NRC Form 313T
10 CFR 35

U.S. NUCLEAR REGULATORY COMMISSION

Approved by OMB
3150-0081
Expires 1-31-85

APPLICATION FOR MATERIALS LICENSE – TELETHERAPY

INSTRUCTIONS – Complete Items 1 through 22 if this is an initial application or an application for renewal of a license. Use supplemental sheets where necessary. Item 22 must be completed on all applications and signed. Retain one copy. Submit original and one copy of entire application to: Director, Office of Nuclear Materials Safety and Safeguards, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555. Upon approval of this application, the applicant will receive a Materials License. An NRC Materials License is issued in accordance with the general requirements contained in Title 10, Code of Federal Regulations, Part 30, and the Licensee is subject to Title 10, Code of Federal Regulations, Parts 19, 20, 21, and 35 and the license fee provision of Title 10, Code of Federal Regulations Part 170. The license fee category should be stated in Item 22 and the appropriate fee enclosed.

1.a NAME AND MAILING ADDRESS OF APPLICANT (Institution, firm, clinic, physician, etc.) INCLUDE ZIP CODE

Grand View Hospital
Department of Radiology
700 Lawn Avenue
Sellersville, Penna. 18960

TELEPHONE: AREA CODE / NUMBER

1.b STREET ADDRESS(ES) AT WHICH RADIOACTIVE MATERIAL WILL BE USED (If different from 1.a.) INCLUDE ZIP CODE

SAME

2. PERSON TO CONTACT REGARDING THIS APPLICATION

Jay A. Wenger, M.D.

TELEPHONE: AREA CODE 215 NUMBER 257-3611

3. THIS IS AN APPLICATION FOR (Check appropriate item)

- [ ] a. NEW LICENSE
- [ ] b. AMENDMENT TO LICENSE NO.
- [X] c. RENEWAL OF LICENSE NO. 37-13187-01

4. INDIVIDUAL USERS (Name individuals who will use or directly supervise use of radioactive material. Complete Supplements A and B for each individual.)

Samuel W. Clipp,M.D.,Morris Levin,M.D.
Harvey W. Scholl,Jr.,M.D.
Jay A. Wenger, M.D. David Bantley, M.D.

5. RADIATION SAFETY OFFICER (RSO) (Name of person designated as radiation safety officer. If other than individual user, complete resume of training and experience as in Supplement A.)

Jay A. Wenger, M.D.

6. SEALED SOURCES TO BE USED IN TELETHERAPY UNITS (Attach supplemental pages if necessary)

	BYPRODUCT MATERIAL (Element and Mass No.)	NAME OF SOURCE MANUFACTURER	SOURCE MODEL NUMBER	MAXIMUM ACTIVITY PER SOURCE	NUMBER OF SOURCES
A	Cobalt 60	A E C L	C-146	4000 curies	2
B					
C					

7. TELETHERAPY UNITS (Attach supplemental pages if necessary)

	NAME OF MANUFACTURER (Include description if unit is custom made)	MODEL NUMBER
A	A E C L	Theratron 60
B		
C		

8. USE (Attach supplementary pages if necessary)

A	B	C	
X			HUMAN USE ONLY
			HUMAN AND OTHER USE (Specify on separate sheet)

RECEIVED BY LFMB
Date. 11/26/84
Log. Nov 15 I
By. Brown
Orig. To.
Action Compl. 12/18/84

Applicant 2387 / 000529
Check No.
Amount/Fee Category #270/7A $80
Type of Fee Renewal
Date Check Rec'd. 11/20/84
Received By. Brown

12/18/84 Bjc chuan

9. PERSONNEL MONITORING DEVICES

	TYPE (Check and/or complete as appropriate)	SUPPLIER (Service Company)	EXCHANGE FREQUENCY
X	1. FILM BADGE - WHOLE BODY	ICN, P.O.Box 28050, Cleveland Ohio 44128	monthly
	2. THERMOLUMINESCENSE DOSIMETER (TLD) - WHOLE BODY		
	3. OTHER (Specify)		

8505160130 850426
REG1 LIC30
37-13187-01 PDR

"OFFICIAL RECORD COPY"

18407 ML10

INFORMATION REQUIRED FOR ITEMS 10 THROUGH 21

For Items 10 through 21, check the appropriate box(es) and submit a detailed description of all the requested information. Begin each item on a separate sheet. Identify the item number and the date of the application in the lower right corner of each page. If you indicate that an appendix to the teletherapy licensing guide will be followed, do not submit the pages, but specify the revision number and date of the referenced guide. Regulatory Guide 10. Rev _____ Date March 82

Division 10; Task TM 608-4

10. MEDICAL ISOTOPE COMMITTEE	15. BEAM STOPS
[ ] Names and specialties attached, and *(check one)*	[ ] Description of stops used to restrict beam orientation attached
[X] a. Duties as in Appendix A, or	16. SHIELDING EVALUATION
[ ] b. Equivalent duties attached	[ ] Evaluation of proposed shielding attached
11. TRAINING AND EXPERIENCE License #37-13187-01 February 1, 1979	17. OPERATING AND EMERGENCY PROCEDURES
[ ] a. Supplements A & B attached for each individual user; and	[ ] a. Description of operating procedures attached; and
[ ] b. Supplement A attached for RSO	[ ] b. Copy of emergency procedures attached
12. INSTRUMENTATION *(check one)*	18. INSTRUCTION OF PERSONNEL *(check one)*
[ ] a. Appendix C form attached, or	[X] a. Training program and schedule in Appendix H followed, or
[ ] b. List manufacturer's name and model number	[ ] b. Description of instruction program for employees attached
13. CALIBRATION OF INSTRUMENTS *(check one)*	19. LEAK TESTS OF SEALED SOURCES
[ ] a. Appendix D, Part 2 procedures followed for instrumentation calibration, or	[ ] Description of leak test procedures attached
[ ] b. Description of sources, calibration frequency and equivalent procedures attached.	20. QUALIFIED EXPERT *(Use only if the individual fails to meet 10 CFR 35.24 requirements.)*
14. FACILITIES AND EQUIPMENT	[ ] Statement of qualifications of the expert who will perform teletherapy calibrations attached
[ ] a. Description and drawing of facilities attached; and	21. ALARA PROGRAM *(check one)*
[ ] b. Description of patient viewing and communicating systems attached; and	[X] ALARA Program as in Appendix I, or
[ ] c. Description of area safeguards attached	[ ] Equivalent ALARA program attached

22. CERTIFICATE
(This item must be completed by the applicant)

The applicant and any official executing this certificate on behalf of the applicant named in Item 1a certifies that this application is prepared in conformity with Title 10, Code of Federal Regulations, Parts 30 and 35, and that all information contained herein, including supplements attached hereto, is true and correct to the best of our knowledge and belief.

a. LICENSE FEE REQUIRED *(See section 170.31, 10 CFR 170)*: 7A	b. APPLICANT OR CERTIFYING OFFICIAL (Signature): Philip J. Byrne
(1) LICENSE FEE CATEGORY:	(2) TITLE: Vice President
(2) LICENSE FEE ENCLOSED: $ 270.00	c. DATE: 11/19/84

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.

Note should be made that we use the Radiological Physics Resourses of Hahnemann Medical College, North Broad Street, Philadelphia, Pennsylvania, which is licensed with the NRC for this work. Their instrumentation and calibration which they use is available on their license.

The yearly calibration of the Cobalt Unit and the semi-annual leak test performed on the unit are performed by the radiological physicists from Hahnemann College and their instruments are of sufficient sensitivity to meet the requirements of the NRC.

APPENDIX C

INSTRUMENTATION

1. Survey meters

a. Manufacturer's name: Eberline

Manufacturer's model number: E 1306

Number of instruments available: 1

Minimum range: 0 mr/hr to 10 mr/hr

Maximum range: 0 mr/hr to 1000 mr/hr

b. Manufacturer's name: Victoreen

Manufacturer's model number: 740B

Number of instruments available: 1

Ranges: X1 X10 X100

Minimum range: 0 mr/hr to 25 mr/hr

Maximum range: 0 mr/hr to 2500 mr/hr

2. Beam-on Monitor

Manufacturer's name: Atomic Energy of Canada

Manufacturer's model number: Primalert 10

Number of instruments available: 2

Backup Battery Power Supply: Yes X No ____

3. Dosimetry System

a. Electrometer

Manufacturer's name: ____

Manufacturer's model number: ____

b. Probes

Manufacturer's name: ____

Manufacturer's model number: ____

Number of probes: ____

Ranges: ____

4. Other (use additional pages)

Dosimeter Corp.of America - 600r dosimeter
Dosimeter Corp.of America - 10r dosimeter
Bendix dosimeter CD V-742 -200r

ITEM# 12

Application Date Nov. 30 1984

A. INSTRUMENT CALIBRATION - Some instruments for doing monthly calibrations are inhouse and are reported on Schedule C. However, the calibration of the Cobalt output and wipe tests are performed by Hahnemann Medical College Department of Radiologic Physics with their instruments which have been properly calibrated. A copy of the last complete report of instruments used and methodology and the calibration of instruments is included. This was performed by David Lightfoot of the Hahnemann Medical College Radiologic Physics Department on 21 January 82, and a copy of the full report is enclosed for both the calibration of the machines and for the methodology used. We are using the same methodology as at that time and there has been no change with regard to the position of the instrument or the architecture of the room since that time.

B. CALIBRATION OF BEAM ON MONITOR - A Prime Alert 10 unit is situated in the room so that it monitors output when the beam is on. This monitor can be seen from outside the maze and this is checked daily by visually seeing whether it does record radiation when the machine is on. There is also a radioactive source which is used to check the performance of the unit while connected to the battery as well as to the regular in-house electrical power source. This is performed on a daily basis and a record is kept.

C. CALIBRATION OF DOSIMETRY SYSTEMS - Dosimeters are kept in the Department as noted in the previous response to Item # 12. These dosimeters are used on a monthly basis and if there is any descreptancy between months, the radiologic physicists of Hahnemann Medical College are consulted for determining whether or not the problem is with the output or with the spot check dosimeters. As stated, the Cobalt machine output is checked on an annual basis by Hahnemann's Department of Radiologic Physics. (NRC license - 37-00467-34)

CALIBRATION OF SURVEY INSTRUMENTS

Check appropriate items.

X 1. Survey instruments will be calibrated at least annually and following repair.

X 2. Calibration will be performed at least at two points on each scale used for radiation protection purposes.

The two points will be located at approximately 1/3 and 2/3 of full scale. A survey instrument may be considered properly calibrated when the instrument readings are within ±10% of the calculated or known values for each point checked. Readings within ±20% are considered acceptable if a calibration chart, graph, or response factor is prepared, attached to the instrument, and used to interpret meter readings to within ±10% for radiation protection purposes.

3. Survey instruments will be calibrated

____ a. By the manufacturer

____ b. At the licensee's facility

(1) Using the calibration source described below:

Radionuclide _____

Manufacturer's name _____

Model No. _____

Activity (e.g., millicuries) or exposure rate output (e.g., R/hr at 1 meter)_____

Accuracy _____

____ (2) Following the calibration procedures in this appendix,

or

____ (3) Following the step-by-step procedures, including radiation safety procedures, that are attached.

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X c. By a consultant or outside firm

(1) Name Rad Services, Inc.

(2) Location Pittsburgh, Penna.

(3) Procedures and sources for calibrating instruments for clients

X have been approved by NRC and are on file in NRC License No. 37-17010-02

____ have been approved by an Agreement State. Attached are a copy of the Agreement State license, a description of the procedures and sources used for calibration, and a copy of the consultant's report* on an instrument calibration.

____ are described in the attached documents that also include a copy of the consultant's report* on an instrument calibration.

*A sample Certificate of Instrument Calibration is on the following page.

ITEM #13

App. Date 11-30-84

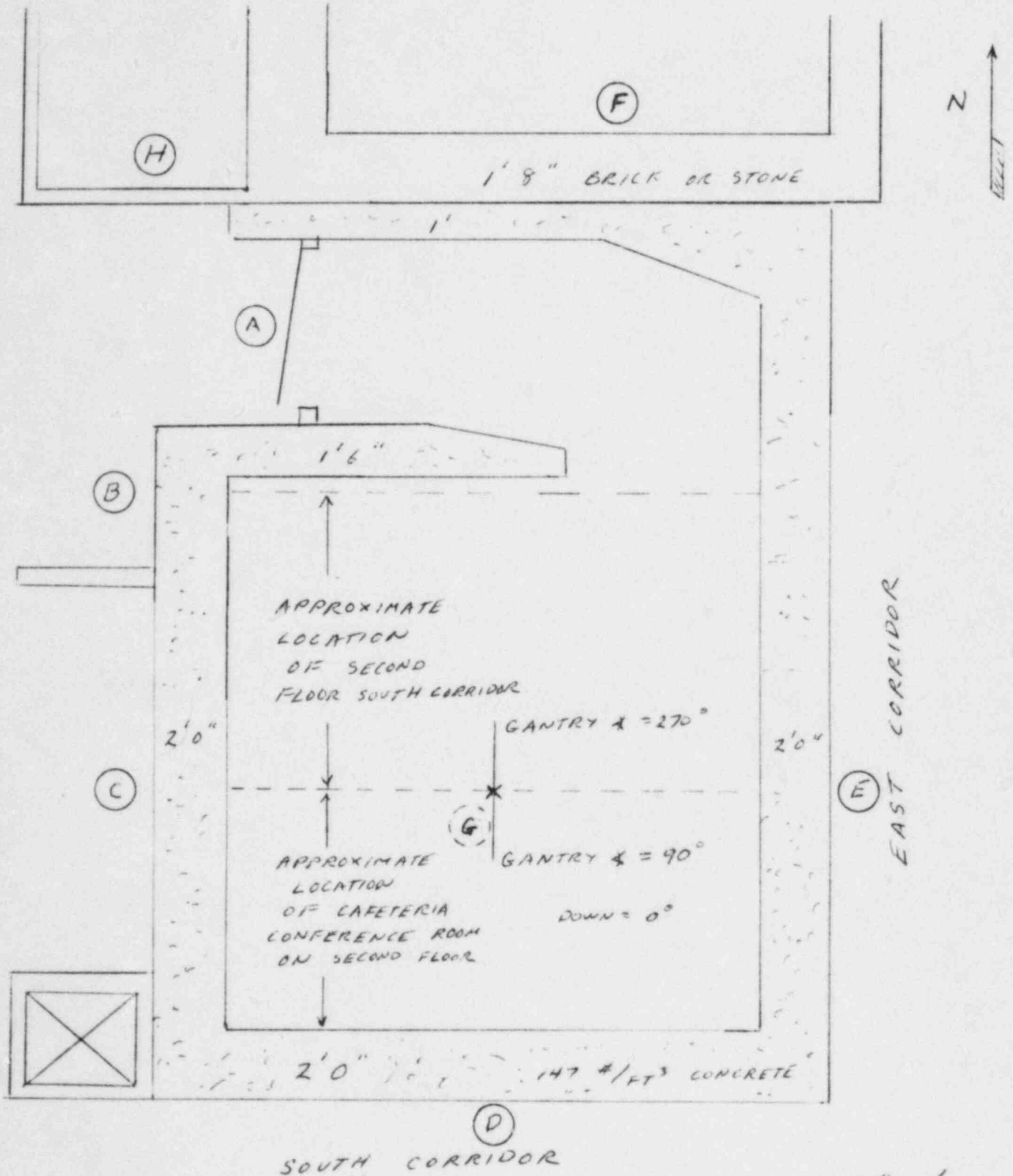
FACILITIES AND EQUIPMENT

A. An annotated plan of the Cobalt Room is included with the thickeness of the walls and the position of the gantry of the Cobalt Unit. There is nothing beneath the floor, since this in on the ground floor and there is two feet of concrete in the ceiling above the Cobalt Unit. There are no windows in the Cobalt Room and there is no leakage about the few conduits which penetrate the shielding as indicated by the previous surveys done in the Department. The room is within the Hospital and there are no areas of earth against the outer walls.

B. There is a lead glass viewing window in the door "A" of the enclosed plan of the Cobalt Room. There is also a mirror, which is a curved mirror, which can be directly visualized through the door "A" and the patient in the treatment area can be seen through this curved mirror. In addition to this, there is also a closed circuit TV monitor with intercom by which the patient can be seen. There is therefore a backup for visualizing the patient, should the closed circuit TV monitor fail.

C. Some of the safeguards which exist are: 1. There is a lock on the door, so that when the machine is not in use, this can be used to secure the area. 2. There is an interlock on the door, assuring that whenever the door is opened, the Cobalt machine cannot be turned to the "on" position. 3. There is a sign of radioactive material and radioactivity on the door leading into the Cobalt Room. 4. There is a red warning light just above the door of the entrance to the Cobalt Room which is lighted when the machine is on. There is also a Prime Alert which is flashing when the machine is on and this can be seen through the door while the door is closed to alert one to the fact that the beam is on. The interlocking system is made such that when the door is open, the machine cannot be turned to the "on" position and should the position be on the "on" position and the door opened, the Cobalt source would automatically be returned to the "off" position. The source cannot be returned to the "on" position until the door is closed and the system is reset at the control panel.

PLAN VIEW - GRAND VIEW HOSPITAL COBALT-60 INSTALLATION



SCALE ¼" = 1'

FIGURE 3

Item #14 App. Date 11.30/84

BEAM STOPS

There are mecury relay switches in the head of the Cobalt Unit which make it impossible to turn the Cobalt source to the "on" position unless the Cobalt source is aimed directly at the intergal beam absorber. The only exception to this is when the beam is directed directly toward the floor. The details of the manner in which the beam stops function is also found in the communication of 21 January 82, which is included under ITEM #13 of the present application.

OPERATING AND EMERGENCY PROCEDURE

1. OPERATING PROCEDURES

A. Daily safety device checks

1. There is a second timer associated with the Cobalt Machine such that the unit timer is completely independent of the second timer. Both of these timers are watched on a daily basis to make certain they both are registering the same time.

2. The electrical interlock system with the door is checked on a daily basis. This is checked by turning the machine "on" and opening the door to make sure that the machine turns "off" and that the machine cannot be turned "on" until the door is closed and the entire control console is reset.

3. The warning lights on top of the door and the beam "on" indicator are both checked to make sure that both of these are functioning on a daily basis. The safety switches which turn the machine "off" at either the table or the console are checked on a daily basis to make certain that these emergency switches can turn the machine "off" at any time.

4. The beam collimation is checked on a daily basis for gross motion, as to whether or not these beam collimators are turning with the appropriate turn of the controls for the beam. A record of the results of all of these above tests is kept and if any of these change from day to day, the radiotherapy technician will immediately cease any further treatments until this is checked by the Radiotherapist or a Radiation Physics person.

B. PERSONNEL DOSIMETRY - All Radiotherapy personnel are required to wear monitoring badges and these are to be worn on the clothing without anything between the dosimeter and the machinery. If a person feels they have received an excessive dose of radiation for any cause or if the badges which are worn show that an increased dose has been obtained, this will be reported immediately to the radiotherapist who will take necessary action.

C. When the Cobalt Room is not in use, the door which controls access to the Cobalt Room is locked and unauthorized personnel cannot enter the area. As stated on previous questions, there is a "radioactive material" and "radiation" sign on the door to inform people of the dangers of unauthorized entry to the room.

D. Instrument calibration - The calibration of instruments is performed by Hahnemann Medical College on their instruments since these are the ones generally used for the annual and semi-annual checks. The dosimeters used for monthly checks, are checked for accuracy if there is any drift in these instruments as compared to the expected output from the source. For the Beam On monitors, there is a daily check performed, indicating that the Beam On monitors are working by both a radioactive source and by observing the Beam On monitor while the Cobalt beam is in the "on" position.

E. The semi-annual and annual checks are performed by the Department of Radiologic Physics of Hahnemann Medical College and they use their on calibrated instruments for these checks. NRC #37-00467-34

F. Monthly spot checks are performed with dosimeters, and if there is any variance in the expected output of the machine, this is reported immediately to the Radiologic Physicist who checks this with his instruments.

G. Leak Testing - The leak tests are also performed by the Hahnemann Medical College Department of Radiologic Physics as recorded on the prior statement. For methodology, see Item #13 of this application.

H. Record keeping - There is a book kept which states the daily checks and the monthly spot checks which are performed on the machine. Note should be make that a check is also performed on the correlation of the light field as seen on a 10 X 10 field as opposed to the Cobalt field on a 10 X 10 field. This would detect any variation of the collimation system as opposed to the lighted field system. Records are also kept of this on a monthly basis and reported to the Radiologic Physicists routinely.

I. Emergency Procedures - A copy of the emergency procedures used is incorporated and attached to the present application.

J. Should there be an unusual occurance or accident with the use of the cobalt unit, this would be immediately reported to the radiotherapist, the radiologic physicist, and the NRC. The initial reaction to any accident or unusual occurrence would be to make certain that the patient is removed from the room and that the door is closed and locked so that no one would have access to the room until the necessary corrective action was taken.

GRAND VIEW HOSPITAL

SELLERSVILLE · PENNSYLVANIA

INSTRUCTIONS TO BE FOLLOWED IF COBALT BEAM CANNOT BE TURNED OFF:

1. If patient is ambulatory, instruct him to get off table and leave room.

2. If patient is not anbulatory:

   a. Move treatment table out of beam
   b. Close collimater to 5 x 5 cm. and rotate head of cobalt unit manually away from patient.
   c. Get patient onto stretcher and out of room.

3. Close door after closing collimator on machine as small as possible and directing beam to barrier.

4. Secure room against unauthorized entry.

5. Notify Radiologist:

   Jay A. Wenger, M.D., 795-2191, or "on call" Radiologist through Hospital telephone operator.

6. **Technologist or other "roaming personnel" should avoid exposure to the primary beam.**

Item #17
App. Date 11/30/84

LEAK TESTING

The Radiological Physics Department of Hahnemann Medical College does the leak testing semi-annually. A copy of the procedure used is enclosed.

See ITEM #13, Table 6.

21 January 1982

Jay A. Wenger, M.D.
Department of Radiology
Grand View Hospital
700 Lawn Avenue
Sellersville, PA 18960

Dear Dr. Wenger:

RE: U.S.N.R.C. License Number 37-13187-01
AECL Theratron-60 Cobalt-60 Teletherapy Unit #149
Model C-146 Source #S-3306 3795 Ci on 5 January 1982.

I. Calibration: 5 January 1982
II. Leakage Test: 5 January 1982
III. Head Survey: 5 January 1982
IV. Room Survey: 18 January 1982
V. Interlock Check: 5 January 1982 and 18 January 1982.

I. CALIBRATION

Pursuant to the requirements of 10CFR35.21 a full calibration was performed using dosimetry instruments calibrated in accordance with 10CFR35.23.

The basic calibration measurements reported herein were performed with a 0.6 cc type NE Farmer ionization chamber Ser. # 1050. This chamber was connected to a Keithley 610C electrometer, Ser. # K21142. The basic calibration factors for this combination were taken from the April 24, 1981 report number 524 of the Regional Calibration Laboratory at Memorial Sloan-Kettering Cancer Center; i.e., 4.696 R/nC ± 1.6% at 22°C and 760 mm Hg and 1.005 x 10^{-8} coulomb per volt on the 10^{-8} coulomb range. Voltages were measured with a Doric 4½ digit DVM which has a built in 6.344 volt zener diode calibration check. A copy of the RCL report is enclosed for your files.

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The corrections applied to the basic exposure rate measurement for a 10 x 10 field size without trimmers are detailed as follows:

DVM Indication	=	4.2257 (average of 3 rdgs)
Chamber Factor	=	4.696 R/nC
Electrometer	=	10.05 nC/volt
DVM	=	1.0003 volt/indicator (Zener rdg = 6.342)
Pressure Temp Factor	=	1.0214 (29.59" Hg, 25° C)
Isocenter Factor	=	1.0067 (ave 90° + 270° vs 0°)
Timer Error	=	1.008 (Table 1)

Multiplication of all factors yields a result of 206.8 R/min. Use of a correction factor for timer error based on the clinical value of -0.014 min. yields a result of 207.7 R/min, which is the value I reported on 6 January 1982. All results in this report are based on the slightly lower results obtained with the correction factor for timer error based on the whole minute value of -0.008 min. Table 1 contains the data and results of measurement of timer error. The Veri-timer reading was usually 0.01 min less than the timer setting.

The effect of source decay on exposure rate for the reference field size (10 x 10 without trimmers) and monitor chamber reading (Bendix mCD V742, #C0510743) is given in Table 2.

The details relating absorbed dose to the reference exposure rate are given in Table 3. The relative exposure rates were measured at 60. cm for all collimator settings listed except for the 18 x 18 setting chosen to yield a 30 x 30 field size at 100 cm. For this particular field size the measured exposure rate was made at 100 cm with an Exradion 0.5 cc chamber #104 connected to a Keithley 616/6169 Dosimetry System #K56913A/K55494A. This system was intercompared with the Farmer chamber at isocenter for a 10 x 10 collimator setting to establish correction factors. The resultant measured value of 79.4 Rmm is 2.1% higher than the AECL specified value of 77.8 Rmm ± 3% adjusted for source decay to 5 January 1982. This is well within the limits dictated by the specified accuracies of the AECL measurement and the dosimetry instrumentation calibration. Monthly values of absorbed dose rates for various conditions are shown in Table 4.

Measured transmission factors of wedges and shadow trays are shown in Table 5.

Uniformity of radiation was determined by measurements at 60 CM for a 25 x 25 collimator setting on the 27.6 SDD scale without trimmers. At 10 cm from the central ray in either direction along either major axis the exposure rate ranged from 91.5 to 93.5% of the central ray value. The average value was 92.4%. The exposure rate for a 10 x 10 collimator setting on the 27.6 SDD scale was measured for various gantry angles. The 90° result was 0.9% higher than the 0° result and the 270° result was 0.5% higher. A correction for this was included in the work-up of the basic calibration measurements. The net result is an overall assymmetry of less than 2%.

Kodak type TL film was exposed at a timer setting of 0.05 min at collimator settings of 5 x 5, 10 x 10, and 15 x 15 on each SDD scale. Scans of these films were returned with the films on 18 January 1982. The films show good congruity of light field and radiation field. The film scans indicate more assymmetry in the IN-OUT axis than was measured with the ionization chamber. This apparent assymmetry on the film scans is attributed to the effect of source ON-OFF movement time relative to the very short film exposure time. Copies of the scans are enclosed as Figure 1.

The 60 cm distance indicated by the mechanical front pointer measured 32.4 cm from the 27.6 cm SDD permanent collimator with a 10 x 10 setting. The plastic rule used for extended distance settings agreed with my scale to within a half millimeter. Hence, the overall accuracy of your distance indicators is better than 0.1 cm.

The cross-hairs of the side wall lights were adjusted by a few millimeters on 18 January 1982 to intersect exactly at the tip of the centered mechanical front pointer.

II. LEAKAGE TEST

Pursuant to the requirements of condition 14 of your NRC license a test for leakage was made on 5 January 1982. The results are shown in Table 6. The test indicated no evidence of removable activity. The test was several orders of magnitude more sensitive than required.

III. HEAD SURVEY

Pursuant to the requirements of condition 18.A(i) a survey was made of the radiation levels around the source housing with the source in the OFF position. At one meter from the estimated source position the average exposure rate was 1.6 mR/hr and the maximum was 5.0 mR/hr. This satisfies the conditions of your license. The survey meter used for the measurements was calibrated on site with a 10 mg radium needle at the conclusion of the tests. Details of the survey are shown in Table 7.

IV. ROOM SURVEY

Pursuant to the requirements of condition 18.A(ii) of your NRC license the radiation levels in all areas adjacent to your treatment room were measured on 18 January 1982 for various orientations of the beam. The unit was operated at a setting of 20 x 20 on the 27.6 SDD scale with a 23 cm diameter x 18 cm high water phantom (11 qt. plastic bucket filled almost to the top) centered at the isocenter. All measurements were taken with a Victoreen Model 470A, #2378 survey meter. The meter was calibrated against a one milligram radium needle in the morning of the day of the survey. It was found to have a net reading at 30% and 80% of full scale on the 3 MR/hr range that was 9% too high. However, no correction was applied to the survey results to correct for this. The check source reading at the time of calibration and at the end of the survey was 1.0 mR/hr on the 3.0 mR/hr range. The measured values for the survey are the maximum values found at one foot from the surface.

A record of the maximum readings is enclosed as Table 8. The angular relations resulting in maximum readings are depicted in Figure 2.

Contrary to expectations a substantial measurement was obtained on the second floor. Previous surveys did not indicate equivalent levels. Because the corridors on the second floor are not aligned with the first floor corridors a little extra effort is required to locate the area directly above isocenter. This turns out to be very close to the center of the corridor wall of the cafeteria conference room. There is no basement or other occupiable area below the treatment room.

The maximum level in any unrestricted area was 1.7 mR/hr. The maximum in any restricted area was 2.0 mR/hr at the viewing window.

Maximum workload for this unit is 32 patient visits per day or 160 patient visits per week (4/hr x 40). Assuming 200 rad per treatment at a dose rate of 87 rad/min at 15 cm depth at 60 SSD for a 20 x 20 field, the maximum beam on time is 6.13 hours per week. Without regard to use factors it may be seen that the requirements of your NRC license conditions 18.A.(ii)(a) and 18.A.(ii)(b) are satisfied.

If account is taken of the beam on time in each of the various directions the resultant summated potential exposure in any area is well below all applicable limits.

The estimated 6.13 hr.beam on time corresponds to a workload of 29,200 R/wk @ 1m.

V. Interlock Check

Pursuant to the requirements of condition 17 and condition 18.B. of your NRC license radiation indicators and interlocks were checked on 5 January 1982 and 18 January 1982.

The following were noted to be functioning properly at both times:

1. Beam on indicator on source housing.
2. Beam on indicator on console.
3. Beam on indicator at door.
4. Independent monitoring device in maze
5. TV system
6. Viewing window and mirror

Opening the door immediately terminated exposure. The exposure could not be resumed unless the door was closed and the reset button was depressed with the timer in the off position.

On 5 January 1982 it was ascertained that none of the interlock switches relating to permissible beam orientation had been disturbed by the source installation team. On 18 January 1982 the exact limits of the interlocks were determined.

When the head is swiveled more than 3 degrees CW or 5 degrees CCW off the direction of the backpointer mercury switches enable exposure only if the beam is directed vertically downward. The limits on the mercury switches are 3 degrees off true vertical towards the north and 6 degrees off true vertical towards the south.

These limits are adequate for all clinical purposes. However, it is possible with careful alignment for a diagonal of the field to extend beyond the side of beam stop with the collimator wide open and a head swivel of slightly over 2 degrees. It is my recommendation to have the head swivel microswitches adjusted to allow no more than one degree head swivel before transferring interlock control to the vertical sensing mercury switches. The current tolerance on the mercury switches need not be adjusted.

If there are any questions concerning this report, please let me know.

Sincerely,

David A. Lightfoot

David A. Lightfoot

DAL/cm

Table 1

Grand View Hospital 60 cm Cobalt-60 Unit
Measured Timer Error (α) - 5 January 1982

Actual time = t + α , t = setting, α = error

I. For a series of short exposures α is equal to the negative of the intercept on the time setting axis of a straight line fit of reading vs setting. For settings of 0.05, 0.10, and 0.15 minutes the average readings were 0.151, 0.367, and 0.578 respectively. This yields a value α = - 0.14 min.

II. For a single vs a fractionated exposure the timer error is computed as $\alpha = \frac{-(R_1 - R_N)}{(NR_, - R_N)} \times t$

where R_1 = reading for single exposure
R_N = reading for fractionated exposure
N = number of fractions
t = timer setting

For a setting of 0.2 minutes a single exposure yielded an average reading of 0.789 and a four-fraction exposure yielded an average of 0.610. Thus the computed α = -0.014 min.

For a setting of 4.0 minutes a single exposure yielded a reading of 1.677 and a four-fraction exposure yielded a reading of 1.667. Thus the computed α = -0.008 min.

III. CONCLUSION:

For clinical purposes add 0.014 minutes to the required time to determine the timer setting.

For calibration measurements made with whole minute settings subtract 0.008 minutes from the setting to determine the actual time.

For calibration measurements made with fractional minute settings subtract 0.014 minutes from the setting to determine the actual exposure time.

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TABLE 2 - GRAND VIEW HOSPITAL CALIBRATION REPORT

PREDICTED EXPOSURE RATES AND MONITOR CHAMBER READINGS

COLLIMATOR SET	SDD	DATE	DECAY FACTOR	R/MIN @60 CM	MONITOR READING	+-2%	+-5%
10X10	27.6	1/ 5/82	1.003	206.8*			
10X10	27.6	1/ 7/82	1.003		145**		
10X10	27.6	1/15/82	1.000	206.1	145	142-148	138-152
10X10	27.6	2/15/82	0.989	203.9	143	141-146	136-151
10X10	27.6	3/15/82	0.978	201.6	142	139-145	135-149
10X10	27.6	4/15/82	0.968	199.4	140	138-143	133-147
10X10	27.6	5/15/82	0.957	197.3	139	136-142	132-146
10X10	27.6	6/15/82	0.947	195.1	137	135-140	130-144
10X10	27.6	7/15/82	0.936	193.0	136	133-138	129-143
10X10	27.6	8/15/82	0.926	190.9	134	132-137	128-141
10X10	27.6	9/15/82	0.916	188.8	133	130-135	126-139
10X10	27.6	10/15/82	0.906	186.7	131	129-134	125-138
10X10	27.6	11/15/82	0.896	184.7	130	127-133	123-136
10X10	27.6	12/15/82	0.886	182.7	129	126-131	122-135
10X10	27.6	1/15/83	0.877	180.7	127	125-130	121-133

* MEASURED VALUE WITH 0.6 CC TYPE NE FARMER #1050 AND KEITHLY 610C #K21142 AND DORIC DVM.

** MEASURED VALUE FOR 0.9 MINUTE EXPOSURE OF BENDIX V742 #C0510743.

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TABLE 3

GRAND VIEW HOSPITAL 60 cm COBALT-60 UNIT
COMPUTATION OF RAD AT DEPTH PER ROENTGEN IN
AIR AT ISOCENTER FOR 10x10 SET AT 27.6 SDD

SET	SDD	TRIM	SSD	DEPTH	K_C**	K_D	f	Aeq	BSF (Johns)	RAD/R ISO
5x5	27.6	NO	60.0	0.5	0.954	0.983	0.957	0.985	1.018	0.900
6x6	27.6	NO	60.0	0.5	0.966	0.983	0.957	0.985	1.022	0.915
7x7	27.6	NO	60.0	0.5	0.976	0.983	0.957	0.985	1.025	0.927
8x8	27.6	NO	60.0	0.5	0.985	0.983	0.957	0.985	1.029	0.940
10x10	27.6	NO	60.0	0.5	1.000	0.983	0.957	0.985	1.035	0.960
12x12	27.6	NO	60.0	0.5	1.016	0.983	0.957	0.985	1.041	0.981
[illegible]x15	27.6	NO	60.0	0.5	1.035	0.983	0.957	0.985	1.051	1.009
20x20	27.6	NO	60.0	0.5	1.055	0.983	0.957	0.985	1.063	1.040
25x25	27.6	NO	60.0	0.5	1.057	0.983	0.957	0.985	1.073	1.052
5x5	45	YES	60.0	0.5	0.985	0.983	0.957	0.985	1.018	0.930
6x6	45	YES	60.0	0.5	0.994	0.983	0.957	0.985	1.022	0.942
7x7	45	YES	60.0	0.5	1.003	0.983	0.957	0.985	1.025	0.953
8x8	45	YES	60.0	0.5	1.013	0.983	0.957	0.985	1.029	0.966
10x10	45	YES	60.0	0.5	1.028	0.983	0.957	0.985	1.035	0.986
12x12	45	YES	60.0	0.5	1.038	0.983	0.957	0.985	1.041	1.002
15x15	45	YES	60.0	0.5	1.051	0.983	0.957	0.985	1.051	1.024
20x20	45	YES	60.0	0.5	1.063	0.983	0.957	0.985	1.063	1.048
25x25	45	YES	60.0	0.5	1.062	0.983	0.957	0.985	1.073	1.056
[illegible]x18	27.6	NO	100	0.5	0.384*	0.990	0.957	0.985	1.080	0.387
5x5	27.6	NO	ISOCENTER		0.954	1.00	0.957	0.985	1.000	0.899
6x6	27.6	NO	ISOCENTER		0.966	1.00	0.957	0.985	1.000	0.911
7x7	27.6	NO	ISOCENTER		0.976	1.00	0.957	0.985	1.000	0.920
8x8	27.6	NO	ISOCENTER		0.985	1.00	0.957	0.985	1.000	0.929
10x10	27.6	NO	ISOCENTER		1.000	1.00	0.957	0.985	1.000	0.943
12x12	27.6	NO	ISOCENTER		1.016	1.00	0.957	0.985	1.000	0.958
15x15	27.6	NO	ISOCENTER		1.035	1.00	0.957	0.985	1.000	0.976
20x20	27.6	NO	ISOCENTER		1.055	1.00	0.957	0.985	1.000	0.994
25x25	27.6	NO	ISOCENTER		1.057	1.00	0.957	0.985	1.000	0.996

**Relative exposure rate at Isocenter measured 5 January 1982.
*This value measured at 100 cm instead of isocenter.

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Table 4

60 cm COBALT-60 UNIT - GRAND VIEW HOSPITAL - DOSE RATE** - RAD/MIN.

USE WITH	COLLIMATOR SET	SDD	TRIM	DISTANCE SSD + DEPTH		RAD/R_{ISO}	15 JAN. 1982 (R_{ISO}=206.1)	15 FEB. 1982 (R_{ISO}=203.9)	15 MAR. 1982 (R_{ISO}=201.6)
%DD	5x5	27.6	NO	60.0	0.5	0.900	185.5	183.5	181.4
%DD	6x6	27.6	NO	60.0	0.5	0.915	188.6	186.6	184.5
%DD	7x7	27.6	NO	60.0	0.5	0.927	191.1	189.0	186.9
%DD	8x8	27.6	NO	60.0	0.5	0.940	193.7	191.7	189.5
%DD	10x10	27.6	NO	60.0	0.5	0.960	197.9	195.7	193.5
%DD	12x12	27.6	NO	60.0	0.5	0.981	202.2	200.0	197.8
%DD	15x15	27.6	NO	60.0	0.5	1.009	208.0	205.7	203.4
%DD	20x20	27.6	NO	60.0	0.5	1.040	214.3	212.1	209.7
%DD	25x25	27.6	NO	60.0	0.5	1.052	216.8	214.5	212.1
[redacted]D	18x18*	27.6	NO	100.0	0.5	0.387	79.8	78.9	78.0
%DD	5x5	45	YES	60.0	0.5	0.930	191.7	189.6	187.5
%DD	6x6	45	YES	60.0	0.5	0.942	194.1	192.1	189.9
%DD	7x7	45	YES	60.0	0.5	0.953	196.4	194.3	192.1
%DD	8x8	45	YES	60.0	0.5	0.966	199.1	197.0	194.7
%DD	10x10	45	YES	60.0	0.5	0.986	203.2	201.0	198.8
%DD	12x12	45	YES	60.0	0.5	1.002	206.5	204.3	202.0
%DD	15x15	45	YES	60.0	0.5	1.024	211.0	208.8	206.4
%DD	20x20	45	YES	60.0	0.5	1.048	216.0	213.7	211.3
%DD	25x25	45	YES	60.0	0.5	1.056	217.6	215.3	212.9
TAR	5x5	27.6	NO	ISOCENTER		0.899	185.3	183.3	181.2
TAR	6x6	27.6	NO	(60 cm)		0.911	187.8	185.8	183.7
TAR	7x7	27.6	NO			0.920	189.6	187.6	185.5
TAR	8x8	27.6	NO			0.929	191.5	189.4	187.3
TAR	10x10	27.6	NO			0.943	194.4	192.3	190.1
TAR	12x12	27.6	NO			0.958	197.4	195.3	193.1
TAR	15x15	27.6	NO			0.976	201.2	199.0	196.8
TAR	20x20	27.6	NO			0.994	204.9	202.7	200.4
TAR	25x25	27.6	NO			0.996	205.3	203.1	200.8

*A set of 18x18 yields a 30x30 field size at 100 cm.
**Based on 5 January 1982 Measurements.

$\dot{R}_{ISO}$ = R/min @ Isocenter for standard opening (10x10 on 27.6 SDD scale).

David A. Lightfoot

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Table 5 - Transmission Factors

Field Size	Device	Transmission Factor
5Wx15	45° 5Wx15 Wedge A	0.788
6Wx15	45° 6Wx15 Wedge B	0.756
8Wx15	45° 8Wx15 Wedge C	0.705
10Wx8	45° 10Wx8 Wedge D	0.641
10Wx10	45° 10Wx15 Wedge E	0.649
10Wx15	45° 10Wx15 Wedge E	0.655
10x10	0.45cm Shadow Tray-Metal Rim	0.975
30x30	0.45cm Shadow Tray-Metal Rim	0.984
10x10	0.55cm Shadow Tray-Plain Plate	0.962
30x30	0.55cm Shadow Tray-Plain Plate	0.974

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Table 6

Swipes for Removable Contamination - Grand View Hospital

Cobalt-60 Unit - with new source

		Net CPM 1/5/82	Net CPM 1/7/82
1.	Top of Collimator	5	5
2.	Top of Collimator	7	3.8
3.	Collimator Bars	2	4.9
4.	Source Slide Table	2	2.1
	MDA	10	6.5
5.	0.005 μCi - Co-60	?	1788

The counts of 1/5/82 were done at Grand View Hospital for 1 minute each on a Picker NaI well counter set for 1 - 1.5 MeV.

The counts of 1/7/82 were done at HMCH for 10 minutes each on a Baird Atomic 3" NaI well counter set for 1 - 1.5 MeV. The net CPM corresponding to 0.005 μCi is based on 3 one minute counts of a standard with a 7/1/77 activity of 0.16 μCi. The overall efficiency of the system as determined from the net CPM per μCi in 16.1% for Cobalt-60.

MDA (Minimum Detectable Activity) in both cases is $3\sqrt{B/t}$, where B is the background CPM and t is the sample counting time. The MDA for 1/7/82 counting is 0.00002 microcurie.

CONCLUSION: No detectable activity.

11/26/84

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

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

Regional License Section
Material Licensing Branch
FCMS, Office of Nuclear Material
Safety & Safeguards

LICENSE FEE TRANSMITTAL

A. REGION I

1. APPLICATION ATTACHED

Applicant/Licensee: Grand View Hospital

Application Dated: 1/21/82

Control No.: 18407

License No.: 37-13187-01

2. FEE ATTACHED

Amount: _____

Check No.: _____

3. COMMENTS

7A
12/31/84

Signed _____

Date _____

B. LICENSE FEE MANAGEMENT BRANCH

1. Fee Category and Amount: #270 + #80 - 7A

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

Amendment _____

Renewal ✓

License _____

Signed G Jackson

Date 12/18/84