MINERAL AREA ONCOLOGY CENTER, INC.

R.R. #3, Box 10A
Farmington, Missouri 63640
(314) 756-6797

Han J. Kim, M.D.

Al Korba, M.D.
Aly Razek, M.D.
Arnold Sorensen, *Certified Radiological Physicist*

September 25, 1989

U.S. Nuclear Regulatory Commission
Licensing Section
Region III
799 Roosevelt Road
Glen Ellyn, IL 60137

REF: License Number 24-24913-01

Dear Sir:

As per license requirement, the cobalt teletherapy survey report, after the source change, is being enclosed.

I will be glad to provide any additional information you may need.

Sincerely,

S. M. Shah

Saiyid M. Shah, Ph.D.
Radiological Physicist

Enclosures

• *Business Office* •
906 S. Hebron, P.O. Box 15040 • Evansville, Indiana 47716-0040
Toll Free: In Indiana, 1-800-843-7117; In Missouri, 1-800-331-9294

COBALT TELETHERAPY SURVEY REPORT
NRC LICENSE 24-24913-01 September 22, 1989

This report is required according to conditions of the NRC License issued July 14, 1987. Within 30 days of the installation of the Co-60 source a protection survey report must be submitted.

1 FACILITY

Mineral Area Oncology Center
RR3
Farmington, MO 63640

This is a one-story medical facility without basement and the building is not connected to or near any other building having more than one story. There is no direct access to the roof.

2 SURVEY PERFORMED BY:

SAIYID M. SHAH, PH.D.
THERAPY ASSOCIATES, INC.
906 SOUTH HEBRON, #4
EVANSVILLE, INDIANA 47716-0040
CERTIFIED IN THERAPEUTIC PHYSICS
AMERICAN BOARD OF RADIOLOGY

3 REASON FOR SURVEY:

Cobalt 60 source change

4 DATE OF SOURCE INSTALLATION:

August 28, 1989

5 DATE OF SURVEY:

August 28, 1989

6 RADIATION DETECTION INSTRUMENTS:

EBERLINE MODEL E-120 (SERIAL NO. 5290) RADIATION SURVEY METER CALIBRATED 4-28-89 IN ACCORDANCE WITH U.S. NRC REGULATIONS.

7 TELETHERAPY UNIT:

Atomic Energy of Canada, LTD. Model T-780, Serial Number 190.

8 TELETHERAPY SOURCE:

Neutron Products
Model: NPI-20-6300W
Serial Number: T-996

9 SOURCE ACTIVITY:

5450 Curies as of 6/1/89

10 PRIMARY BEAM INTENSITY:

The calibrated output in air at 80 cm WSAD was 151.1 rads/min for a 20 x 20 cm field. This is equal to 6065 RHM. The calibration was performed with a Capintec 192 electrometer and 0.6 cc chamber. This instrument was calibrated in accordance with NRC Standards on August 10, 1989. (A copy of the calibration certificate is on file at this facility.) The Teletherapy Calibration was performed by Saiyid M. Shah, Ph.D.

11 RADIATION SOURCE LEVELS MEASURED WITH THE SOURCE IN THE OFF POSITION:

The attached Figure F-1 shows in detail the radiation exposure levels at each of the specified points averaged over 10cm x 10cm area. The maximum value is 2.5 mR/hr and the average of the 14 positions is 0.9 mR/hr.

12 BEAM ORIENTATION LIMITS:

The unit is an isocentric machine capable of rotating 360 degrees with the beam intercepted by the beam stop. The source housing is also rotatable independently of the gantry rotation, but the interlock switches have been set so the beam can only be turned on as follows:

a. The beam is turned away from the beam stopper, and aimed at the floor only.
b. The beam is turned away from the beam stopper, and aimed at the outside wall.
c. For all other beam orientations, the beam must be intercepted by the beam stop.

13 RADIATION MEASUREMENTS IN ADJOINING AREAS:

Both primary and secondary radiation measurements were made in all adjoining areas. The attached drawings show the measurement points, and the table lists the measured values for primary (where applicable) and 30 degrees and 90 degrees scatter. The highest exposure level measured was 0.2mR/hr when the beam stop intercepted the beam, and 45mR/hr without beam stop interception. We do not anticipate treating more than one person annually with the beam aimed directly on the outside wall and a typical treatment time would be less than 10 minutes. Not a single patient has been treated in this mode since the initial inception of the facility in August, 1987. The area behind the outside wall (D) is a grass plot unoccupied with no traffic. The shielding, therefore, exceeds all radiation standards allowing 10 millirems per week to non-occupationally exposed people.

Radiation measurements were not made on the roof since it can only be accessed by leaning a ladder against the outside of the building.

14 ADDITIONAL TESTS CONDUCTED:

TIMER ACCURACY: The timer is accurate with a timer error of 0.01 minutes and the calibration sheet has this correction included in the data. A "count-up" digital timer has been added as a safety device. The timer accuracy was determined using the procedure described in 4.14.1 of ANSI Standard (ANSI N449.1-1978) "Procedures for periodic inspection of Cobalt-60 and Cesium-137 teletherapy equipment".

The mathematical relationship used is:

$$= \frac{t(R_2-R_1)}{n\ R_1-R_2}$$

where

= effective time difference due to source "on-off" mechanism.

R_1 = average of dosimeter readings for set time t.

R_2 = average of dosimeter readings for set time t (n cumulative readings).

t = time for single long/cumulative in radiation

n = no. of irradiations during cumulative irradiation.

TELETHERAPY "ON-OFF" INDICATORS: There is a mechanical indicator for "source on" position, and warning lights are mounted on the control, above the door to the room, and on the cobalt teletherapy gantry. An independent area monitor also indicates "Beam-On" and "Beam-Off", and it is connected to a battery pack.

(i) Verified that the Red and Green lights on control console and door light up correctly.

(ii) Verified that the Green light is lit on Cobalt machine when the source is "OFF".

(iii) Verified that the Primalert is working. The green light blinks with the CO-60 source "OFF". Holding the 10μci CS-137 source against Primalert verified that the red light on Primalert blinks.

DOOR INTERLOCK: The door to the teletherapy room is equipped with a microswitch which terminates "Beam-On" when the door is opened. Verified that when the door is left open, the source cannot be turned on from the console. Verified that when the door is opened with beam "ON", the source retracts to the "OFF" position.

EMERGENCY "OFF" SWITCHES: The Emergency Power Off switches on the control and the sides of treatment couch are functional.

PATIENT MONITORING: During treatments the patients will be monitored with a close circuit TV system, and an intercom system provides oral patient communication.

SURVEY METER: The facility has a functional survey meter which has been calibrated in accordance with the appropriate regulation specified by the U.S. Nuclear Regulatory Commission.

FILM BADGES: Film badges are supplied to personnel effective 8/10/87 on a monthly basis.

PERSONNEL INSTRUCTIONS: The Cobalt Teletherapy Operators received the INSERVICE INSTRUCTIONS on 8-28-89 as was specified in the license application.

Two warning signs have been mounted on the roof, and the staff has been instructed not to allow anyone on the roof without prior permission of the Radiation Safety Officer.

S. M. Shah

SAIYID M. SHAH, PH.D.
RADIOLOGICAL PHYSICIST

MINERAL AREA RADIATION ONCOLOGY CENTER
FARMINGTON, MO

CO-60 RADIATION PROTECTION SURVEY
8-29-89 and 9-21-89
The initial survey was performed on 8-29-89. At the time of preparing final report, it was discovered that the survey meter used for survey did not have valid calibration certificate. Therefore, the protection survey was redone using a survey meter with valid calibration certificate. No real difference was found between the values obtained with both survey meters.

WALLS "C" and "D" ARE OUTSIDE WALLS
HAVING BRICK VENEER FINISH

WALL "D" CAN BE STRUCK BY PRIMARY
BEAM WITHOUT BEAM STOP INTERCEPTION

SOURCE ACTIVITY 5450 CURIES AS OF 6-1-89

MEASUREMENT LOCATION	MR/HR MEASURED FOR			
	90° SCATTER	30° SCATTER	PRIMARY	LEAKAGE
A CONTROL SECONDARY BARRIER	0.1	0.1	---	---
B TOILETS PRIMARY SECONDARY	0.1	0.1	0.1	0.1
C OUTSIDE SECONDARY BARRIER	0.2	---	---	---
D OUTSIDE PRIMARY BARRIER (WITHOUT BEAM STOP)	0.2	0.2	0.2 (45 - 3 ft from wall)	0.2
E X-RAY ROOM SECONDARY BARRIER	0.2	---	---	---
F DOOR TO TELETHERAPY ROOM	0.1 DOOR CLOSED			

S. M. Shah

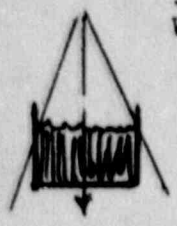
SAIYID M. SHAH
MEDICAL PHYSICIST

CONTROL NO. 87996

PROTECTION
SURVEY

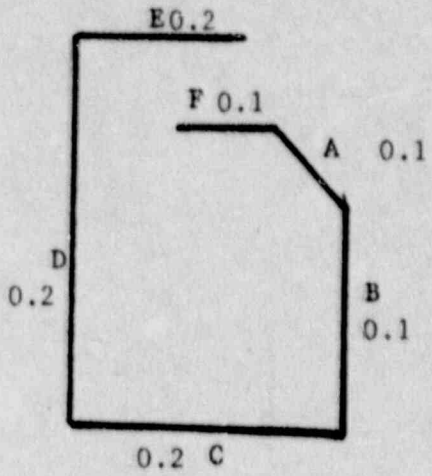
MINERAL AREA RADIATION ONCOLOGY CENTER, FARMINGTON, MO

I SECONDARY - 90° SCATTER



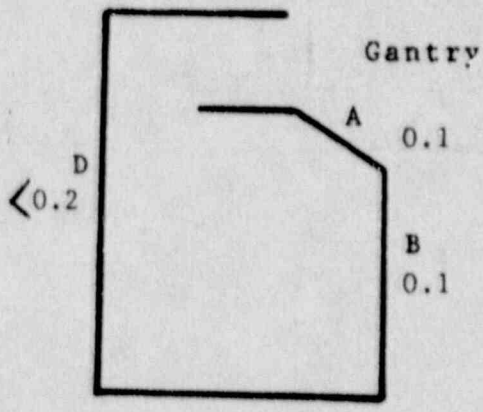
30x30x20cm
Water Phantom

CA

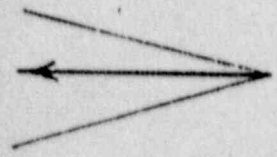


II SECONDARY 30° SCATTER

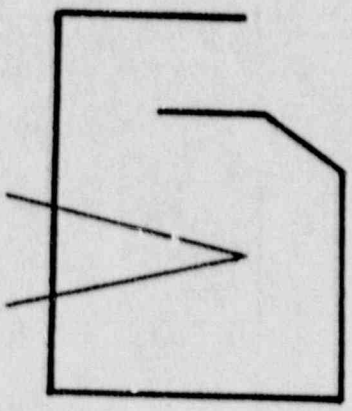
Gantry Angle



III PRIMARY/LEAKAGE



Gantry Angle

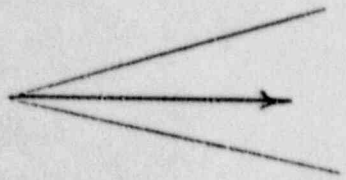


Primary
< 0.2

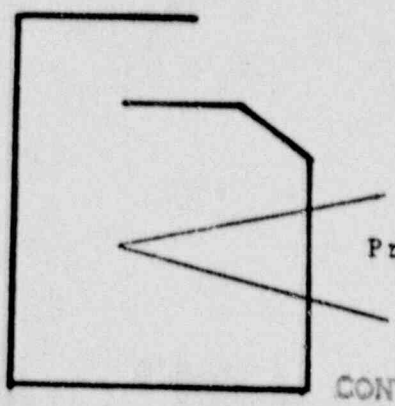
45mR/hr at 3ft without
beam stopper

Leakage
0.1

Gantry Angle



Leakage
< 0.2



Primary
0.1

AS 11/87

CONTROL NO. 87996

Figure F-1
TELETHERAPY HEAD SURVEY

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

Position No.		Radiation Level (mR/hr)
View A	1	0.4
	2	2.5
	3	1.0
	4	2.0
View B	5	0.3
	6	1.0
	7	1.0
	8	0.8
View C	9	0.4
	10	0.4
View D	11	0.8
	12	0.8
	13	0.8
	14	0.8
Average value		0.93
Maximum value		2.5

* Date of survey: 8-28-89 / 9-21-89

Instrument used: G.M. Counter Eberline Model E-120 Serial No. 5290

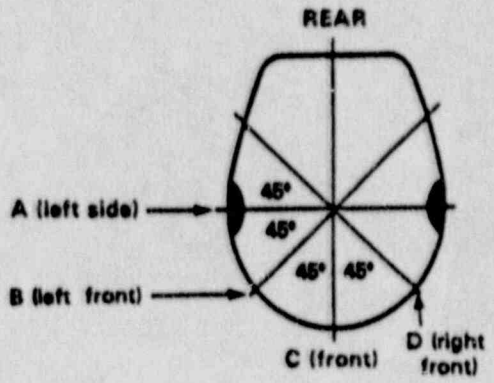
Manufacturer's name & modal number of teletherapy source: NPI-20-6300W T-996

Date of installation: 8-28-89

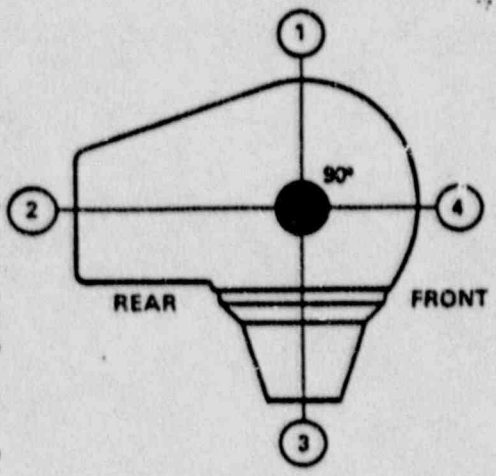
OUTPUT: 6065 ☒ RHM ☐ RMM

Date of output measurement: 8-28-89

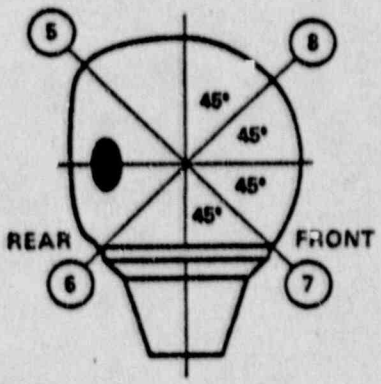
Top View-Showing orientation of Views A through D



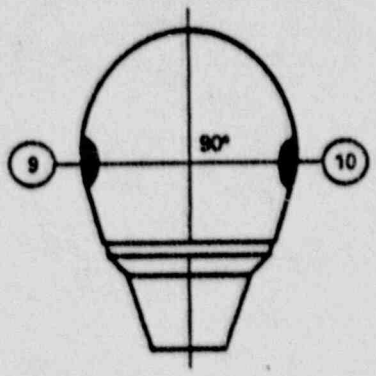
View A-Vertical from left side



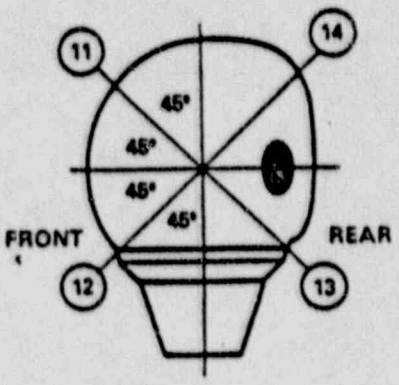
View B-Vertical from left front



View C-Vertical from front



View D-Vertical from right front



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