



BALL MEMORIAL HOSPITAL • 2401 UNIVERSITY AVE. • MUNCIE, IN 47303-3499 • 317/747-3111

March 26, 1985

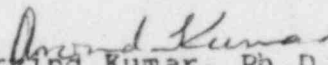
Materials Licensing Branch
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Sir:

In accordance with Item 18 of our Co-60 license, we are submitting the report of the radiation surveys and tests performed after the installation of a new teletherapy unit.

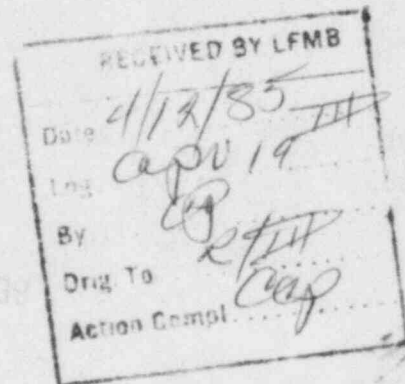
With regards,

Sincerely,


Arvind Kumar, Ph.D.
Radiation Physicist
Ball Memorial Hospital
Muncie, IN. 47303

ak/dc
3/26/85

cc. Office of Inspection and Enforcement
U.S. Nuclear Regulatory Commission
Region III
799 Roosevelt Road
Glen Ellyn, Illinois 60137



8506050028 850510
REG3 LIC30
13-00951-04 PDR

RECEIVED

APR 05 1985

REGION III


FEE EXEMPT

CONTROL NO. 78666

APR 5 1985

COBALT-60 TELETHERAPY SURVEY REPORT

Department of Radiology
Ball Memorial Hospital
2401 University Ave.
Muncie, IN. 47303

NRC License No: 13-00951-04

March 26, 1985

UNIT: ATC C-9 Model No. 590-G, Serial No. 108

Co-60 Source Catalog No. AMS-3802, Serial No. AMS-2521

INSTALLATION

DATE: March 4, 1985

SURVEY DATE: March 5, 1985

SURVEY METER: Victoreen GM Meter
Model No 493, Serial No. 446
Calibrated against NBS calibrated CS-137 source
on June 15, 1984.

DOSIMETRY

EQUIPMENT: Nuclear Enterprises ion chamber Model No. 2571,
Serial No. 721 and Keithley electrometer
Model No. 35025, Serial No. 14036. Calibrated by
Accredited Dosimetry Calibration Laboratory at
Allegheny General Hospital, Pittsburg on
August 15, 1984.

OUTPUT

MEASUREMENT: The source output was measured on March 5, 1985
to be 197 Roentgens/min at 80 cm. distance and
126 Roentgens/min at 100 cm. distance for a
30 x 30 cm. field size at 80 cm.

CONTROL NO. 7 8 6 6 6

SAFETY SYSTEMS TESTS

ATC C-9 Cobalt Teletherapy Unit

Interlocks:

1. Door interlock was tested with cable connected ion chamber to determine the source "ON-OFF" status of the source. With the source in the "ON" position, the door was opened. The source immediately moved to the "OFF" position as seen on the electrometer. An attempt was made to turn the source "ON" with the door open, but the source only moved to the "ON" position with the door closed and reset at the controls.
2. There is a zone guard beam limiter system to restrict the orientation of the beam not attenuated by the primary beam stopper. With the source gantry in the vertical position, the stops limit the beam to 19° on the north wall, 47° on the south wall, 27° on the west wall and 39° on the east wall. With the source gantry in the horizontal position, the stops allow the beam to come "ON" only between 42° to 47° tilt towards the south wall. All the stops were tested by rotating the head beyond these angles and attempting to turn the source "ON" and were found to be working properly.

Emergency Stop and Light Indicators:

1. A cable connected ion chamber was used to determine the source "ON-OFF" status. The emergency stop on the control was tested with the source in the "ON" position. As soon as the emergency bar was pressed, the source moved to the "OFF" position, the "shutter open" light extinguished and the "shutter closed" light came on.
2. The "shutter open" and "shutter closed" light on the control console, the red and white indicator lights on the entrance door and at the roof, and the room monitor lights were working properly according to the "ON-OFF" status of the source.

Timer:

The treatment timer and the elapsed time timer were tested with a stop watch for 0.5, 1.0 and 2.0 minute settings. The timer and stop watch were engaged at the same instant and the timers were working properly to terminate the exposure after completion of pre-set time. The source returned to the "OFF" position and would not return to the "ON" position until the timer was reset. The timer error was evaluated to be - 0.26 seconds.

March 5, 1985

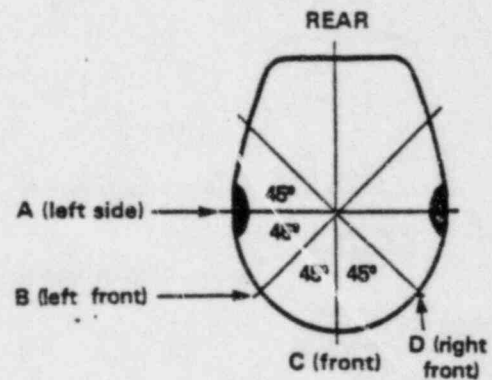
Arvind Kumar
Arvind Kumar, Ph.D.
Radiation Physicist

Figure F-1 TELETHERAPY HEAD SURVEY

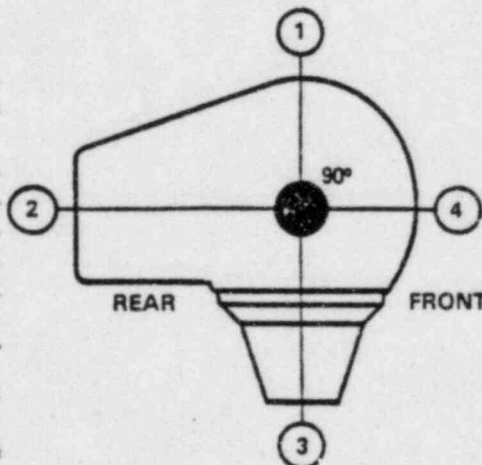
(Source in "OFF" position.
Measurements taken one meter
from source)

Top View-Showing
orientation
of Views A through D

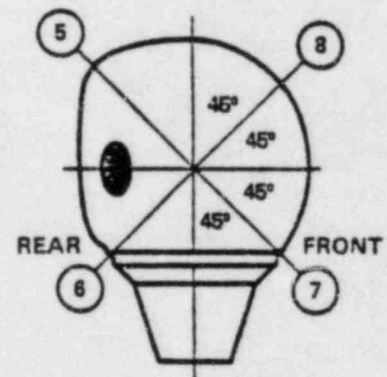
Position No.	Radiation Level (mr/hr)
View A	1 0.9
	2 1.7
	3 8.0
	4 1.4
View B	5 1.0
	6 1.5
	7 1.2
	8 0.9
View C	9 1.2
	10 0.8
View D	11 1.5
	12 1.3
	13 1.5
	14 1.7
Average value	1.76
Maximum value	8.0



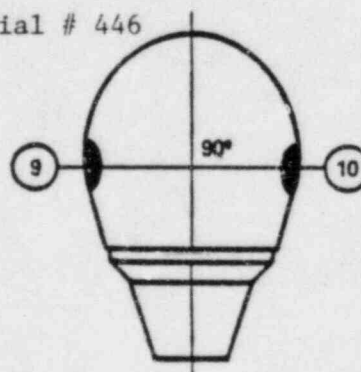
View A-Vertical
from left side



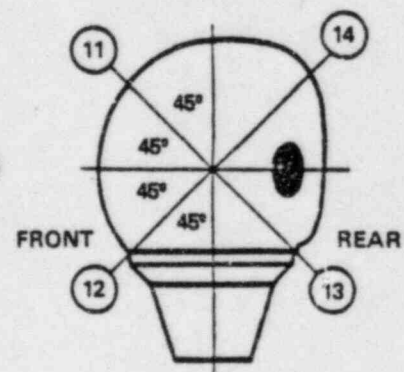
View B-Vertical
from left front



View C-Vertical
from front



View D-Vertical
from right front



Date of survey 3/5/85

Instrument used Victoreen GM Meter

Model #493, Serial # 446

Manufacturer's
name & model number
of teletherapy source AMS-2521

Date of installation 3/4/85

OUTPUT 126. ☐ RHM

☒ RMM

Date of output
measurement 3/5/85

AREA SURVEY

Cobalt-60 Teletherapy Area

A radiation survey was performed with RANDO phantom placed in a 35 x 35 cm. field at 80 cm. SSD. A Victoreen GM Survey meter, Model #493, Serial #446 was used to measure the exposure rates at various locations for various head orientations.

I. Source head vertically pointing towards the floor:

1. Controls	0.1 mR/hr
2. Viewing window	0.1 mR/hr
3. AT the door	0.3 mR/hr
4. Under the door	1.0 mR/hr
5. East corridor	<0.1 mR/hr
6. South corridor	<0.1 mR/hr
7. West (stairwell)	<0.1 mR/hr
8. Roof area (outside fence)	0.5 mR/hr
9. No occupancy below	

II. Source Head vertically pointing towards the ceiling:

1. Controls	0.1 mR/hr
2. Roof area (inside fence)	50.0 mR/hr
3. Roof area (outside fence)	8.2 mR/hr

III. Source head 19° from the vertical towards the North wall:

1. North wall	0.5 mR/hr
---------------	-----------

IV. Source head 47° from the vertical towards the south wall:

1. South wall	0.7 mR/hr
---------------	-----------

V. Gantry Angle 270° and source head tilted 47° towards the south wall:

1. South wall	20.0 mR/hr
2. East wall	0.1 mR/hr
3. Door	3.7 mR/hr

VI. Source head 39° from the vertical towards the east wall:

1. East wall	< 0.1 mR/hr
2. At the door	8.0 mR/hr
3. Controls	0.3 mR/hr

Area Survey
C0-60 Teletherapy Area
Page Two

VII. Source head 27° from the vertical towards the west wall:

- | | |
|--|------------|
| 1. West wall
(inside closed off area) | 30.0 mR/hr |
| 2. West wall
(at stair well) | 0.1 mR/hr |
| 3. Controls | 0.2 mR/hr |

VIII. Gantry angle 300° and source head pointing to east wall through the beam stopper:

- | | |
|-------------------|-------------|
| 1. East wall | < 0.1 mR/hr |
| 2. At the door | 4.0 mR/hr |
| 3. At the control | 0.1 mR/hr |

IX. Gantry angle 60° and source head pointing towards the west wall through the beam stopper:

- | | |
|--------------------------------|-----------|
| 1. West wall at the stair well | 0.1 mR/hr |
| 2. Controls | 0.1 mR/hr |

On the roof outside the fenced off area, the maximum reading is 8.2 mR/hr. Considering a use factor of $1/4$, the occupation factor of $1/16$, and the maximum "ON" time of 6.5 hrs/week, the maximum exposure will be less than 1 mR/week outside the fence. The fence is kept locked and posted with radiation caution signs. Also a red light on the roof indicates when the beam is "ON". The passageway on the west side has been closed off and locked up. The set up with the gantry angle of 270° and the source head tilted 47° towards the south wall is very rarely used and has a use factor of $< 1/20$ which makes weekly exposure < 6.5 mR without any consideration of occupancy factor. All the other exposure rates are below the limits specified in section 20.101, Title 10, Part 20, Code of Federal Regulations. Hence the area survey indicates adequate shielding.

March 5, 1985

Arvind Kumar
Arvind Kumar, Ph.D.
Radiation Physicist