

Southwestern Michigan Health Care Assoc.
960 Agard Street
Benton Harbor, Michigan 49022
License No. 21-04177-02
November 29, 1985

Material Licensing Branch
Office of Nuclear Material Safety and Safeguards
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Applicant *Southwestern Michigan Health Care Assoc.*
Check No. *12/14/85*
FEE EXEMPT
Type of Fee *Survey*
Date Check Rec'd *12/14/85*
Received By *[Signature]*

Dear Sirs:

This report contains the results of a survey and calibration of the teletherapy unit located at the address above and operated under the license referenced above. The reason for the survey and calibration was a source change. The numbering of the items presented in this report follow that presented in "Guide for the Preparation of Application for Licenses in Medical Teletherapy Programs" Appendix F, March 1982.

1.a. The license is possessed by Southwestern Michigan Health Care Association. The address and License No. appear above.

b. The survey and calibration was conducted by:

William G. Van de Riet, Ph.D.
Associated in Radiation Oncology, P.C.
Skyrise Center, Suite 252
535 S. Burdick
Kalamazoo, Michigan 49007

Assisted by D. S. Reddy, Ph.D. who has recently joined Southwestern Michigan Health Care Association as a Radiological Physicist.

c. Installation of a new source.

d. The new source and five year inspection were performed on November 22 and 23, 1985.

e. The survey and calibration were performed on November 23 and 24, 1985.

f. Survey meters: Victoreen GM Thyac III survey meter calibrated on 9/5/85 by Syncor Corp. under License No. 13-19229-01 MD.

Keithley Model 36100 ionization chamber survey meter calibrated on 02/15/85 by William G. Van de Riet, Ph.D. using Cs-137 and the methods of Appendix D of Regulatory Guide 10.8.

Keithley 516 electrometer and PTW 0.6 cc ion chamber. Calibrated in March 1984 by Allegheny General Hospital Regional AAPM Certified Calibration Laboratory for Co-60.

Dosimeter:

RECEIVED
DEC 11 1985
REGION III

CONTROL NO. 80303

B604070074 B60214
REG 3 LIC 30 PDR
21-04177-02

- g. Picker C-9 Model 6296D teletherapy unit.
 - h. Atomic Energy of Canada Limited type C-151 Serial No. S-3794 (copy of source certificate attached)
 - i. Source contained 5073 curies on 11/23/85.
 - j. The output was measured for 17 different field sizes ranging from 5x5 cm at 80 cm to 35x35 cm at 80 cm. When the output for a 25x25 cm collimator setting at 80 cm is converted to RHM in air, the value obtained is 6407.
- In addition, the transmission of wedges, block trays, etc. were measured.
- k. The head survey was conducted at the 14 locations specified in Figure F-1 and the average and maximum values obtained were 1.7 and 6.3 mR/hr respectively. The maximum value was obtained under the primary collimator with the jaws set for a 15x15 cm field. The individuals who had installed the source had conducted a survey at 26 points and obtained an average of 1.65 mR/hr. A copy of Figure F-1 is attached.
 - l. The source is electrically prevented from being turned "on" unless the beam is centered on the beam shield except when the beam is directed approximately vertically toward the floor. The allowed sector for head swivel away from the beam shield when the arm is at 0 degrees is 35 degrees toward the north and 10 degrees toward the south. This is controlled by mercury switches. The head tilt motor on this unit for east-west head tilt is disconnected. When the beam is in a "non-allowed" orientation, the zone guard light on the head goes off. Attempts to turn the unit "on" when the zone guard light was off failed. There are also interlocks to prevent beam "on" if the field is set greater than 30x30 cm at 80 cm and the collimator is swiveled away from 0 degrees.
 - m, n. The orientation of this rotational unit is up-down and north-south.
 - & o. Vertical down is 0 degrees; vertical up is 180 degrees; horizontal north is 90 degrees; horizontal south is 270 degrees.

An area survey was conducted with a water phantom centered at isocenter and the beam collimator wide open (approximately 36x36 cm at 80 cm). All barriers were surveyed with the arm of the unit placed at 30 degree intervals to simulate all fixed plus rotational techniques. The G.M. survey meter was used because of its fast response time. All readings above approximately 0.2 mR/hr were confirmed with the Keithley ionization type survey meter. The comparison between the two instruments was excellent. A sketch of the room is shown in Figure 1 and the readings and angles at which they were obtained are presented in Table I.

An additional survey was conducted with the arm at 320 degrees and the head swiveled away from the beam shield toward the north as far as allowed by the electrical interlocks. This represented the "worst case" condition for the north wall.

Table I also shows the expected hourly and weekly totals based upon

"on" times of 0.28 hours per hour and 11.1 hours per week. This represents a work load of six patients per hour, 400 rads in air per patient, and the initial output at 80 cm for a 10x10 cm field.

Table I

Location	Arm Angle												Off stop
	0	30	60	90	120	150	180	210	240	270	300	330	
Control	.06	.05	.05	.08	.08	.06	.07	.07	.07	.06	.06	.06	.06mR/hr
Door	.30	.20	.05	.15	.18	.10	.25	.45	.70	.40	.45	.40	.30
West	.05	.05	.05	.05	.05	.05	.05	.05	.05	.05	.05	.05	.05
North	.14	1.1	3.3	2.0	4.6	1.2	0.1	.05	.05	.05	.05	.05	8.0
East	.06	.06	.06	.05	.06	.07	.08	.08	.08	.08	.06	.06	.07
South	.06	.06	.06	.06	.05	.06	.06	.08	.50	.80	.90	1.1	.20
Roof (around perimeter of barrier)	.05	.05	.08	.20	.80	1.4	1.4	1.4	1.2	.30	.08	.06	.06

Location	Beam Centered on Shield		Beam Off Shield	
	mR in any given hour	mR/week	mR in any given hour	mR/week
Control	.02	0.9	.02	0.7
Door	0.2	7.7	.08	3.3
West	.01	0.6	.01	0.6
North	1.3	50.9	2.2	88.5
East	.02	0.9	.02	0.8
South	0.3	12.2	.06	2.2
Roof	0.4	15.5	.02	0.7

The area adjacent to the north wall is currently a film file room as shown in Figure 1. It is proposed that this room become a staff office for the radiological physicist in the future. The radiation measurements taken during the September 26, 1982 survey in the film room were taken on the room side of film cabinets located along the south wall of the film file room. During this survey, the maximum readings were obtained by reaching behind the film bin to the wall. This was done to record the maximum readings in areas which could be potentially occupied if this area is used as an office. Thus, the readings obtained during the

most recent survey are higher than recorded during the September 1982 survey.

The area above the teletherapy room is outside and only accessible thru a maintenance door out to the roof. The roof has a posted fence around the perimeter of the teletherapy room and in addition a sign on the maintenance entrance door informs personnel to contact the radiation therapy department if access to the roof over the teletherapy room is necessary.

- q. The only area where the measured radiation levels exceeded 2 mR/hr was under the "worst case" conditions of scatter to the north wall. With respect to the off shield situation, this orientation would not be used clinically. If large field treatments are required, the beam would be directed vertically toward the floor which would result in less scatter to the north wall than under the conditions tested.

With respect to rotational or fixed field therapy, a 36 x 36 cm would not normally be used with an arm orientation of 60 to 120 degrees. Even if full rotation were ever used with a field this large, the average radiation levels would only be approximately 1 mR/hr or about 0.3 mR in any given hour using the anticipated beam "on" time.

Thus, even if the area adjacent to the north wall becomes an office for a radiation worker, it is anticipated that the weekly exposure resulting from occupancy of this office full time would be less than 10 mR.

- r. 1) The teletherapy treatment room door interlock was tested several times for proper operation. With the unit "on", the door was cracked open and the area room monitor was observed from the door way to assure that the source was turned "off". When the door was shut following this test, the only the way that the unit could be turned back "on" was by activating the key switch at the console.
- 2) The "on-off" indicators were observed for proper operation at the console during the calibration. The "on-off" indicators on the head of the unit were observed for proper operation via the closed circuit TV monitor during several cycles of "on-off". The area monitor was observed through the lead glass window of the entrance door for proper operation under normal operation and under battery backup operation.
- 3) The units beam stop buttons and switches were tested for proper operation. The timer shut the source "off" at the end of a preset time. The timer's "off" switch shut the source "off" when activated before the end of a preset time. The red emergency button on the console was tested for proper operation. The unit could not be turned "on" with the entrance door open, nor with the Zone Guard light on the head off indicating a non-allowed sector or condition of operation as described in item 1.
- 4) The unit's timer clock was checked against a digital watch with agreement within the accuracy of one's ability to activate both simultaneously. The effect of source travel or "timer error" was tested. It was found that the effective "on" time is 0.45 seconds longer than the preset clock time. This value is almost identical to measured values obtained in the past with this unit.

- 5) The alignment between the radiation and light fields was measured at 80 cm for 10x10 cm and 20x18 cm fields. The maximum misalignment for the 10x10 was found to be 2 mm and that for the 20x18 cm field was found to be 1.2 mm. The field size indicators read within 1 mm of the measured radiation field sizes.

The range light was found to be accurate within 1 mm at 80 cm and within 2 mm at 65 and 95 cm distances.

The image of the cross wires drifted less than 2 mm at 80 cm as the collimator was rotated through it's maximum limits.

The isocenter was found to be located at 80.6 cm from the source by tracking the image of the cross wires as the arm was rotated 360 degrees. This agrees to within 1 mm with the value found independently by the installation team. The image of the cross wires was found to shift 3-4 mm in and out between arm angles of 0 and 180 degrees.

Scans of a 25 x 25 cm field at 80 cm were made both in plane and cross plane with respect to the C-arm using a diode detector. The scans demonstrated that the fields were symmetric. Copies of the scans are attached.

At the end of the survey, a wipe test of the primary collimators and adjustable jaws was performed. Both dry and wet applicators were used and the results indicate that there was no removable contamination above background levels. A copy of the leak test is attached.

We trust that this information completes the requirements of Conditions 18 and 19 of our byproduct license.

Prepared by,

William G. Van de Riet, Ph.D.

William G. Van de Riet, Ph.D.
Certified Radiological Physicist

cc. Region III office

FIGURE 1

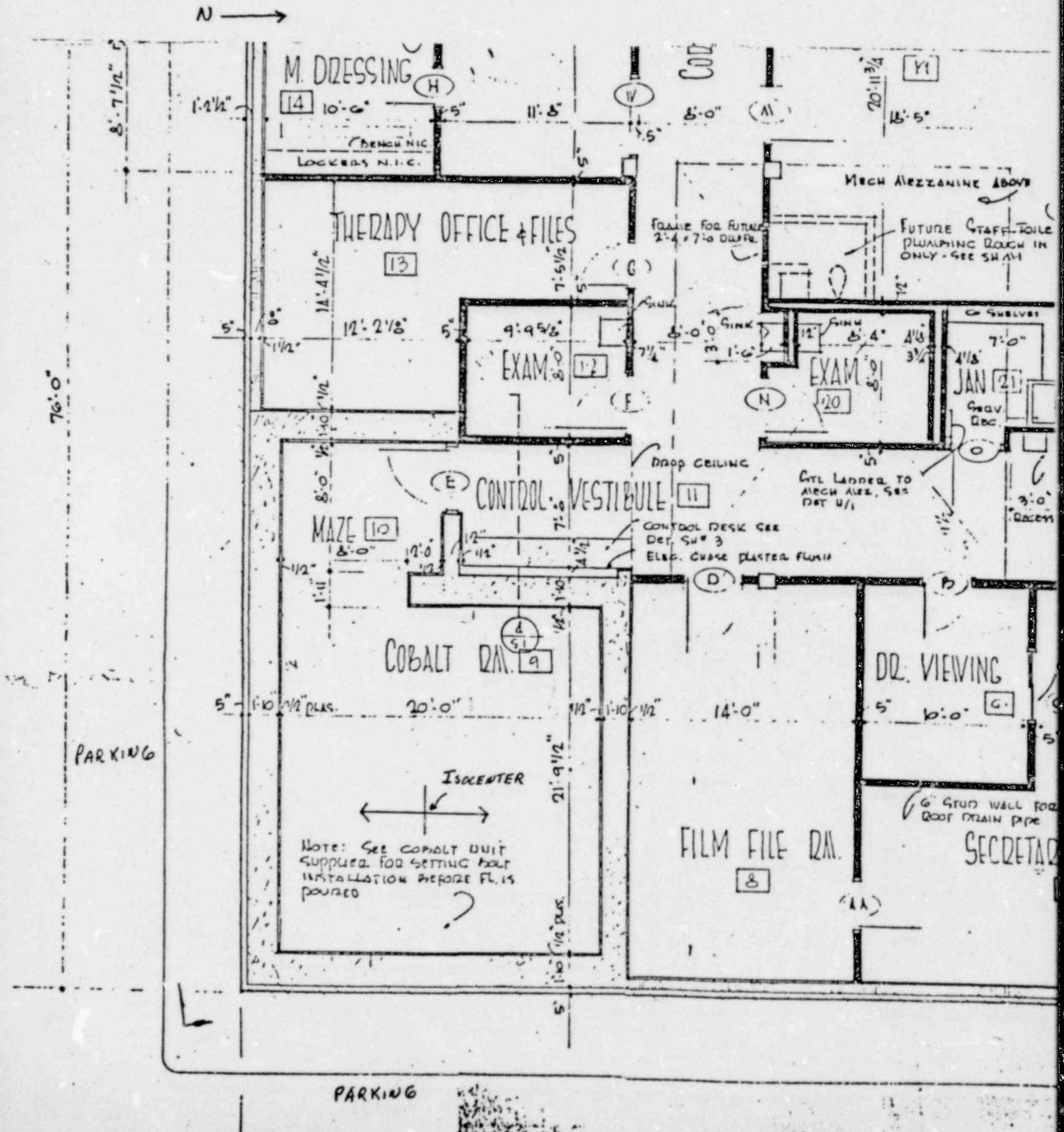


Figure F-1 TELETHERAPY HEAD SURVEY

(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 <u>2.8</u>
	2 <u>0.3</u>
	3 <u>6.3</u>
	4 <u>1.4</u>

View B	5 <u>1.3</u>
	6 <u>1.9</u>
	7 <u>1.8</u>
	8 <u>2.1</u>

View C	9 <u>0.6</u>
	10 <u>0.6</u>

View D	11 <u>1.4</u>
	12 <u>1.2</u>
	13 <u>1.1</u>
	14 <u>1.0</u>

Average value 1.7

Maximum value 6.3*

SET FOR 15X15 AT 80

Date of survey 11/24/85

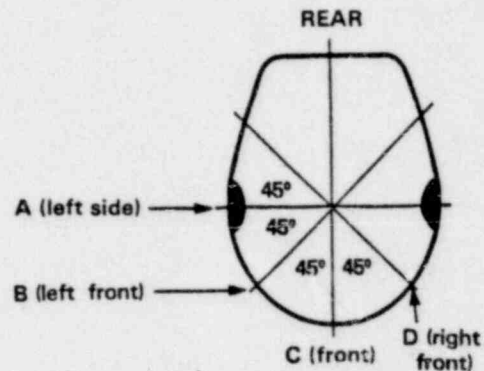
Instrument used KEITHLEY
VICTOREEN
36100

Manufacturer's
name & model number
of teletherapy source AECL
C-151

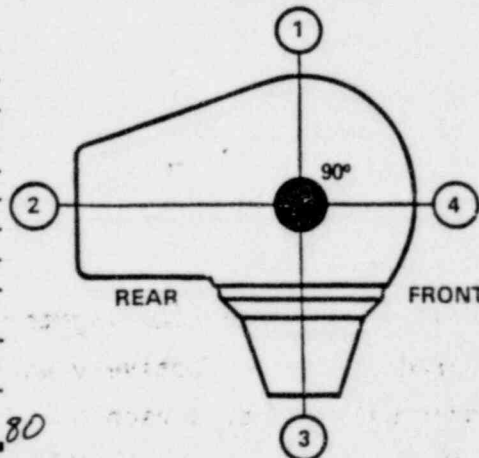
Date of installation 11/22/85

OUTPUT 6407 ☒ RHM
☐ RMM

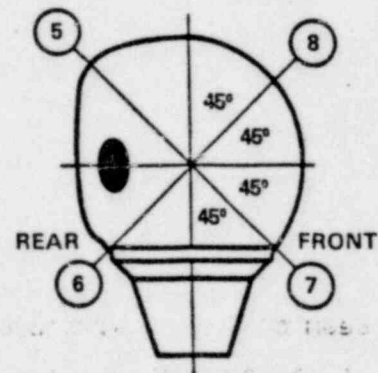
Date of output
measurement 11/23/85



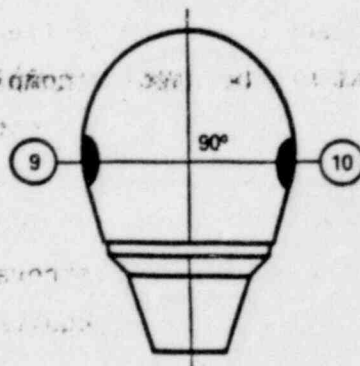
View A-Vertical
from left side



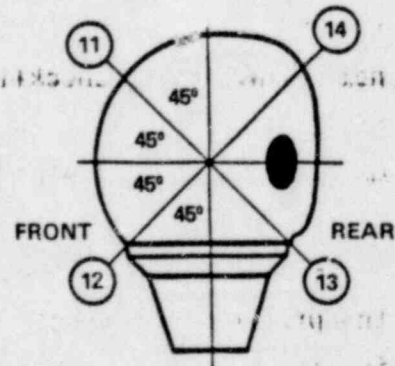
View B-Vertical
from left front



View C-Vertical
from front



View D-Vertical
from right front



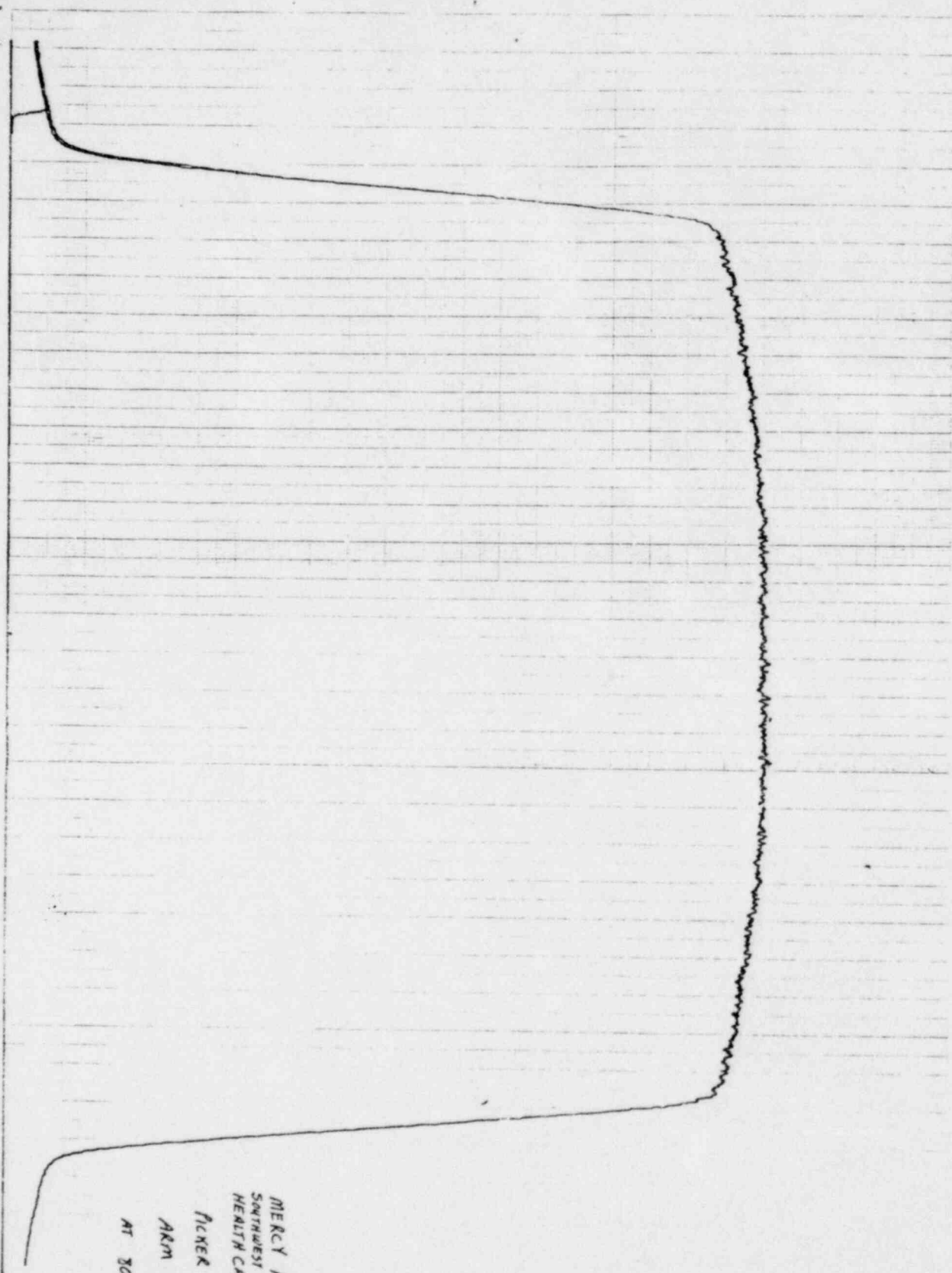
SEALED SOURCE LEAK TEST

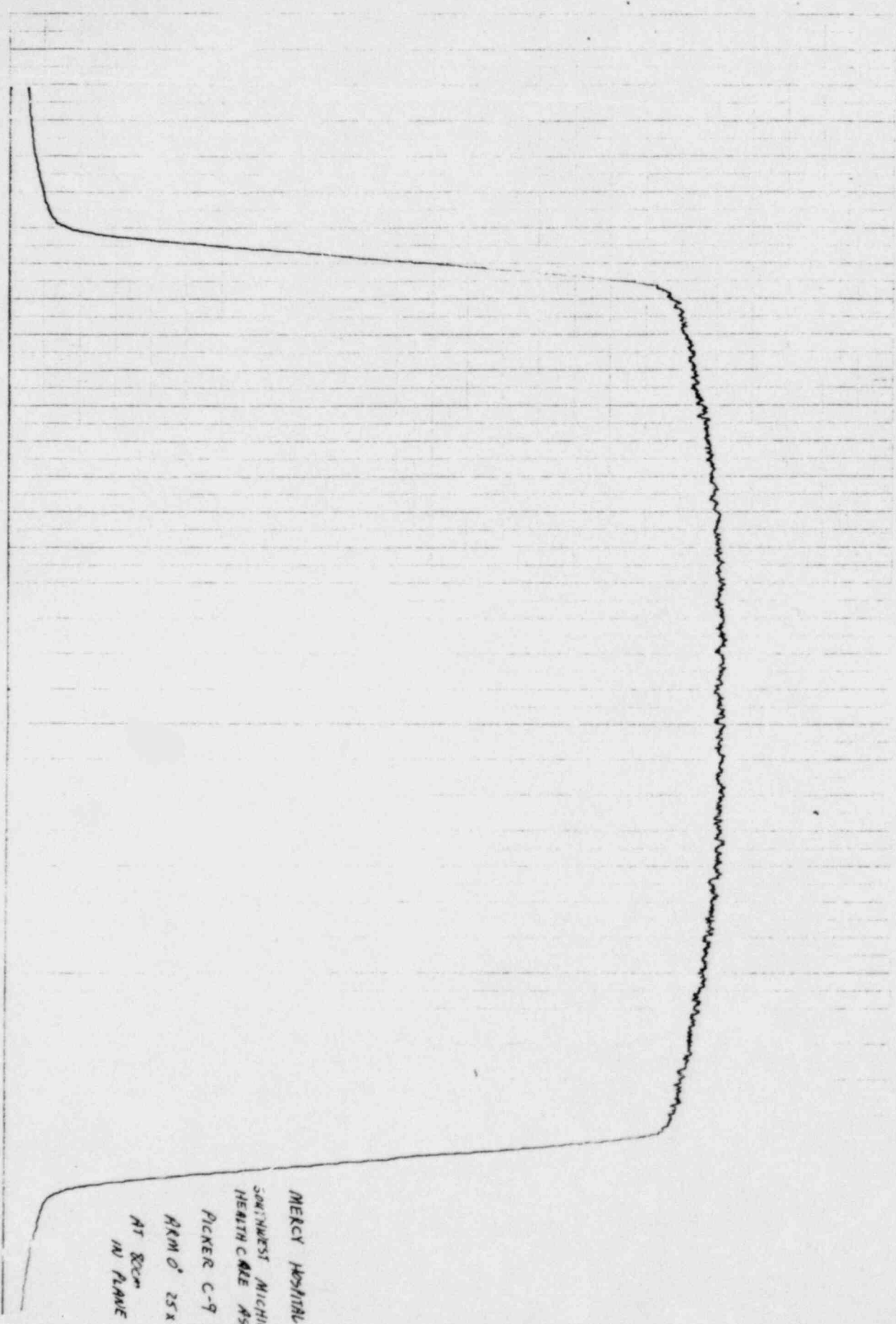
1. Institution: SOUTHWESTERN HEALTH CARE - MERCY
2. Description of Sources: PICKER C-9 Teletherapy - new source AECL C-151
3. Date of Test: 11/24/85
4. Description of Leak Test Procedure: Wiped inside of primary collimator around mirror & jaws with dry & then alcohol moistened swabs.
5. Standard: Co-60 0.109 μ Li 1/15/81 \rightarrow 0.0527 μ Li 11/24/85
6. Instrumentation: Pickers NaI Single Channel analyzer system
7. Background Count: 941 CPM
8. Standard Count: 14101 CPM $\sigma = 30.67$ $3\sigma = 92.03$ CPM
9. Minimum Detectable Activity (3σ of background): 3.69 $\times 10^{-4}$ μ Li Co-60 (MDA)
10. Sample Data:

Sample	Count	Net	Activity
Dry	954	13	less than MDA
Wet	952		less than MDA

11. Comments: Removable activity less than 0.005 μ Li of Co-60.
12. Leak Test Performed By: William J. Van de Riet, Ph.D.

MERCY HOSPITAL
SOUTHWEST MICHIGAN
HEALTH CARE ASSOC.
PICKER C-9
ARM 0° 25X25
AT 30 CM CROSS PLANE





MERCY HOSPITAL
SOUTHWEST MICHIGAN
HEALTH CARE ASSOC.
PICKER C-9
ARM Ø 25X25
AT 8cm
IN PLANE

Certificate Of Measurement

of

TELETHERAPY SOURCE S-3794

for

CUSTOMER

MERCY MEMORIAL HOSPITAL
BEN HARBOUR MICHIGAN

AECL ORDER No.

P&S 43529

THERAPY UNIT
OUTPUT

When installed in a teletherapy unit, the source exposure rate will increase by an amount dependent on the field size setting and equipment conversion ratio of the unit.

MEASUREMENT
OF SOURCE

Source S-3794 is a 2.0 cm diameter standard source, type C-151, containing 5129 curies cobalt 60. The source exposure rate was 95.4 Rmm ($\pm 3\%$) at the one metre position of the measurement cell.

DATE OF MEASUREMENT

1985 OCTOBER 21

MEASUREMENT METHOD

The source exposure rate was measured in the cell described on the following sheet (Form QC 9 Sheet 2). The exposure rate was measured with an air wall cavity ionization chamber having a volume of 0.6 cm³ and fitted with a 4.6 mm lucite equilibrium cap. The instrument is calibrated in a cobalt-60 exposure rate certified by the National Research Council of Canada.

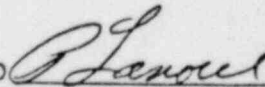
ACCURACY

The uncertainty in the source exposure rate applies only to measurement of this source in the AECL Measurement Cell. It represents the maximum total uncertainty due to all causes including the calibration of the Council's primary exposure rate, the calibration of their instrumentation and the precision of measurement in the Measurement Cell. Additional uncertainty due to the comparative measurements involved, has been included in the statement of unit output.

EXCERPT FROM THE RECOMMENDATIONS OF THE INTERNATIONAL COMMISSION ON RADIATION UNITS & MEASUREMENTS, REPORT ICRU-18, OCTOBER 1970. "It must be emphasized the measurement of exposure rate and/or absorbed dose for treatment purposes should be made locally by the user himself. The statement of equipment conversion ratio by the manufacturer should not be regarded as a substitute for this."

ISSUED 1985 OCTOBER 23

APPROVED

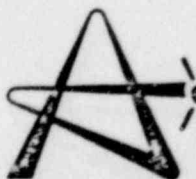


P.D. Lanoue

Measurement

J.A. Worswick

Authorization



Atomic Energy of Canada Limited • Radiochemical Company

Kanata • Ontario

NOTE: Rmm stands for roentgens per minute at one metre.

CONTROL NO. 80303

A.E.C.L. Procedure DG-0065

TITLE: DRY WIPE TEST — ABSTRACT

The surface of the capsule is thoroughly wiped with a filter paper. The paper is monitored and the amount of radioactive material present is determined. If less than 0.0005 microcuries are present, the results are described as negative. The limit is raised to 0.005 microcuries on the inner capsule of a double encapsulated assembly.

The source assembly is retested after a minimum period of 7 days of storage and within 7 days of final packaging. The limit on the 7 days leak test is 0.005 microcuries.

Procédé DG-0065 ÉACL

TITRE: ÉPREUVE PAR FROTTEMENT À SEC — APERÇU

On essuie soigneusement la surface de la capsule avec un papier filtre. On vérifie le papier pour déterminer la quantité de matières radioactives présentes. Lorsqu'on détecte moins de 0.0005 microcuries, on considère que les résultats sont négatifs. Cette limite est portée à 0.005 microcuries sur la capsule intérieure d'un ensemble doublement encapsulé.

On revérifie l'ensemble de la source après une période minimale de 7 jours de stockage et dans les 7 jours qui précèdent l'emballage définitif. La limite prévue pour l'épreuve détachéité de 7 jours est de 0.005 microcuries.

LEAK TEST CERTIFICATE ATTESTATION D'ÉTANCHÉITÉ

ORDER No.
N° DE COMMANDE

P.S. 43529

DATE

1985 NOVEMBER 1

DESCRIPTION OF SOURCE TESTED DESCRIPTION DES SOURCES VÉRIFIÉES

One Cobalt-60 Teletherapy Source 2.0 CM. Active Diameter, AECL Type C 151
Une source de téléthérapie au Cobalt-60, CM de diamètre actif, ÉACL, Type C

Serial No. S-3794 Other
N° de série Autre

LEAK TESTS PERFORMED ÉPREUVES D'ÉTANCHÉITÉ EFFECTUÉES

(See reverse for description of tests)
(Description des épreuves au verso)

RESULTS OF TESTS RÉSULTATS DES ÉPREUVES

- ☒ 1. THE DRY WIPE TEST, PROCEDURE DG-0065
ÉPREUVE PAR FROTTEMENT À SEC, PROCÉDÉ DG-0065
- ☐ 2. OTHER TESTS (AS DESCRIBED BELOW)
AUTRES ÉPREUVES (DECRIRES CI-APRÈS)

- NEGATIVE

DATE OF COMPLETION OF TESTS
ÉPREUVES TERMINÉES LE

1985 NOVEMBER 1

FOR THE COMPANY
POUR LA SOCIÉTÉ


Source Production Department
Service de la production des sources



Atomic Energy
of Canada Limited

Commercial Products

P.O. Box 6300
Postal Station J
Ottawa, Canada
K2A 3W3

L'Énergie Atomique
du Canada, Limitée

Produits Commerciaux

C.P. 6300
Succursale Postale J
Ottawa, Canada
K2A 3W3

X-RAY EQUIPMENT COMPANY

P. O. Box 2431 Phone 817/429-5099
FORT WORTH, TEXAS 76113-2431

INSPECTION CERTIFICATE

THIS IS TO CERTIFY THAT THE Picker C-9 TELETHERAPY UNIT
MODEL 59E, SERIAL NO. 191, LOCATED AT
So. Western Michigan Health Care Assoc.

WAS INSPECTED AND SERVICED ON November 23, 1985
BY Danny P. Abudy / Tom Kidd / X-Ray Equipment Company, TO ASSURE THE FUNCTIONS OF
THE UNIT ARE PROPER, AND TO MEET THE CONDITION:

"Each Teletherapy Unit shall be fully inspected and serviced
during source replacement or at intervals not to exceed
five years"

DATE November 23, 1985

SIGNED

Danny M. Seabrook

X-RAY EQUIPMENT COMPANY, INC.

TEXAS R.A.M. LICENSE NO. 5-1485

X-RAY EQUIPMENT COMPANY

P.O. Box 2431
Fort Worth, Texas 76113-2431
(817) 429-5099

THIS IS TO CERTIFY THAT A COBALT-60 SOURCE:

MODEL NUMBER: C-151
SERIAL NUMBER: S-3794
CONTAINING 5129 CURIES AS OF 10/21/85

AND WHICH HAS BEEN DETERMINED BY WIPE TEST TO BE LEAK FREE, HAS
BEEN INSTALLED IN A TELETHERAPY UNIT DESCRIBED AS FOLLOWS:

MANUFACTURER: PICKER
MODEL NUMBER: C-9
SERIAL NUMBER: 191

AND IS HEREBY TRANSFERRED FROM:

X-RAY EQUIPMENT COMPANY
P.O. BOX 2431
FORT WORTH, TEXAS 76113-2431 TX. R.A.M. LICENSE #TX-5-1485

TO:

S.O. WESTERN MICH. HEALTH CARE ASSOC.
960 AGARD STREET
BENTON HARBOR, MICHIGAN

LICENSE NUMBER: 21-04177-02

RS Riddy

RSO

DATE: 11/23/1985

Danny m. Peabody

DANNY m Peabody

DATE: 11/23/85

CONTROL NO. 80308

X-RAY EQUIPMENT COMPANY

P.O. Box 2431
Fort Worth, Texas 76113-2 31
(817) 429-5099

THIS IS TO CERTIFY THAT A COBALT-60 SOURCE:

MODEL NUMBER: AMS 3802
SERIAL NUMBER: AMS 2471
CONTAINING 3355 CURIES AS OF 11/1/85

AND WHICH HAS BEEN DETERMINED BY WIPE TEST TO BE LEAK FREE, HAS
BEEN REMOVED FROM A TELETHERAPY UNIT DESCRIBED AS FOLLOWS:

MANUFACTURER: PICKER
MODEL NUMBER: C-9
SERIAL NUMBER: 191

AND IS HEREBY TRANSFERRED FROM:

SO. WESTERN MICH. HEALTH CARE ASSOC.
960 AGARD STREET
BENTON HARBOR, MICHIGAN

LICENSE NUMBER: 21-04122-02

TO: X-RAY EQUIPMENT COMPANY
P.O. BOX 2431
FORT WORTH, TEXAS 76113-2431 TX. R.A.M. LICENSE #TX-5-1485

DS Ridds
RSO

DATE: 11/23/1985

Danny M. Peckody
DANNY Peckody

DATE: 11/23/85

DEC 11 1985