



# Boone Hospital Center

1600 E. Broadway • Columbia, Missouri 65201 • Phone 314-875-4545

**FEE EXEMPT**

170.116(a)(9)

RECEIVED BY LFMB	
Date.	10/10/85
Leg.	Reg. 11. II
By.	[Signature] Sept. 24, 1985
Orig. To.	[Signature]
Action Compl.	10/15/85
EX 7A	170.116(a)(9) #13

U.S. NRC  
FEE MGMT. BRANCH

85 OCT 10 A9:11

RECEIVED

Dr. Bruce Mallett  
Chief, Materials Licensing Section  
Region III, US NRC  
799 Roosevelt Road  
Glen Ellyn, Illinois 60137

Subject: Amendment Request for License  
No. 24-01565-02. Boone Hospital Center.

Dear Sirs:

Enclosed, you will find the necessary information to amend our cobalt-60 teletherapy license so that we may install a Neutron Products cobalt source of up to 7000 Curies in our Theratron-780 unit.

We would also like to add two of our radiologists as authorized users under our cobalt materials license. Both radiologists, Drs. Rall and Cochran, have been listed previously on our cobalt license. They will be providing back-up assistance to Dr. H. Jerry Murrell, radiation oncologist.

Boone Hospital Center of Boone County, Missouri is a non-profit, local government operation and, in our evaluation, not subject to any amendment request fees.

If there are any questions about the attached materials, or if you need additional information, would you please contact our radiation safety officer, Thomas A. Sullivan, M.S., at 314-875-3729.

Sincerely,

8602190501 851212  
REG3 LIC30  
24-01565-02 PDR

*John O'Shaughnessy*  
John O'Shaughnessy, President BHC  
OCT 7 1985

REGION III

Copy: Thomas A. Sullivan, M.S., R.S.O.  
Robert R. Hurst, Ph.D., Director of Med. Physics &  
Clinical Engineering  
Radiation Safety Committee Files

CONTROL NO. 79904

OCT 7 1985

REQUEST FOR LICENSE AMENDMENTS-  
Boone Hospital Center  
License No. 24-01565-02

- I. We request to amend our cobalt materials license Condition 7.c and 8.c. Specifically, we wish to increase our cobalt teletherapy source possession limit to a total of 14,000 curies (two sources of not more than 7000 curies each). Also, we wish to be able to install a Neutron Products, Inc. cobalt-60 source into our Theratron-780 unit (no. 307). We wish to leave the AECL Model C-146 or C-151 cobalt source already listed in Condition 7.c on our license because we will be cascading the source presently in our Theratron-780 (Serial No. S-3244) to our Eldorado-8 unit (no. 102).

The following information describes the Neutron Products cobalt teletherapy source:

Source model number: NPI-20-6600W or NPI-15-6600W  
Nominal exposure rate: 6600 RHM  
Maximum activity: 7000 curies

Source installation and "five year inspection" for both units will be done by Neutron Products, Inc. under Maryland license number MD-31-025-03. The existing source in the Eldorado-8 unit (Serial No. S-3157) will be disposed of by Neutron Products, Inc. in accordance with all applicable regulations.

Both the Eldorado-8 and Theratron-780 units have internal shielding designed to accommodate Co-60 activities of 7000 curies. Attachments show the Eldorado and Theratron head leakage survey reports that were sent to the NRC after previous new source replacements of 4181 and 5265 curies respectively. Assuming exposure levels that are linear with total source activity, these old measured values can be multiplied by (7000/4181) for the Eldorado and (7000/5265) for the Theratron to obtain the approximate head leakage for both units with a new source of 7000 curies each. The results show that the maximum exposure at 1 meter from the Eldorado source would be about 5.0 mR/hr and the average exposure at 1 meter would be about 2.0 mR/hr. Similar calculations show that the maximum exposure at 1 meter from a 7000 curie Theratron source would be about 0.6 mR/hr and the average would be about 0.3 mR/hr. Of course the Eldorado head leakage will be much less than that stated above because the cascaded cobalt source from the Theratron is only about 2900 curies.

Similar calculations for a theoretical 7000 curie source in both units show that exposure levels in restricted and unrestricted areas would be within acceptable limits specified in 10CFR 20.101. The same electrical/mechanical beam stops used in the previous surveys will be maintained.

# RADIATION SURVEY REPORT

Teletherapy Head - Beam Off

P&S 41150A

Customer Boone County Hospital

Location 1602 E. Broadway, Columbia, Missouri

Model Eldorado 8

Serial Number K17

## SOURCE DATA

Serial No. S3157 Diameter 1.5 cm Curies 4181 cobalt 60  
 Measured Output 64.8  $\pm$  3% Rmm(ICRU) Measurement Date October 27/80  
 Maximum Unit Output 75.1  $\pm$  5% Rmm Rated Capacity 124 Rmm(ICRU)

Survey Meter Berthold

Model RAT01F

Serial No. 1716

Calibration Date 10/28/80

Supplementary Shielding: Donut ☐

Air Cylinder End ☐

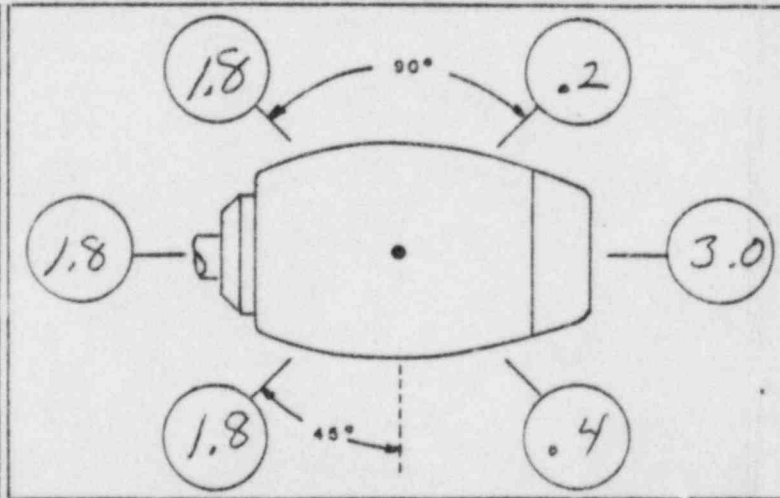
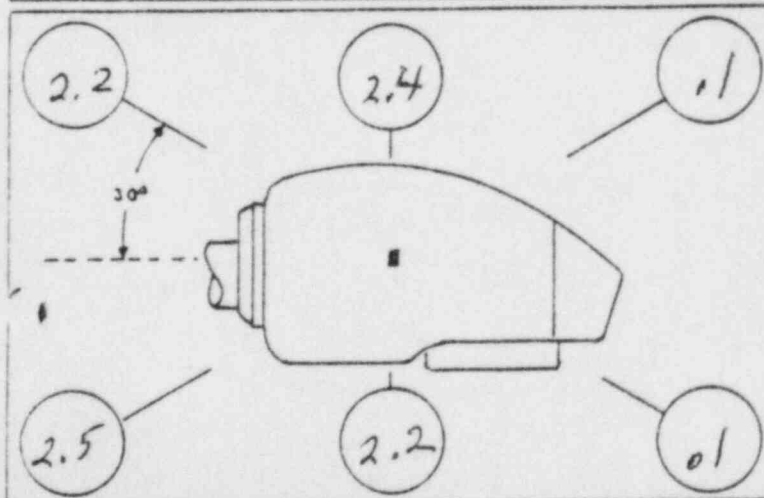
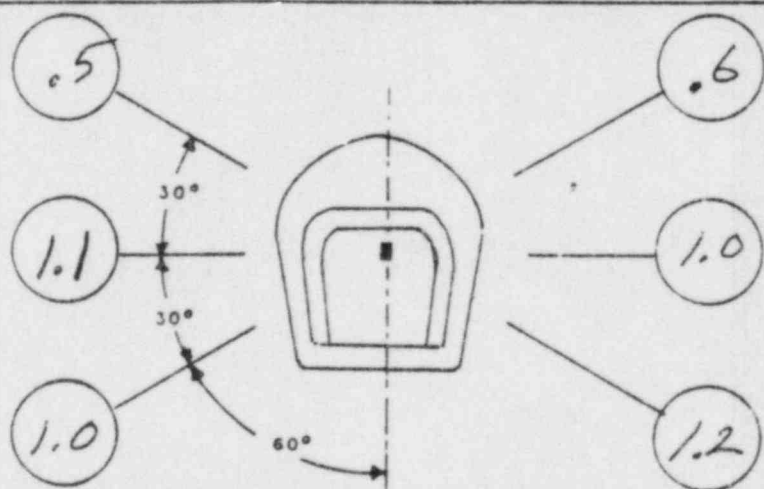
Other ☐

Facility Survey Performed by Richard D. Doss

Date 12/16/80

Comments

Measurements in mR/h at 1 metre from the source.



T-780 Head Leak Test

Boone Hospital Center

1602 E. Broadway

Columbia, MO 65201

Theratron-780, Serial No. 307, Manufacturer - AECL, Source - S-3244, 5265 Curies of Co-60 as of April 16, 1981, maximum unit output - 100.8 ( $\pm 5\%$ ) Rmm.

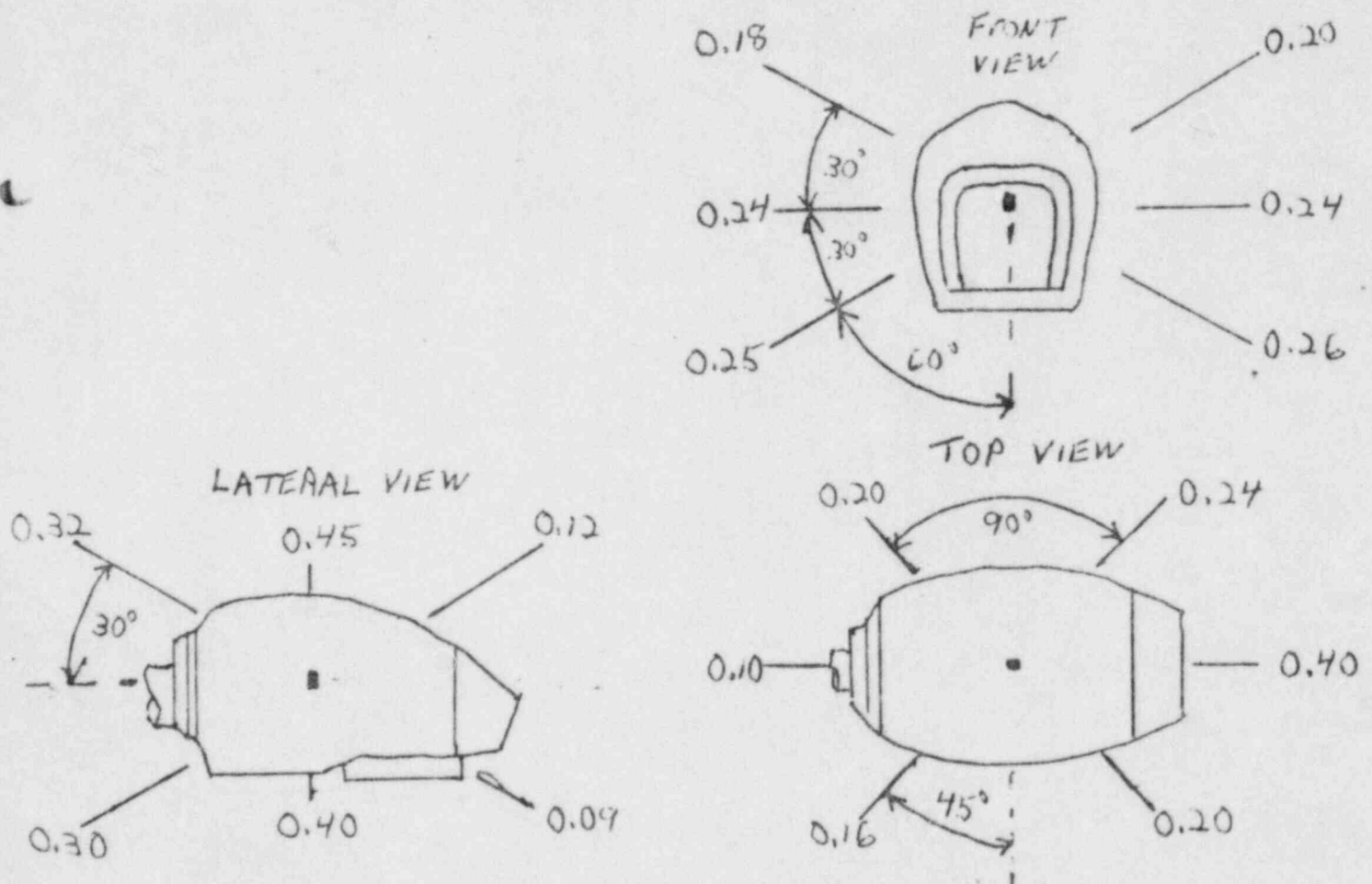
Date: October 21, 1981

Performed by: Thomas A. Sullivan, M.S.

Survey Meter: Victoreen 471-50, Serial No. 249

Calibrated: October 19, 1981 with 10 mg. Ra.-eq. Cs-137 brachytherapy source.

Parameters: Beam "off". All measurements in mR/hour at one meter from source.





teletherapy facility, including above and below, and specify the orientations producing such radiation levels.

The maximum values measured are given on the facility sketch which is attached. Also, the values measured (maximum and otherwise) are given in the table which follows. All of the readings were taken nine (9) inches from the wall. The letter identification in the table corresponds to the letter identification on the sketch.

### SURVEY RESULTS

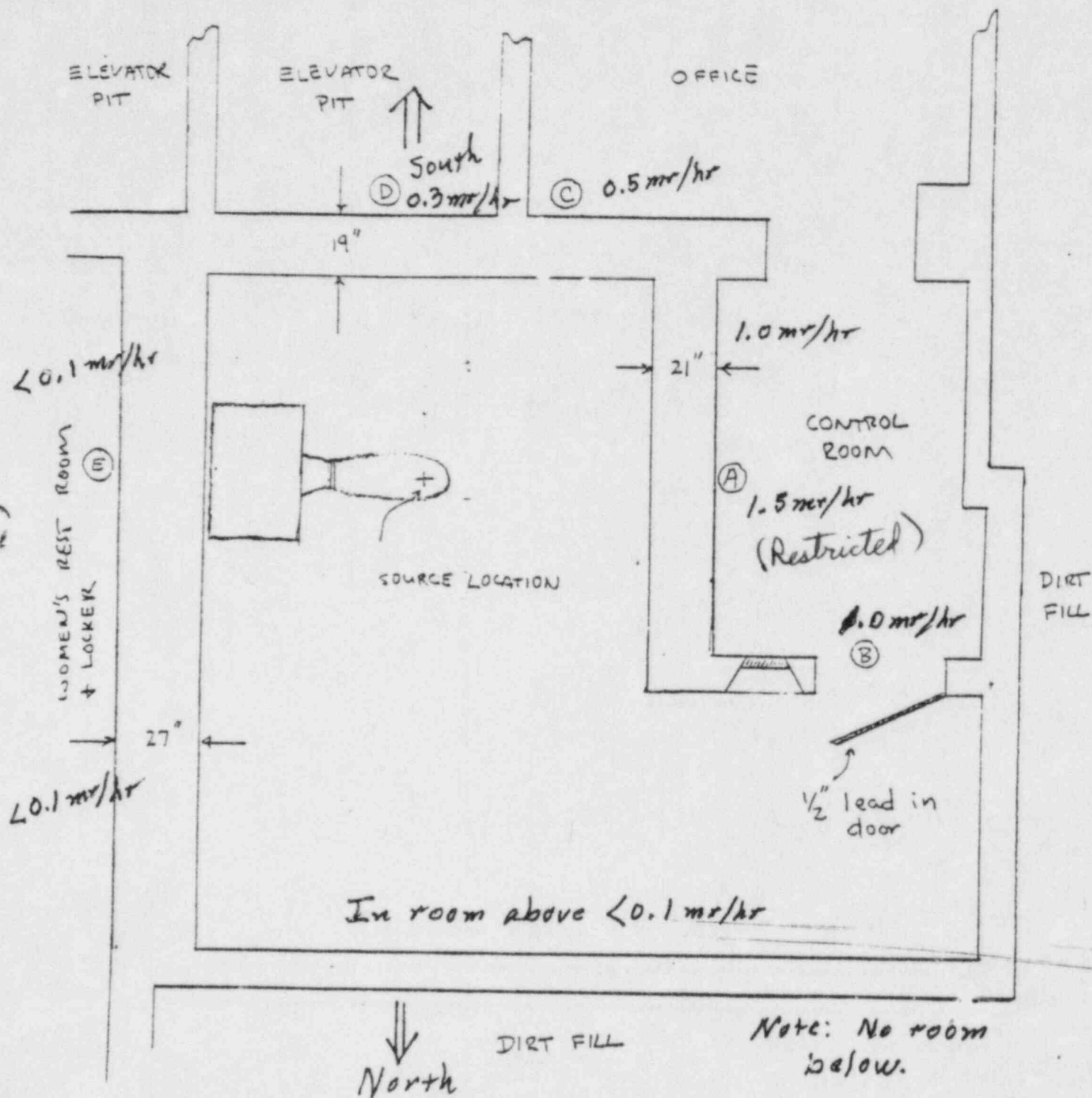
(in mr/hour)

Sketch Position	Location Description	<u>Beam Angulation</u>			*
		Vertical Down	Toward Wall	12° to Elevator	
A	Control Room Desk	0.25	1.5	0.25	
B	Control Room Entry Door	0.15	1.0	0.10	
	Control Room at Telephone	0.30	2.0	0.3	
C	Office area mid-wall at floor	0.20 0.50	0.1	0.5	
D	Elevator Pit	0.3	0.1	0.3	
E	Women's Locker and Rest Room	< 0.1	< 0.1	< 0.1	
	Room above	< 0.1	< 0.1	< 0.1	

\* Note: Measurements were made in the elevator pit with an angulation of 40 degrees toward that wall. The maximum value measured was 5mr/hr. The beam stop was repositioned to 12 degrees to limit exposure level to a maximum of 0.3 mr/hour.

Boone County Hospital  
License #24-01565-02  
January 24, 1981

# ELDORADO - 8



BOONE COUNTY HOSPITAL  
RADIATION THERAPY  
 $\frac{1}{4}" = 1'$

and 12. The maximum exposure levels in each area adjacent to the teletherapy facility with a phantom in the primary beam and the corresponding unit rotational positions is given in the following table. These values are also listed in the attached sketch of the facility. All readings were taken approximately six inches from the wall and with maximum field size. The letter identification in the table corresponds to the letter identification on the sketch.

## Theratron-780

### SURVEY RESULTS (in mR/hour)

Sketch position	Location	Vertical down	Off shield*	Rotation Max.**
A	1' above door	0.8	0.4	1.8 (250°)
B	Door	0.15	0.2	0.5 (250°)
C	Console wall near door	0.1	0.2	0.2 (250°)
D	Console area	≤0.1	≤0.1	0.1 (250°)
E	Hall	≤0.1	≤0.1	≤0.1
F	Patient waiting room	≤0.1	≤0.1	≤0.1
G	Outside sidewalk (up to 10')	≤0.1	≤0.1	≤0.1
H	Accelerator room	≤0.1	≤0.1	≤0.1
I	Roof	≤0.1	0.2 max.	0.1 (180° and 270°)

\*Off shield measurement made with gantry arm angle=30° and the head angle=345°, ie. beam aimed toward the Northwest corner. Also, measurements made: no phantom and head angle of 270° (NW corner).

\*\*Indicates gantry angle. (NOTE: 0°=vertical, 270°=towards console area, 90°=towards NW corner, etc.)

13. The following is a report of the safety and interlock tests that were performed before initiation of a treatment program:

- The teletherapy room door was opened during a beam "on" condition and the door interlock caused the source to retract to the "off" position. The unit would not turn back on until the door was closed and the beam "on-off" control was reset at the control panel. The door interlock will be tested for proper operation at least once every six months and records of such tests will be maintained.
- The teletherapy source "on-off" indicators at the source housing, on the control panel, and above the door all properly indicated the actual condition of the source as verified with the room monitor and the survey meter listed in No. 6.
- The teletherapy unit's beam stops (as described in No. 10) all functioned properly. The source would not turn "on" when the "off-shield" condition was indicated.
- The teletherapy treatment timer was checked for accuracy with a stopwatch and for its "shutter correction". Both tests were satisfactory.
- All emergency switches were tested and were found to function properly.

#### ATTACHMENTS:

T-780 Head Leak Test  
Certificate of Measurement  
Leak Test Certificate  
Facility Sketch  
Permissible Beam "on" Angles

Boone Hospital Center  
License No. 24-01565-02  
December 14, 1981

CONTROL NO. 79904

BOONE HOSPITAL CENTER  
Theratron-780

Scale  
1" = 1'  
1/4" = 1'  
North

9' Ceiling with 36" CONCRETE  
Earth + gravel Fill UNDER CONCR  
Slab floor  
No ROOMS ABOVE OR BELOW

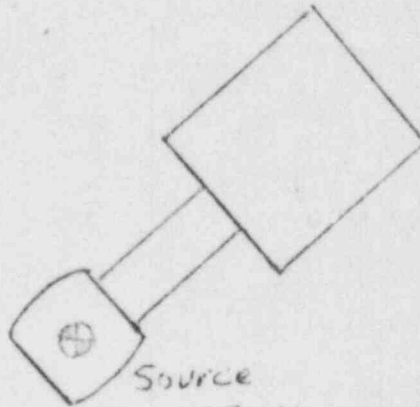
$< 0.1 \text{ mR/hr}$  (UNRESTRICTED)

(G) OUTSIDE SIDEWALK 3'-5' below floor level

CONCRETE 45"

30"

45"



Source  
LOCATION

45"

(H)

$< 0.1 \text{ mR/hr}$

(RESTRICTED)

Accelerator  
ROOM

30"

(C)

$0.2 \text{ mR/hr}$

(D)

$0.1 \text{ mR/hr}$

0.22" Lead  
IN DOOR

CONSOLE  
AREA

(A)  $1.8 \text{ mR/hr}$

(B)  $0.5 \text{ mR/hr}$  (RESTRICTED)

20"

Air Gap

CONCRETE BLOCKS

Hall (E)

$< 0.1 \text{ mR/hr}$

(I) ROOF

$0.2 \text{ mR/hr}$

SOUTH

Patient WAITING ROOM  
(UNRESTRICTED)  
 $< 0.1 \text{ mR/hr}$

$< 0.10 \text{ mR/hr}$

Air Gap

30"