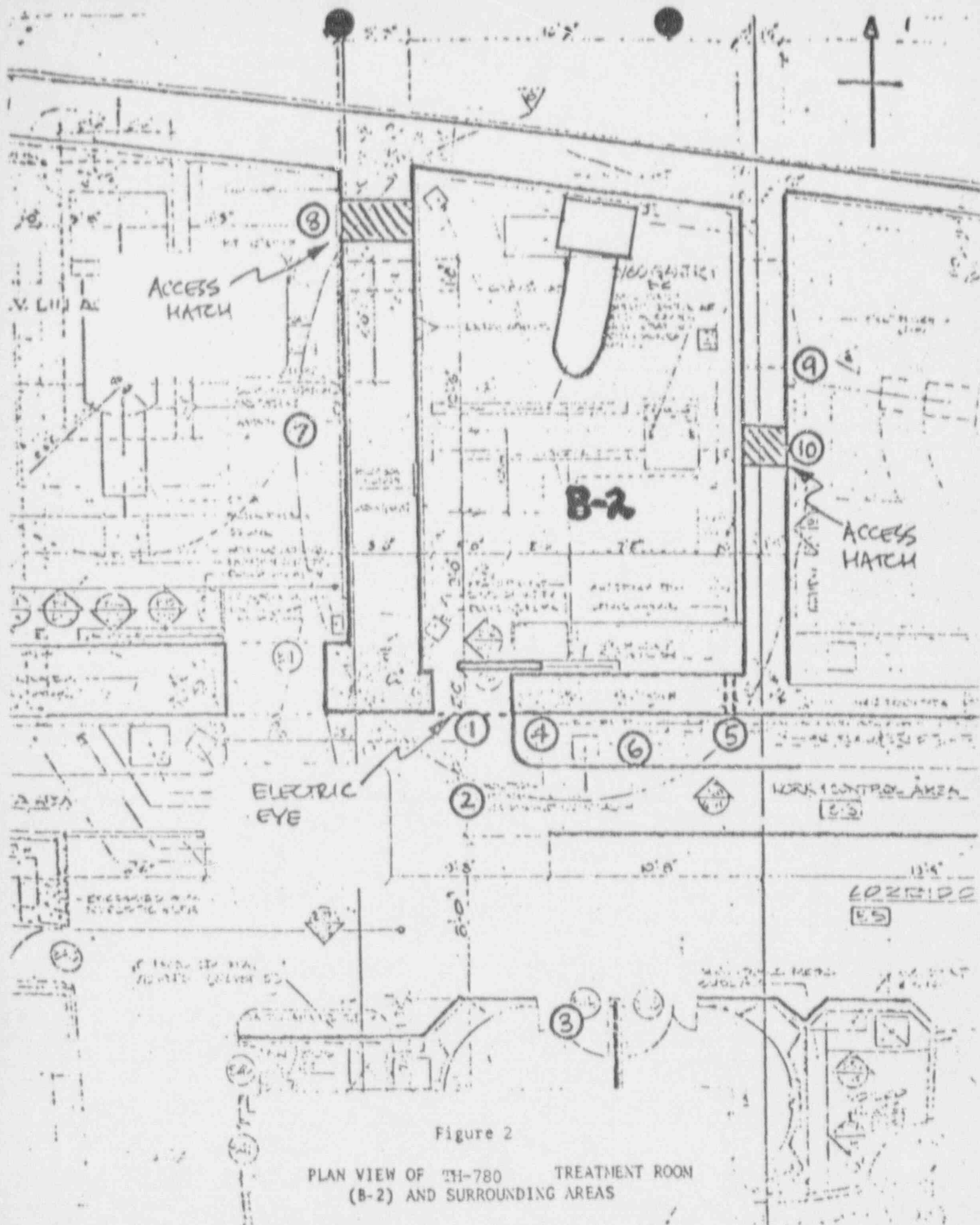
View C - Vertical from front



View D - Vertical from right-front



\* Measurements taken with Victoreen Model 450 SN: 519



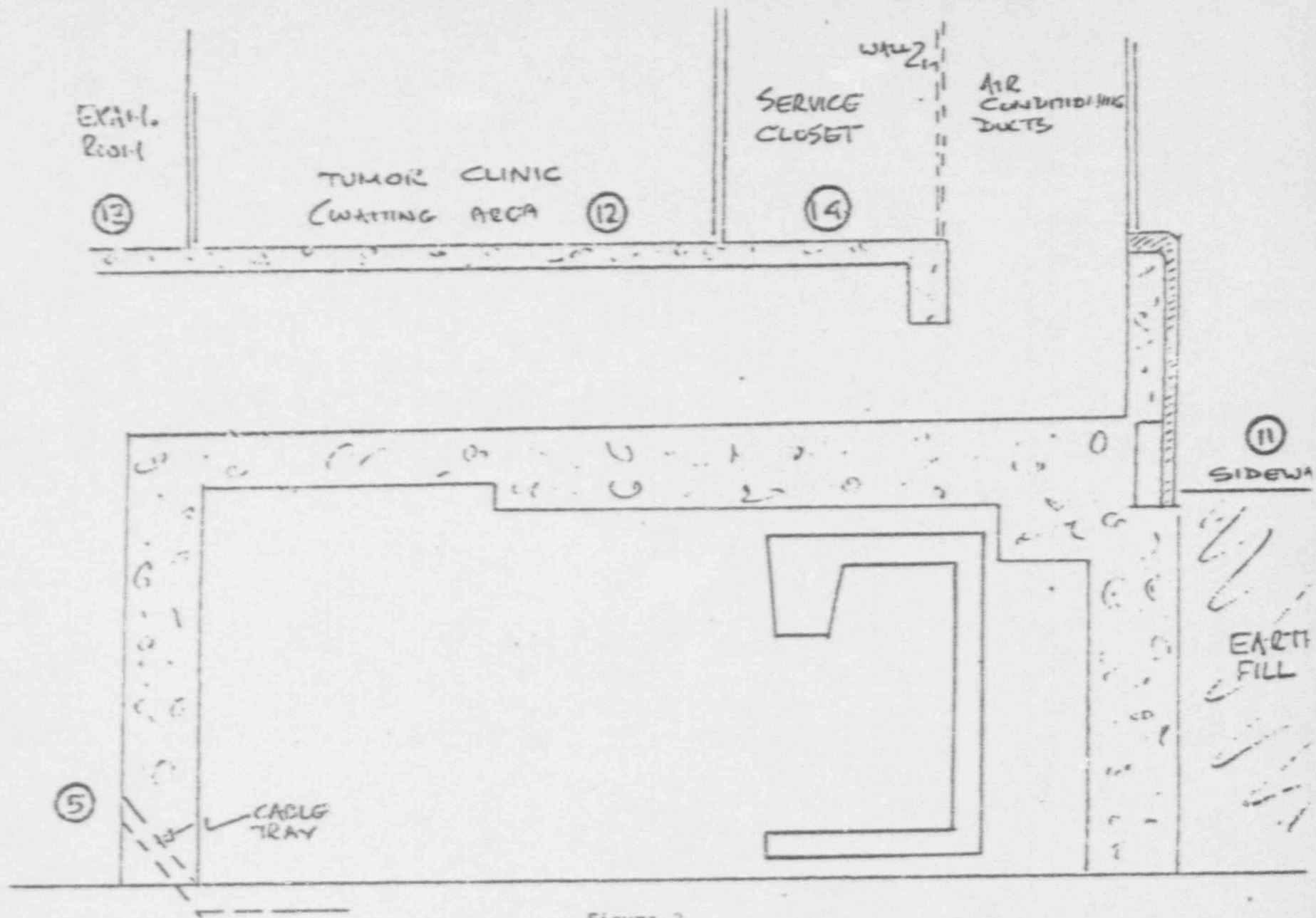


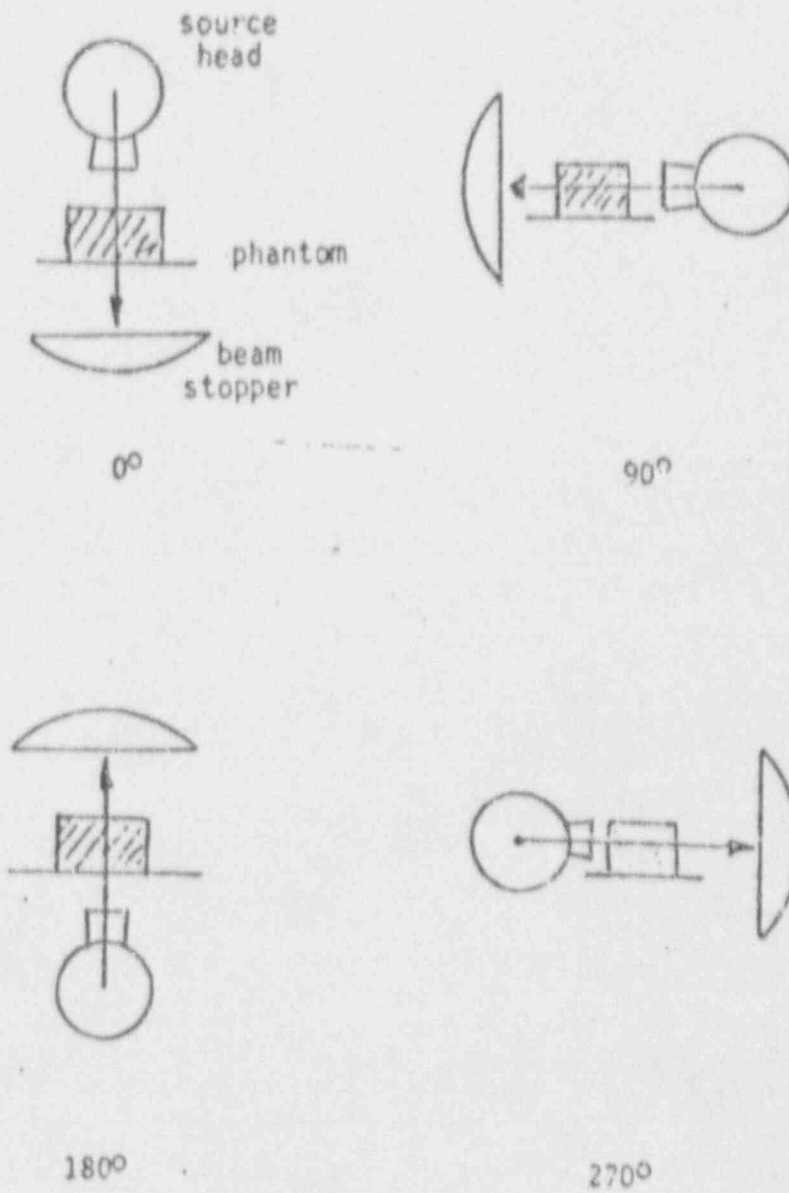
Figure 3

ELEVATION OF TH-780 TREATMENT ROOM  
(B-2) AND SURROUNDING AREAS



FIGURE 4

GANTRY ANGULATION (SLEN FIRST CONTROL AREA)



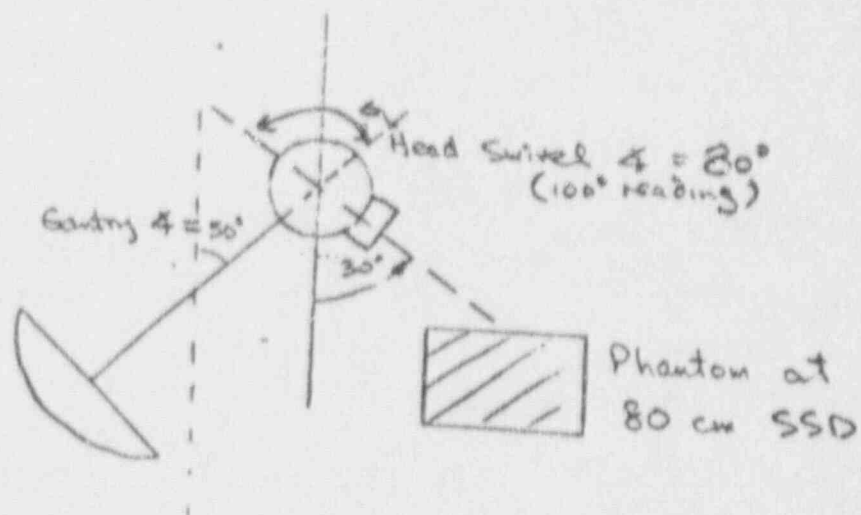


Figure 5.  
off-shield Configuration

20 FEB 15 1990

RECEIVED

FEB 12 1990.



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
REGION I  
475 ALLENDALE ROAD  
KING OF PRUSSIA, PENNSYLVANIA 19406

DEC 22 1989

Massachusetts General Hospital  
Department of Radiology  
ATTN: Edward W. Webster, Ph.D.  
Chairman, Rad. Safety Comm.  
Boston, MA 02114

DOCKET NO. 030-00239  
LICENSE NO. 20-03814-14  
CONTROL NO. 111662

SUBJECT: LICENSE RENEWAL APPLICATION

Gentlemen:

This is to acknowledge receipt of your application for renewal of material(s) license identified above. Your application is deemed timely filed, and accordingly, the license will not expire until final action has been taken by this office.

Any correspondence regarding the renewal application should reference the control number specified and your license number.

Sincerely,

Original Signed By:  
Doris J. Foster

Doris J. Foster, Chief  
Licensing Assistant Section  
Division of Radiation Safety  
and Safeguards

OFFICIAL RECORD COPY ML10

MASSACHUSETTS GENERAL HOSPITAL

HARVARD MEDICAL SCHOOL

030-00239

DEPARTMENT OF RADIOLOGY

Division of Radiological  
Sciences and Technology

Director:

EDWARD W. WEBSTER, Ph.D.

Professor of Radiology (Physics)



Mailing Address:

Massachusetts General Hospital

Boston, Massachusetts 02114

(617) 726-8326/3078

November 24 1989

U.S. Nuclear Regulatory Commission,  
Region I,  
475 Allendale Rd,  
King of Prussia, PA 19406

Addendum to License Renewal  
#20-03814-14

mailed 11/24/89

Gentlemen,

It has come to my attention that one item that should have been included in our application was inadvertently omitted.

I am attaching two copies of a certificate relating to the Cobalt-60 source transfer which occurred on April 19 1989 and which therefore has reduced our complement of teletherapy units from two to one under the above license.

The application was mailed today and I trust that this document will be added to the original and one copy which was sent to you.

Sincerely,

Edward W. Webster, Ph.D.  
Chairman, Rad. Safety Comm.

111652

OFFICIAL RECORD COPY ML1B

NOV 27 1989

TELETHERAPY UNIT AND SOURCE TRANSFER

This is to certify that a cobalt-60 source described as follows:

Model Number: C-146 AECL  
Serial Number: S-3876  
Containing 5605 curies as of 4-18-89

has been determined by a wipe test to be leak free and has been removed from a teletherapy unit described as follows:

Manufacturer: AECL  
Model Number: Eldorado 78  
Serial Number: 16

The above unit and source have been removed and transferred from  
Massachusetts General Hospital 20-03814-14  
to Neutron Products License MD-31-025-03.

Joseph Leong M.G.H.

DATE: April 19, 1989

D. Rapp  
Neutron Products, Inc.

DATE: 4-19-89

NEUTRON PRODUCTS inc



TELETHERAPY UNIT AND SOURCE TRANSFER

This is to certify that a cobalt-60 source described as follows:

Model Number: C-146 AECL  
Serial Number: S-3876  
Containing 5605 curies as of 4-18-89

has been determined by a wipe test to be leak free and has  
been removed from a teletherapy unit described as follows:

Manufacturer: AECL  
Model Number: Eldorado 78  
Serial Number: 16

The above unit and source have been removed and transferred from  
Massachusetts General Hospital 20-03814-14  
to Neutron Products License MD-31-025-03.

Joseph Leong M.G.H.

DATE: April 19, 1989

D. Rapp  
Neutron Products, Inc.

DATE: 4-19-89

OFFICIAL RECORD COPY ML18  
NEUTRON PRODUCTS inc

111662

## HARVARD MEDICAL SCHOOL

X



Mailing Address:  
Massachusetts General Hospital  
Boston, Massachusetts 02114  
(617) 726-8326/3070

U. S. Nuclear Regulatory Commission  
Region I  
475 Allendale Road  
King of Prussia, PA 19406

Gentlemen,

The above license is due to expire on December 31, 1989. We have received your reminder of expiry and a copy of the Guide for Preparation of Applications for a Medical Teletherapy License, and have followed the instructions in Appendix L thereof.

I am forwarding herewith the application for renewal in letter form. Responses to items a through p as listed in the above Appendix L are attached, together with an Appendix on our current teletherapy operating procedures and a list of our current Radiation Safety Committee members (item m).

Yours sincerely,

E. W. Webster

E. W. Webster, Ph.D., Chairman  
Radiation Safety Committee

EWV/bh

Enc. Fee (check for \$350)

Dec-7-1  
6 374616  
2310  
7A  
Rm  
12 1/85  
12 1/85  
Messer

111662

OFFICIAL RECORD COPY ML10

NOV 27 1989

SUPPORTING INFORMATION FOR RENEWAL OF  
MATERIALS LICENSE NO. 20-0384-14

- a. This is an application for the renewal of materials license #20-03814-14.
- b. Massachusetts General Hospital  
Department of Radiation Medicine
- c. Fruit Street  
Boston, Massachusetts 02114
- d. Department of Radiation Medicine  
Blossom Street  
Boston, Massachusetts 02114  
Department of Radiation Medicine  
Cox Building  
Lower Level  
Room B4
- e. Location of teletherapy unit is the same as that described in previous license renewal application dated September 20, 1984. No changes have been made that affect radiation levels in surrounding areas or that affect the patient viewing system. (See also survey report of July 11, 1986.)
- f. Electrical or mechanical stops that limit use of the primary beam of radiation are still installed and continue to operate as described in the last survey report of July 11, 1986 submitted to the NRC.
- g. Only one source and teletherapy unit remains in our possession for the treatment of humans (Items 6A through 9A of license):

Sealed Source:  
Cobalt-60  
Atomic Energy of Canada Ltd.  
Model Number: C-146 or C151  
Maximum Activity per Source: 9000 curies  
Maximum Number of Sources: 2

Teletherapy Unit:  
Atomic Energy of Canada Ltd.  
Theratron 780

The following source and teletherapy unit (Items 6B through 9B of license) has been transferred to Neutron Products, Inc. See attached copy of document from Neutron Products Inc. regarding transfer.

Sealed Source:  
Cobalt-60

Atomic Energy of Canada Ltd.  
Model Number: C-146 or C-151  
Maximum Activity per source: 9050 curies  
Maximum Number of Sources: 2

Teletherapy Unit:  
Atomic Energy of Canada Ltd.  
Eldorado 78

- h. Three new users, all received certification in therapeutic radiology from the American Board of Radiology, are to be included in the list:

Daniel Flynn, M.D.	Cert. 1984
Paul O'Kunieff, M.D.	Cert. 1986
Christopher G. Willett, M.D.	Cert. 1985

Mary Austin-Seymour, M.D. is to be deleted from the list.

- i. The interim Radiation Safety Officer is Stephen R. Larson, M.S.
- j. Item 8--Training for Individuals Working in or Frequenting Restricted Areas. We, Massachusetts General Hospital, Department of Radiation Medicine, have adopted the training program described in Appendix D of Draft Regulatory Guide FC 414-4.

Item 10.5--Operating Procedures. (See attached Appendix).

Item 10.6--Emergency Procedures. We, Massachusetts General Hospital, Department of Radiation Medicine, will follow the emergency procedures described in Appendix I of Draft Regulatory Guide FC 414-4.

- k. Item 10.1--Personnel Monitor Program. We, Massachusetts General Hospital, Department of Radiation Medicine, have established procedures for personnel monitoring that include as requirements the criteria specified in Item 10.1.2 of Draft Regulatory Guide FC 414-4.

Item 10.2--Instrumentation. We, Massachusetts General Hospital, Department of Radiation Medicine, will have available for use the instrumentation specified in Item 10.2.2 of Draft Regulatory Guide FC 414-4.

Item 10.3--Calibration of Portable Survey Instruments. We, Massachusetts General Hospital, Department of Radiation Medicine, will calibrate our own survey instruments in accordance with written procedures that include as requirements the criteria described in Item 10.3.4 of Draft Regulatory Guide FC 414-4.

- l. There has been no change in the information previously submitted to NRC regarding other aspects of the radiation

protection program or the teletherapy program.

- m. Radiation Safety Committee: membership in item m attached.
- n. We, Massachusetts General Hospital, Department of Radiation Medicine, have adopted the model ALARA program described in Appendix J of Draft Regulatory Guide FC 414-4.
- o. Survey reports for source changes performed on July 7, 1986 were submitted.
- p. We request the following changes be made in our teletherapy program:
  - 1) Addition of three new users (See Item h of this application).
  - 2) Change Condition 18 in license to include the following:

Maintenance and repair operations to be performed by in-house engineers:

    - i) All air system components excluding source drawer, source drawer air cylinder and its attached air hoses.
    - ii) Source drawer air cylinder connecting pin.
    - iii) All control system components including timer and safety interlocks.
    - iv) All ancillary system components including cord reel assembly and field light.
    - v) All radiation monitoring devices and indicators



## Appendix: Operating Procedures

1. Receipt and Disposal of Radioactive Materials. Radioactive materials are always handled by licensed source handlers for receipt and disposal.
2. Use of the Teletherapy Unit. Only certified radiation therapy technologists and certified radiation therapists may operate the unit to treat patients. In addition physicists certified in radiation therapy performs monthly and annual checks on this unit. The unit may be operated in any gantry orientations provided the primary beam is intercepted by the beam stop. A 'search button' is installed in the treatment room. To turn the unit on, this button has to be pressed and the room door has to be closed within a preset time period (~30 sec). This therefore requires the operator to enter the room for a survey each and every time the unit is to be turned on. A daily check, in accordance with section 35.615 is performed each day by the technologist before patients are treated.
3. Safety Device Checks. All safety devices are checked daily, monthly and annually. Any malfunctions are to be reported to a certified physicist and the use of the unit is to be discontinued until either the problem is corrected or a backup safety device is put into operation.
4. Personnel Dosimetry. All personnel who work full-time in the radiation area shall wear film badges. These are whole body film badges and should be worn at chest level. In the event that a person receives or suspects that he/she received a high exposure, the incident is to be report to the Radiation Safety Officer.
5. Procedure for Securing the Teletherapy Unit. When the unit is unattended, the unit is locked and the key kept in a secured place.
6. Instrument Calibration and Checks. Calibration of instruments is carried out and/or supervised by certified physicists. Full calibration dosimetry system are calibrated by NBS or AAPM accredited calibration laboratory within the last twenty-four months. Spot check dosimetry systems are calibrated using the full calibration dosimetry system bi-annually. Beam-on monitor and survey meter are check daily with a ~10  $\mu\text{Ci}$  Cs137 source. Survey meters are calibrated annually.
7. Full Calibration of Teletherapy Units. Full calibration is carried out at intervals not exceeding one year by certified physicists according to 35.632 using the instruments describe in Item 6 above.
8. Monthly Spot-check Measurements of Teletherpy Units. Spot checks are carried out once in each calendar month by certified physicists according to 35.634 using the instruments described in

Item 6 above.

9. Leak Test. Leak test is performed biannually in accordance to Item 10.4 of Draft Regulatory Guide FC 414-4.

10. Inspection and Servicing of the Teletherapy Unit. The unit shall be fully inspected and serviced during source change or at intervals not to exceed 5 years by licensed source handlers.

11. Limitations on Work Done on Teletherapy Unit. See Item p of this application.

12. Survey Reports. A radiation survey shall be performed whenever a source is changed, changes are made to the treatment room shielding, the location of the unit within the room is changed or the use of the teletherapy unit is changed such that radiation levels outside the room is altered. A report of the survey shall be submitted to the NRC within 30 days following these changes.

13. Relocation of Teletherapy Unit. A relocation of the unit shall require an amendment to the license and also approval by the NRC.

14. Recordkeeping. The following records shall be maintain to comply with NRC regulations.

- (i) Copies of the NRC licenses.
- (ii) License applications.
- (iii) Correspondence with the NRC in support of a license request.
- (iv) Daily safety device checks.
- (v) Daily beam-on monitor checks.
- (vi) Survey instrument calibrations.
- (vii) Calibrations of dosimetry systems.
- (viii) Results of spot-checks and full calibrations.
- (ix) Results of leak tests.
- (x) Records of full inspections and servicing of unit.
- (xi) Radiation survey reports.
- (xii) Personnel dosimetry records.
- (xiii) Records of training of new personnel and annual refresher training of personnel.
- (xiv) Records of receipt and disposal of radioactive materials.

15. Emergency Procedures. Emergency procedures shall be posted at the teletherapy machine control. Refer to Item 10.6 of Draft Regulatory Guide FC 414-4.

16. Procedures for Notifying the Proper Persons in the Event of an Accident or Unusual Occurrence. In the event of a teletherapy unit malfunction or therapy misadministration, this shall be reported to the appropriate individuals listed in the machine control area. This list includes the names, addresses and

telephone numbers of the radiation safety officer, hospital administrator, teletherapy unit manufacturer, service representative and the NRC.

Radiation Safety & Radioactive Drug Research Committee

Dr. Edward W. Webster, Chairman	Radiology
Dr. Charles Boucher	Medical Service
Dr. Gordon L. Brownell	Radiology
Dr. John Burke	Surgical Service/SBI
Ms. Carol Camooso	Medical Nursing
<del>Dr. Frank P. Castroneve</del>	<del>Radiology</del>
Dr. Gilbert Daniels	Medical Service
Dr. Leonard Ellman	Clinical Laboratories
Mr. Robley D. Evans	Honorary Member
Dr. Daniel F. Flynn	Radiation Medicine
Ms. Joan Gallagher	Surgical Nursing
Dr. Richard D. Granstein	Dermatology
Dr. George Hauser	Biochemistry Dept., McLean
Dr. Lewis Holmes	Children's Service
Mr. Robert Johnson	Harvard University Health Services
Dr. Homayoun Kazemi	Medical Service
Dr. Ban An Khaw	Medical Service
Dr. Rita M. Linggood	Radiation Medicine
Dr. Gino Segre	Medical Service
Dr. Jacob Shapiro	Harvard University Health Services
Dr. Vivian Shih	Neurology
Dr. John Smith	Molecular Biology
Ms. Maryanne Spicer	Administration
Dr. H. William Strauss	Radiology
Dr. Alfred Weber	Radiology
Mr. Steven P. Larson	Radiation Officer (Interim) (effective August 1, 1989)

Effective: January 1, 1989

In the above list Dr. Edward W. Webster is certified by the American Board of Radiology in Radiological Physics and by the American Board of Health Physics (Comprehensive) (reactified 1987). Dr. Gordon L. Brownell, Dr. Jacob Shapiro, Mr. Robert Johnson and Mr. Stephen Larson are experienced in the measurement of radiation and radioactivity. Dr. Daniel Flynn and Dr. Rita Linggood are both therapeutic radiologists, certified by the American Board of Radiology in Therapeutic Radiology. Ms. Maryanne Spicer is the representative of the Administration. Ms. Carol Camooso and Ms. Joan Gallagher are representatives of the Nursing Service.

The Committee meets monthly and will continue to include the individuals specified in Paragraph 35.11(b).

BETWEEN:

LICENSE FEE MANAGEMENT BRANCH, ARM  
AND  
REGIONAL LICENSING SECTIONS

(FOR LFMS USE)  
INFORMATION FROM LTS

PROGRAM CODE: 02300  
STATUS CODE: 2  
FEE CATEGORY: 7A  
EXP. DATE: 19891231  
FEE COMMENTS: CODE 23

\*\*\*\*\*

LICENSE FEE TRANSMITTAL

A. REGION y

1. APPLICATION ATTACHED

APPLICANT/LICENSEE: MASSACHUSETTS GENERAL HOSPITAL  
RECEIVED DATE: 891127  
DOCKET NO: 3000239  
CONTROL NO.: 111662  
LICENSE NO.: 20-03814-14  
ACTION TYPE: RENEWAL

2. FEE ATTACHED

AMOUNT: \$350.00  
CHECK NO.: 6-314636

3. COMMENTS

SIGNED  
DATE

EMW  
12-1-89

B. LICENSE FEE MANAGEMENT BRANCH (CHECK WHEN MILESTONE 03 IS ENTERED 1-1)

1. FEE CATEGORY AND AMOUNT: 7A (\$350)

2. CORRECT FEE PAID. APPLICATION MAY BE PROCESSED FOR:

AMENDMENT -----  
RENEWAL -----  
LICENSE -----

3. OTHER -----

SIGNED  
DATE

Ms. McLean  
12/1/89