Louis A. Weiss Memorial Hospital

4646 North Marine Drive
Chicago, Illinois 60640
(312) 878-8700

James Champer
President

July 5, 1985

Bruce Mallett, Ph.D.
Materials Licensing Branch
U.S.Nuclear Regulatory Commission, Region III
799 Roosevelt Road
Glen Ellyn, IL 60137

Re: Installation of a Cobalt-60 Teletherapy Unit

Ref : License No.: 12-02418-02
Our Letters of September 13, 1984 & January 23, 1984

Dear Dr. Mallett :

In accordance with the conditions of our Cobalt Teletherapy License pertaining to the replacement of old Picker C-9m Cobalt Teletherapy Machine with a new ATC-Picker C-9 reconditioned Machine, please find enclosed the following :

(a) Teletherapy Unit Tests, Physical Factors, etc.
(b) Exhibit 1 : Copy of Certificate of Wipe Testing of the Radioactive Co-60 Source,
(c) Exhibit 2 : copies of Certificate of Measurement of Co-60 source and Co-60 Source Warranty,
(d) Exhibit 3 : Teletherapy Head Survey and Calibration of Survey Meters,
(e) Exhibit 4 : Lower Level and Ground Level Plans,
(f) Exhibit 5 : Area Survey,
(g) Exhibit 6 : Copies of Calibration of Dosimetry Systems,
(h) Exhibit 7 : Emergency Operation,
(i) Exhibit 8 : Certificate of Receipt of the replaced Picker C-9m Teletherapy Machine with NPI-20-5803W Cobalt-60 Source (Activity 2506 Ci on 6/14/85).

The tests were performed with the assistance of Ram Basavatia, M.S.,D.A.B.R., Radiation Physicist.

We trust that the data supplied herewith ensures a safe operation of the machine for Radiation Therapy.

Should you desire, I would be happy to provide with any more pertinent information. My phone No. is 312-878-8700, X-2325. Thank you very much for your co-operation and help.

Sincerely,

Arun G. Kaluskar, Ph.D.,
Diplomate American Board of Radiology
Radiation Physicist/ Radiation Safety Officer

Encl.
cc : G. Banaszynski, Vice Pres.
Y. Mehta, M.D., Director, Radiation Oncology
USNRC Document Management Branch

Louis A. Weiss Memorial Hospital
4646 N. Marine Drive
Chicago, Illinois 60640

License # 12-02418-02

TELETHERAPY TESTS

1. Dates of Survey : June 14-17, 1985

2. Licensee : Louis A. Weiss Memorial Hospital
Deapartment of Radiation Oncology
4646 N. Marine Drive
Chicago, Illinois 60640

3. License Number : NRC 12-02418-02

4. Cobalt Teletherapy Unit : ATC Medical Group(Picker Corp)
Model : Picker C-9, Catalog No. 6269
Source : AMS 3802, Sl. No. AMS 2539
Source Activity : 5627 Ci on June 1, 1985
Output : In Air, 80.5 cm SAD, Collimators 10 cm X 10 cm; 156.06 R/Min as measured by CAPT PRO6-G ionization Chamber Probe with Keithley 602 Electrometer & Data Precision 245 DVM, on June 14, 1985.

5. Door Interlock : The entrance to the teletherapy treatment room is equipped with electrical interlock system, that turns the Primary beam of radiation "OFF" immediately upon opening the door. Our tests showed that the primary beam of radiation could not turned on until the treatment room door is closed and the beam "ON-OFF" key at the control reset.

6. ON-OFF Indicator : The electrical indicators (red light) at the control panel, on the entrance door, on the west wall and eletrical (red light) and mechanical (red semicircular plate) indicator on the cobalt source head worked satisfactorily when we tested them using the dosimetry probes (CAPT PRO6-G and PRO6-C) in the primary beam path and Victoreen "VAMP" Area Monitor.

7. Area Monitor : Victoreen "VAMP" Area Monitor. Red warning light appears in the background radiation when the beam is "ON".This monitor has a backup battery pack. Also a survey meter is available in case of power failure.

8. Emergency Switch : Tested - Operates properly. The primary beam is turned "OFF". The beam can be turned "ON" only after the beam "ON-OFF" is reset.

9. Treatment Timer : The timer was tested using a stopwatch and was found to be accurate within 0.2 sec. The Cobalt-60 source returned to "OFF" position, as monitored by the dosimetry systems and area monitors, at the end of the PRESET time. The source could not be turned to the "ON" position until the timer was reset.

10. Patient Viewing Systems : These operated properly.
    a. Hitachi Closed Circuit Camera and T.V.
    b. Large Convex Mirror - Aligned Correctly.
    c. Talk-a-Phone two way Intercom.

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Chicago, Illinois 60640

NRC 12-02418-02

Continued

11. Shutter Movement : Tested Operates Smoothly

a. Time Taken - Fully OFF to Fully ON = 1.5 Sec.
b. Time Taken - Fully ON to Fully OFF = 1.3 Sec.

12. Radiation and Light Field Alignment : Alignment Satisfactory, within ± 2 mm

a. Centering - within ± 2 mm
b. Flatness of the Radiation Field - within ± 3%

13. Emergency Instructions : Posted, Exhibit 7. A dry drill was conducted on June 25, 1985 by the Radiation Safety Officer and was attended by the Radiation Therapy Technologists & the Radiotherapists.

14. Warning Signs : Posted - " CAUTION HIGH RADIATION AREA" and "RADIOACTIVE MATERIALS".

15. Wipe Test : Please refer to Exhibit 1. The removable contamination was less than 0.005 uCi.

16. Teletherapy Head Survey : Please refer to Exhibits 3. With the source in "OFF" position, the measurements taken at 1 meter from the source show that the average exposure was 1.6 mR/Hr while the maximum exposure rate was 3.5 mR/Hr. The GSM-5 GM survey meter was calibrated by A.G.Kaluskar, Ph.D., D.A.B.R. at Weiss Memorial Hospital and the Keithley Model 36-100 Ion Chamber surveymeter was calibrated by Stan Huber Consultant Inc. (NRC license # 12-17503-01).

17. Mechanical and/or Electrical Beam Stops : Please refer to Exhibit 4 for floor plans.

a. When the integral absorber intercepts the primary beam, the teletherapy head can rotated 180^{0} in each direction, using the gantry.
b. At all gantry angles the beam can be directed only witin $\pm 3^{0}$ radially (i.e. In-Out or North-South), the primary beam always intercepting the beam stopper.
c. the primary beam can be directed only within $\pm 2^{0}$ sideways (i.e transverse or East-West) for all beam orientations except when the beam is vertically down (see part d.). the beam always intercepting the beam stopper.
d. When the beam direction is vertically down the teletherapy head can be turned upto 18^{0} to East and West. However, the primary beam can never hit the East Wall. This setting is used for large mantle fields.

When the primary beam is directed towards any of the unallowed directions, the electrical circuit breakers are activated and the power to the source head is cut off. This is indicated by the "Zonegard" light on the source head. We could not produce the primary beam under these conditions. This was verified using the area monitor and dosimetry probes.

Continued

18. Area Survey :

The survey was made with Johnson GSM-5 GM survey meter and Keithley 36-100 ionization chamber survey meter while the beam was "ON". A maximum opening of 35 cm X 35 cm was used. A tissue equivallent phantom (36 cm X 36 cm X 30 cm) was placed at 80 cm SAD in the beam as a scatterer. Maximum readings, at locations and between the two survey meters, averaged over 10 cm X 10 cm area, were recorded. The beam orientations were manipulated to yield exposures at low angle scatterings and also at most adverse conditions. Please refer to exhibits 4 and 5 for the survey results. At none of the locations the weekly exposure levels exceed the Maximum Permissible Dose (MPD) for that area.
Please note that at the most adverse orientation of the beam (i.e. Gantry at 180°-beam vertically up, head 4° South and 35 cm X 35 cm field) the exposure level at the laundry room floor is 3.5 mR/Hr (instanteneous rate). Assuming use factor of 1/16, weekly workload of 60000 R at 1 meter and the measured output of 6570 RHM this gives

$$\frac{60,000}{6570} \times 3.5 \times \frac{1}{16} = 2.0 \text{ mR per week,}$$

which is bellow MPD. However, this treatment condition has never been used in last 6 (six) years.

References : 1. " Structural Shielding Design and Evaluation for Medical Use of X-rays and Gamma Rays of Energies Up to 10 MeV " -National Council on Radiation Protection and Measurements, Report No. 49 (1976)

2. " Dosimetry of X-ray and Gamma Ray Beams for Radiation Therapy in the Energy Range 10 keV to 50 MeV " - National Council of Radiation Protection and Measurements, Report No. 69 (1981)

3. " American National Standard Procedures for Periodic Inspection of Cobalt-60 and Cesium-137 Teletherapy Equipment " - ANSI N449.1-1978

4. " A Protocol for The Determination of Absorbed Dose From High-Energy Photon and Electron Beams " - Task Group 21, Radiation Therapy Committee, American Association of Physicists in Medicine, Medical Physics, Vol 10, 741-771, Dec. 1983.

7/15/85

CONTROL NO. 7 9321

Advanced Medical Systems, Inc.
1020 London Road
Cleveland, OH 44110
(216) 692-3268

Exhibit 1

Louis A. Weiss Memorial Hospital
4646 North Marine Drive
Chicago, IL. 60640

NRC # 12-02418-02

CERTIFICATE OF WIPE-TESTING OF RADIOISOTOPE SOURCE

This is to certify that the radioisotope source identified as ADVANCED MEDICAL SYSTEMS, INC., Catalog No. AMS-3802, Serial No. AMS-2539 Cobalt-60 Therapy Source and to be installed in Picker Model No. 590-G, Serial No. 319 Therapy Unit, was wipe tested on 4th June, 1985 and found to have .00202 microcurie of removable contamination, as determined by comparison of the wipe with a standard Cobalt-60 source of .0612 microcurie in a Picker Model 2804 Welltype Scintillation Detector and a Picker Model 628433 Spectroscaler.

Signed: Glenn R. Sibert
Glenn R. Sibert

Dated: June 6th, 1985

CONTROL NO. 79321

ATC medical group

Advanced Medical Systems, Inc.

1020 London Road
Cleveland, OH 44110
(216) 692-3268

Exhibit 2(A)

Louis A. Weiss Memorial Hospital
4646 North Marine Drive
Chicago, IL. 60640

NRC # 12-02418-02

CERTIFICATE OF MEASUREMENT
COBALT-60 SOURCES

CATALOG NO. AMS-3802
SERIAL NO. AMS-2539

This is to certify that the radioisotope source as identified above was measured at the Advanced Medical Systems, Inc., 1020 London Road Cleveland, Ohio, U.S.A., in such a fashion that the measurement is equivalent to that obtained when the source is installed in a Picker Corporation Catalog Number 6269 60-Cobalt Beam Therapy Treatment equipment with Catalog Number 3706D beam defining device of 25 cm by 25 cm aperture at a distance of 80 cm.

Under these conditions this source was found to have a radiation output in free air of 6568 roentgens per hour at one meter on 5th JUNE 1985.

The attached decay table for this radioisotope will be useful in estimating the activity at future dates.

This source contained 5627 Curies asof 1st June, 1985.

Glenn R. Sibert

Signed: Glenn R. Sibert

Dated: June 6th, 1985

The measurement reported is for invoicing purposes only and A.M.S. Inc, assumes no responsibility for results of exposures computed with this value.

^{60}Cobalt Teletherapy Source Warranty

Advanced Medical Systems, Inc., hereinafter called "the Company", warrants that its ^{60}Cobalt Teletherapy Source (hereinafter called "the Source") is and shall be free from defects in material and workmanship and shall contain its radioactive content without leakage of such content for a period of 15 years from the date of installation thereof by the Company or its authorized representative in a Picker Corporation or Company manufactured teletherapy unit or until the Source is removed from such unit provided such removal is conducted by the Company or its authorized representatives, whichever occurs first (hereinafter called "the Warranty Period").

In the event that the Source should become defective during the Warranty Period in accordance with paragraph 1 above, the Company will remove and replace the Source and remove, within the limitations described in this warranty, any radioactive contamination caused by the defective Source, at no charge.

The Company further warrants that:

1. Any Company/Picker Corporation manufactured source head with a Company manufactured Source installed by the Company or its authorized representatives meets N.R.C. and State regulations regarding radiation leakage.
2. No Source manufactured by the Company shall be subject to mixture or movement of the radioactive content such as would cause fluctuations, lessening, or increasing of the output of such Source.
3. Any service work performed by the Company or its authorized representatives at the time of a Source exchange shall be warranted for a period of 6 months from the date of such service work.

This warranty is subject to the following conditions:

1. The warranty is non-transferable.
2. The warranty shall become void in the event of improper maintenance, sale, modification or movement of the teletherapy unit or repair of the teletherapy source head in which the Source is installed or exchange or removal of the Source by other than the Company or its authorized representatives.
3. The obligations of the Company under this warranty shall consist solely of replacement of the Source with one of equivalent or greater output at the time the warranty is invoked by the Customer and of decontamination of the teletherapy unit and the treatment room in which the Source is installed to an acceptable radiation level as defined in this warranty.
4. The Customer must carry out routine wipe tests as prescribed by local licensing authorities and in no event shall such tests be less than those described in the Instruction Manual of the teletherapy unit.
5. The Customer will immediately notify the Company if a Source is suspected of leakage during routine wipe tests.

Decontamination

In the event of radioactive contamination caused by a defective Source under the terms of this warranty, the Company will decontaminate (within a reasonable period of time) the teletherapy unit and treatment room within the following limitations:

For Fixed Contamination — the maximum and average radiation levels at 1cm from any contaminated surface shall not exceed 1.0 and 0.2 mR/h respectively when measured with a beta-gamma survey meter through a tissue equivalent absorber of not more than 7mg/cm^2.

For Removable Contamination — the maximum amount of radioactivity removable from a 100cm^2 surface area by wiping that area with a dry filter or soft absorbent paper shall not exceed 0.05 microcuries.

Limitations of Warranty

The Company will not be responsible for:

1. Loss of use of the teletherapy unit.
2. Any ill effects or injuries to any person by the radioactive materials pertaining to the Source and teletherapy unit.
3. Damage to the Source caused by any person not acting on behalf of the Company or by any act of God, war, fire, strikes, plots, conspiracy, sabotage or vandalism.
4. Losses or additional costs incurred by the Customer during any clean-up period.
5. Damages caused by or removal of any radioactive contamination being transported outside of the treatment room.
6. There are no representations or warranties with respect to the Source other than as contained herein.

Advanced Medical Systems, Inc.
1020 London Road
Cleveland, OH 44110
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CONTROL NO. 7 9321

L.A.Weiss Memorial Hospital
Chicago, Illinois 60640

Exhibit 3(A)

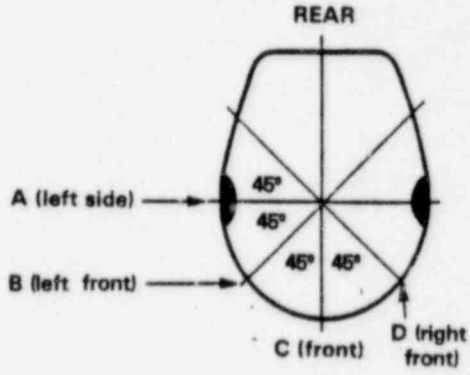
NRC # 12-02418-02

Figure F-1
TELETHERAPY HEAD SURVEY

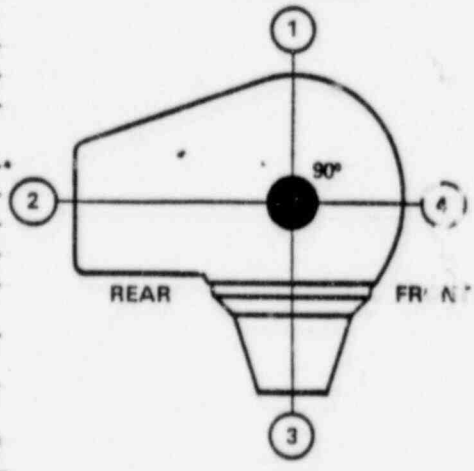
(Source in "OFF" position. Measurements taken one meter from source)

Position No.		Radiation Level (mr/hr)
View A	1	3.5
	2	0.5
	3	0.7
	4	2.5
View B	5	2.2
	6	2.0
	7	2.5
	8	0.7
View C	9	0.6
	10	0.7
View D	11	1.2
	12	1.3
	13	3.0
	14	1.6
Average value		1.6
Maximum value		3.5

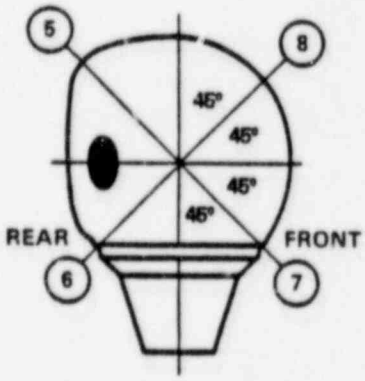
Top View-Showing orientation of Views A through D



View A-Vertical from left side



View B-Vertical from left front



Date of survey 6-13-85

Instrument used GSM-5

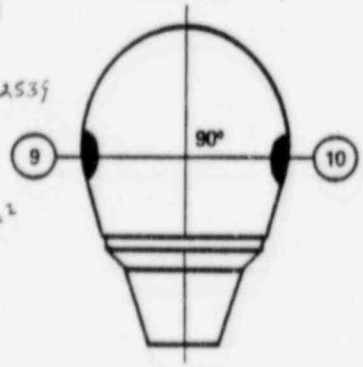
Manufacturer's name & model number of teletherapy source Picker-Cs 590-C Head 6269, AMS-3EC2, SN-2535

Date of installation 6/13/85

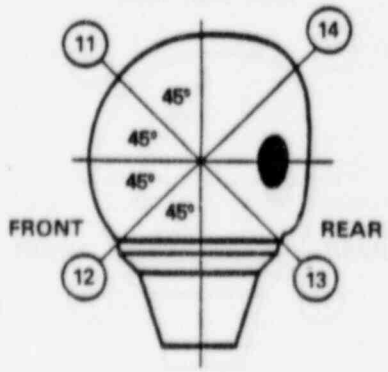
OUTPUT 6570 ☒ RHM for 25 x 25 cm² field
☐ RMM

Date of output measurement 6/13/85

View C-Vertical from front



View D-Vertical from right front



C.G. Kalukow
6/13/85

SURVEY INSTRUMENT CALIBRATION SHEET

Name of Person Calibrating: A. G. Kaluskar, Ph.D., P. Hayden R.T.

Date Calibrated: Feb 1, 1985

Manufacturer of Instrument: Johnson Associates

Name of Model: Survey meter

Serial Number: 979 - Rad Cheol.

Model Number: GSM-5

Calibration Source Isotope	Activity mCi	Distance (meter)	Primary Field Reaching Probe (Calculated) A (mR/h)	Scatter Field Reaching Probe (Measured) B (mR/h)	Total Field at Probe A + B (mR/h)	Scale	Meter Reading (mR/h)
Cs-137	25.69	2.5	1.35	0.3	1.65	10	1.6
# 402	(10 mg Ra Eq)	4.0	0.53	0.1	0.63	10	0.8
		8.0	0.13	0.05	0.18	1	0.18
		10.0	0.08	0.03	0.11	1	0.12
Cs-137	61.27	1.25	12.9	2.0	14.9	100	15.0
# 801	(25 mg Ra Eq)	3.0	2.2	1.0	3.2	100	3.5

$\Gamma_{Cs\text{-}137} = 3.28 \frac{R\text{-}cm^2}{hr\text{-}mCi}$, Probe diameter 3.5 cm
length 14 cm

All within ± 10 %
O.K. for survey.

Quarterly checks
✓ 6/4/85

Varipulsor Frequency (cpm)	Scale	Meter Reading (cpm)

A. G. Kaluskar, Ph.D.
Radiation Physicist
Certified by American Board of Radiology

L.A.Weiss Mem Hosp
Chicago, Illinois 60640

NRC# 12-02418-02

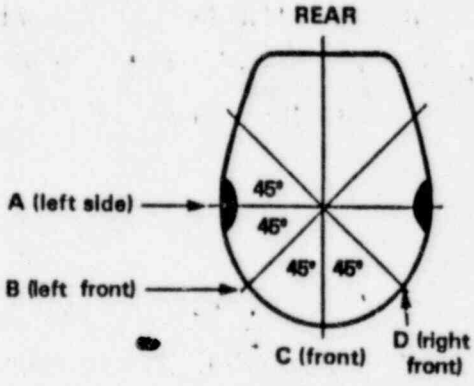
Exhibit 3(C)

Figure F-1
TELETHERAPY HEAD SURVEY

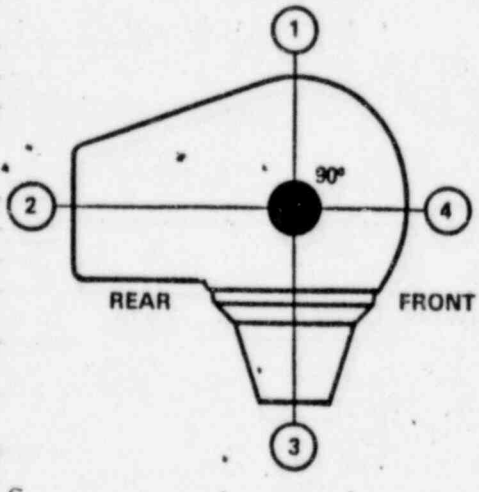
(Source in "OFF" position. Measurements taken one meter from source)

Position No.		Radiation Level (mr/hr)
View A	1	2.6
	2	0.5
	3	0.4
	4	2.6
View B	5	1.9
	6	1.9
	7	2.0
	8	0.7
View C	9	0.4
	10	0.4
View D	11	1.2
	12	1.2
	13	2.5
	14	1.6
Average value		1.4
Maximum value		2.6

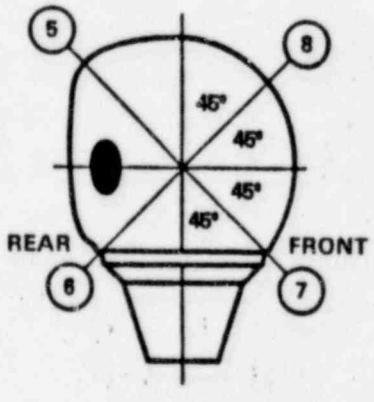
Top View-Showing orientation of Views A through D



View A-Vertical from left side



View B-Vertical from left front



Date of survey 6-13-85

Instrument used Keithley 36100

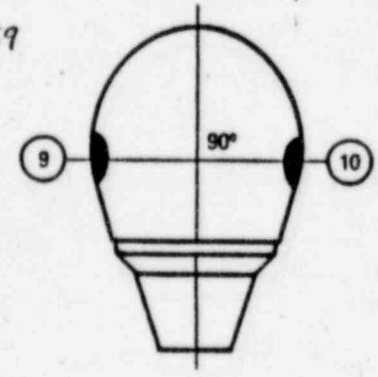
Manufacturer's name & model number of teletherapy source Picker C-9, 0269 AFC-570 G AMS-3802

Date of installation 6-13-85

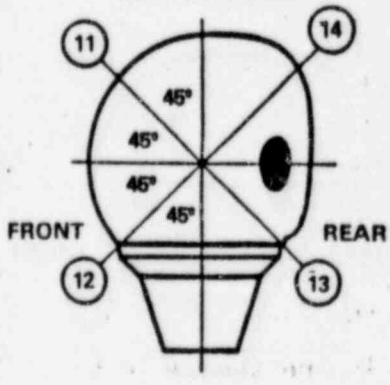
OUTPUT 6570 ☒ RHM for 25×25 fld
☐ RMM

Date of output measurement 6-13-85

View C-Vertical from front



View D-Vertical from right front



Ram Basavatia
6-13-85

L.A.Weiss Memorial Hospital
Chicago, Illinois 60640

Exhibit 3(D)

NRC 12-02418-02

CERTIFICATION OF CALIBRATION–GAMMA SURVEY INSTRUMENTS

Calibration Date: 12-27-84
Facility: St Joseph City/State: Joliet, IL
Instrument Identification
☐ G-M ☑ Ion Chamber ☐ Model # 36100
Manufacturer: Keithley Serial No. 10437
Calibration Source
Radionuclide: _____ Source Strength: _____ mR/hr/mCi @ 1m

RANGE	ACTUAL mR/hr	OBSERVED mR/hr
200	50	51
	150	147
2000 (2 R/hr)	500	455
	1500	1428

RANGE ANALYSIS

200	Within ± 10%	Correction Factor OK
		Correction Factor ok
2000 (2 R/hr)	Within ± 10%	Correction Factor ok
		Correction Factor ok
_____	Within ± 10%	Correction Factor _____
		Correction Factor _____
_____	Within ± 10%	Correction Factor _____
		Correction Factor _____
_____	Within ± 10%	Correction Factor _____
		Correction Factor _____

Battery Change: YES ☐ NO ☑

N/A uCi Cs137 ck. at N/A cm = N/A

Efficiency for N/A = N/A %

Remarks: _____

Next Calibration Date: 12-85 Calibrated by: Mark J. Kapelinski

sahci STAN A. HUBER CONSULTANTS, INC.

235 ESSEX LANE ☐ NEW LENOX, ILLINOIS 60451

(815) 722-8009

NRC License # 12-17503-01

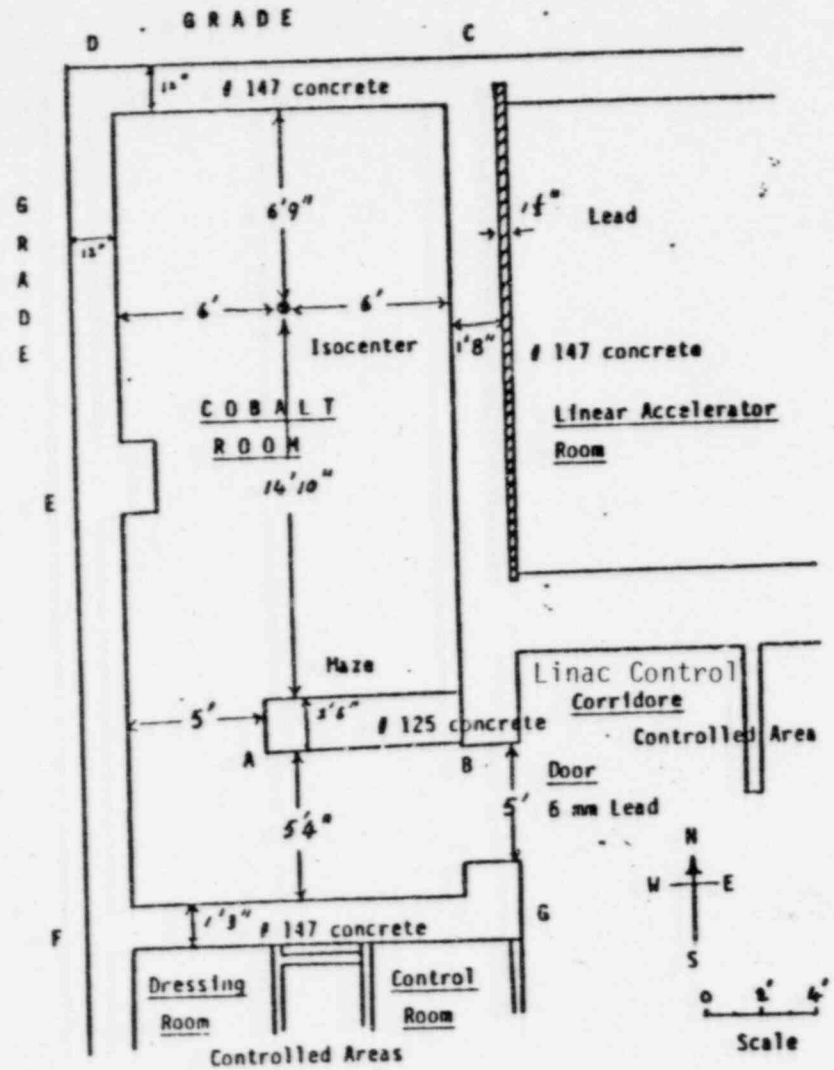


Figure 1 (A) : Partial Lower Level Plan

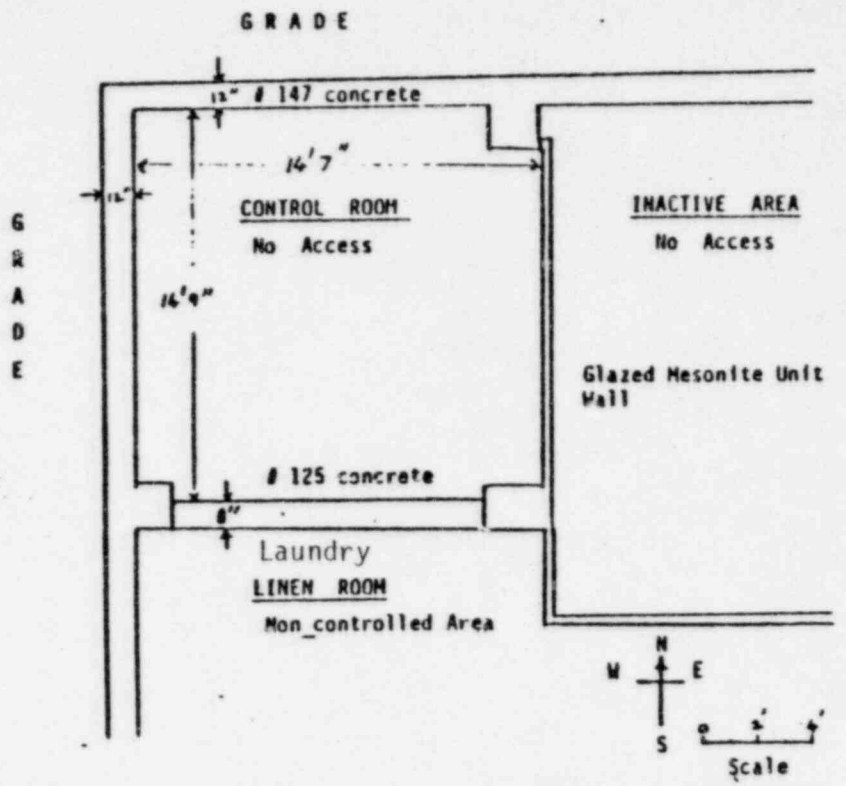


Figure 1 (B) : Partial Ground Floor Plan - Ceiling of Cobalt Room.

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12-02418-02

Exhibit 4(A)

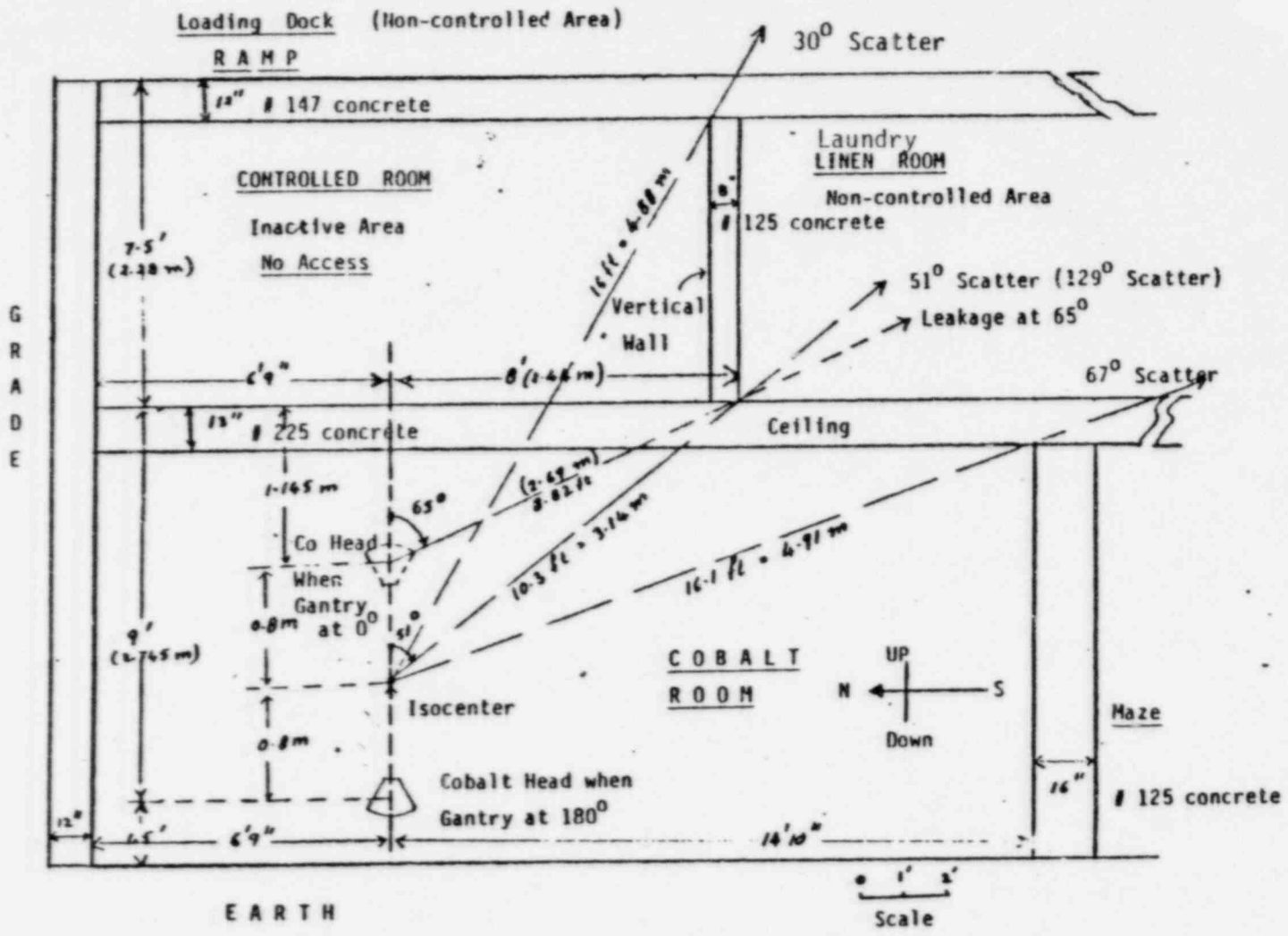

Figure 2 : Vertical Layout

L. A.Weiss Memorial Hospital
Chicago, Illinois 60640
12-02418-02

Exhibit 4(B)

CONTROL NO. 7 9 3 2 1

Exhibit 5

Louis A. Weiss Memorial Hospital
Chicago, Illinois 60640

AREA SURVEY

NRC License # 12-02418-02

The survey was made with Johnson GSM-5 and Keithley 36-100 survey meters while the beam was "ON". A maximum Collimeter opening (35 cm x 35 cm at 80 cm SAD) was used with a tissue equivallent phantom (36 cm x 36 cm x 30 cm) in the field at 80 cm SAD. Maximum meter readings are recorded under all conditions. Note that the head angle is within $\pm 3^{0}$ where not mentioned, and only the floor can be a primary barrier.

BEAM ORIENTATIONS

Gantry Angle ° ----➤		0	45	60(i)	90	135	150	180	180(ii)	210(iii)	240(iii)	270	270(iv)	300(iii)	315(iii)
Head Angle ° ----➤				18° East					4° South						
LOCATION	OCC. TYPE	Maximum Survey Meter Readings (mR/Hr) * Note m ≤ 0.05 mR/Hr													
1) Control Area	C	m	m	m	m	m	m	m	m	m	m	m	m	m	m
2) Dressing Room	C	0.2	0.3	0.1	0.4	0.4	0.4	0.3	0.1	0.3	0.2	0.2	m	0.2	0.1
3) Door and Window	C	0.4	0.4	0.4	0.6	0.6	0.6	0.5	0.3	0.6	0.5	0.6	0.3	0.6	0.5
4) Linac Control Area, So. Corri.	C	m	m	m	m	m	m	m	m	m	m	m	m	m	m
5) East Wall Linear Acclerator Room	C	m	m	0.2	m	m	m	m	m	0.1	0.4	0.6	0.5	0.6	0.5
6) North Wall	Grade	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7) West Wall	Grade	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8) Floor	Ground	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9) Ceiling Laundry Room Ground Floor	NC	m	m	m	m	0.3	0.3	0.4	3.5	0.4	0.2	m	m	m	m
10) Loading Dock	NC	m	m	m	m	0.2	0.6	0.1	1.3	0.2	0.1	m	m	m	m

NOTES :
(i) The beam (directed towards ground) does not intersect the beam stopper. The field edge is closest to the East Wall. The beam hits the ground but not the east wall. Beam orientation similar to one used for irradiating large mantle fields.
(ii) The MOST adverse condition when the beam is directed towards ceiling. This setting has never been used in the last 6 (six) years.
(iii) Small angle scattering towards East Wall.
(iv) No Phantom in the field, the beam hits the beam stopper directly.

June 14, 1985

Arun G. Kaluskar, Ph.D., D.A.B.R.
Radiation Physicist

L.A.Weiss Memorial Hospital, Chicago NRC 12-02418-02 Date : 6/14/85

Output Measurements of Co-60 in Air

Probe Used : Capintec CAPT PR06-G Calibration Factor (N_c) : 5.208 R/nC

Electrometer Assembly : Keithley E 602 (2)

Electrometer Connections : +300 V to ground

Electrometer Calibration Factor (N_a) : 0.992

Temperature (T) : 26 ^{0}C ; Pressure (P) : 745 mm Hg

Timer Correction $\Delta t = (Q_2 t_1 - Q_1 t_2)/(n Q_1 - Q_2)$ .....(I)

Where t_1 = time of single exposure ; t_2 = Total time of n exposures

and Q_1 and Q_2 are respective Electrometer Readings

Absorbed Dose Rate in Medium (m) : D_m (note this is in a miniphantom)

$D_m = [Q/(t + \Delta t)] . N_c . N_a . (760/P) . [(273+T)/295] . A_{ea} . f_m$ ..... (II)

Note A_{ea} = 0.985 ; f_w = 0.966 (water) and f_T = 0.957 (tissue)

Distance from source to center of probe (SAD) : 80.5 cm

Build up Cap : Yes / ~~No~~ ; Δt-Timer Correction : 0.005 Min.

Field Size cm	Time t Min	Electrometer Readings Q, (10^{-8}C) :	Ave. Q (10^{-8}C)	Exposure R/Min	D_w Rads/Min	Remarks
4*10	1.0	2.935, 2.934, 2.937	2.936	158.06	148.49	
	2*0.5	2.947, 2.952, 2.956, 2.947	2.951			
5*5	1.0	2.828, 2.828	2.828	150.32	143.03	
20*20	1.0	3.118, 3.118	3.118	165.73	157.69	

Ram Basavatia

Ram Basavatia, M.S., D.A.B.R.
Radiation Physicist

Arun G. Kaluskar

Arun G. Kaluskar, Ph.D., D.A.B.R.
Radiation Physicist

L.A.Weiss Memorial Hospital
Chicago, IL 60640

Exhibit 6(B)

NRC # 12-02418-02

Report No. : ION142

ACCREDITED DOSIMETRY CALIBRATION LABORATORY

DEPARTMENT OF MEDICAL PHYSICS

UNIVERSITY OF WISCONSIN, MADISON

1530 Medical Sciences Center
1300 University Avenue
Madison, WI 53706
(608) 262-0378

REPORT OF CALIBRATION

FOR

IONIZATION CHAMBER

Submitted by:

Arun Kaluskar, Ph.D.
Weiss Memorial Hospital
4646 N. Marine Drive
Chicago, IL 60640

Ion Chamber:

Capintec Model PR-06G
S.N. CIIG.64044

Received by Madison ADCL on : 09/MAY/85

Calibration completed on : 10/MAY/85

Form Revised: 1/MAY/85

CONTROL NO. 7 9 3 2 1

Proper function and reliability of the radiation measuring devices described in this document are highly dependent upon handling and use. Therefore, the duration of responsibility of the University of Wisconsin, Department of Medical Physics, and its employees for the calibration results extends only to the time the instruments leave the premises of the University of Wisconsin. It is recommended that the instrument user establish an appropriate technique of monitoring the constancy of the instrument response before and after its submission to the Accredited Dosimetry Calibration Laboratory and on a regular basis thereafter. In addition, it is the express responsibility of the instrument user to assure (by personal communication if necessary), that interpretation of the information in this document is consistent with the interpretation intended by the Accredited Dosimetry Calibration Laboratory.

The Calibration Factor for an ionization chamber reported by this laboratory is the quotient of the X-ray or gamma-ray exposure in roentgens, to the ionization-chamber charge in coulomb, generated by the radiation. For integral dosemeters which read directly in units of exposure, a Correction Factor is reported, which is a dimensionless number by which the instrument reading is to be multiplied to obtain the actual exposure under the specified conditions.

If the chamber was open to the atmosphere the currents were normalized to one standard atmosphere (760 mm Hg) and 22°C. Use of the chamber at other pressures and temperatures requires correction of the ion currents to the standard conditions. The correction factor F is computed from the following expression :

$$F = \frac{(273.15 + T)}{295.15} \times \frac{760}{P}$$

where T is the temperature in °C, and P is the pressure expressed in mm Hg, Torr or Pascal/133.289.

The exposure at the calibration position was measured by a cavity ionization chamber and an electrometer, both with calibrations directly traceable to NBS primary standards.

During calibration the ionization chamber was centered in the beam with the stem perpendicular to the beam direction, except for end-window chambers, which are calibrated with the window normal to the beam direction. The source-chamber distance given in the Measurement Data sheet is the distance from the source to the geometrical center of the active volume of the chamber. The source-collimator distance is the distance from the source to the extreme end of the collimator. Stem effect was not investigated.

The calibration field size is given by the distance across the field from one 50-percent intensity line to the other (in air) measured at the calibration distance. The calibration factor applies only to the field size stated.

The accuracy of the exposure measurement for reference-class instruments is believed to be within ± 0.5 percent of the NBS calibration for Cobalt-60 or Cesium-137 calibrations and ± 1.0 percent for X-ray calibrations, and the ion current measurement is believed to be accurate to within 0.2%.

Information on technical aspects of this report may be obtained by calling Steven J. Goetsch at (608) 262-6320.

Steven J. Goetsch, Ph.D.
Chief Physicist

Larry A. DeWerd, Ph.D.
Director

L.A.Weiss Mem Hosp
Chicago IL 60640

NRC # 12-02418-02

Report No. : ION142

ACCREDITED DOSIMETRY CALIBRATION LABORATORY
DEPARTMENT OF MEDICAL PHYSICS
UNIVERSITY OF WISCONSIN, MADISON

MEASUREMENT DATA

CALIBRATION DATE: May 9, 1985 REPORT DATE: May 10, 1985

IONIZATION CHAMBER:

Manufacturer	:	Capintec
Model	:	PR-06G
Nominal volume	:	0.6 cc
Serial number	:	CIIG.64044
Build up cap	:	Plastic

IRRADIATION CONDITIONS:

Field size	: 10 x 10 cm	Source-chamber dist.:	95 cm
Pre-irrad. leakage	: $+2.7 * 10^{-14}$ amp	Source-collim. dist.:	61 cm
Orientation	: Vent hole toward beam		
Polarizing voltage	: -300 V (Collecting electrode negative)		
Charge collected	: Positive		

BEAM QUALITY	EXPOSURE RATE (R/min)	TOTAL EXPOSURE (R)	CALIBRATION* FACTOR
Co-60	24.75	55.69	$5.20_8 * 10^9$ R/C

* At 22°C, 760 mm Hg.

NOTES: The chamber was determined to be open to atmospheric communication. Ratio of charge collected at full (-300) voltage to that collected at half (-150) voltage was 1.001, which corresponds to an A_{ion} of 1.000.

Recorded in data book: UW ADCL 9 Pages: 82-83

S. J. Goetsch
Calibrated by S.J. Goetsch, Ph.D.
Chief Physicist

L A DeWerd
Reviewed by L.A. DeWerd, Ph.D.
Director

CONTROL NO. 7 9321

L.A.Weiss Memorial Hospital
Chicago, Illinois 60640

Exhibit 6(C)

NRC # 12-02418-02

REPORT No. : EM101

ACCREDITED DOSIMETRY CALIBRATION LABORATORY

DEPARTMENT OF MEDICAL PHYSICS

UNIVERSITY OF WISCONSIN, MADISON

1530 Medical Sciences Center
1300 University Avenue
Madison, WI 53706
(608) 262-0378

REPORT OF CALIBRATION

FOR

ELECTROMETER

Submitted by:

Arun Kaluskar, Ph.D.
Weiss Memorial Hospital
4646 N. Marine Drive
Chicago, IL 60640

Electrometer:		Multimeter:	
Manufacturer	: Keithley	Manufacturer	: Data Precision
Model	: 602	Model	: 248
Serial number	: 37989A	Serial number	: 7969

Received by ADCL, Madison on : 09/MAY/85

Calibration completed on : 09/MAY/85

Form Revised: 10/19/83

Proper function and reliability of the radiation measuring devices described in this document are highly dependent upon handling and use. Therefore, the duration of responsibility of the University of Wisconsin, Department of Medical Physics, and its employees for the calibration results extends only to the time the instruments leave the University of Wisconsin premises. It is recommended that the instrument user establish an appropriate technique of monitoring the constancy of the instrument response before and after its submission to the Accredited Dosimetry Calibration Laboratory and on a regular basis thereafter. In addition, it is the express responsibility of the instrument user to assure (by personal communication if necessary), that interpretation of the information in this document is consistent with the interpretation intended by the Accredited Dosimetry Calibration Laboratory..

Calibration of electrometers is performed using a set of calibrated capacitors and a calibrated potentiometer. A precisely known voltage is introduced onto one side of the capacitor and the electrometer to be calibrated is connected to the other side. The charge introduced onto the capacitor is given by the product of the voltage and capacitance. The electrometer reads this charge and a correction factor is computed from the ratio of that charge to the charge indicated on the electrometer.

The calibration factors given in this report are given in coulomb/reading, or if the electrometer has an external output, the calibration factor can be given in coulomb/volt = farad. Note that if a digital multi-meter is supplied as a readout device with the electrometer to be calibrated, the electrometer and DMM will be calibrated as a system. The accuracy of the calibration is believed to be within +/- 0.5 percent.

Information on technical aspects of this report may be obtained by calling (608) 262-6320, and by asking for Steven Goetsch.

Steven J. Goetsch, Ph.D. Larry A. DeWerd, Ph.D.
Chief Physicist Director

REPORT No.: EM101 Page-3

ACCREDITED DOSIMETRY CALIBRATION LABORATORY

DEPARTMENT OF MEDICAL PHYSICS

UNIVERSITY OF WISCONSIN, MADISON

REPORT OF ELECTROMETER CALIBRATION

CALIBRATION DATE: May 9, 1985 REPORT DATE: May 10, 1985

ELECTROMETER:

Manufacturer	Keithley
Model	602
Serial Number	37989A

MULTIMETER:

Manufacturer	Data Precision
Model	248
Serial Number	7969

CALIBRATION INSTRUMENTS: Leeds and Northrup Potentiometer
Standard Polystyrene Capacitor
Data Precision Multimeter (15569)

SCALES, SWITCH POSITIONS, AND CONDITIONS:

ELECTROMETER:

Ranges	10^{-8}, 10^{-9}C
Multiplier	10
Feedback	Fast
Sensitivity	Auto
Output	1 Volt

MULTIMETER:

Function	DC Volts
Range	Auto
High Input	x1 Output
Common	Ohms Guard

CHARGE CALIBRATION FACTOR:

SCALE	Leakage	Zero Drift	COULOMB/rdg
10^{-8}C	$8.3 * 10^{-14}$ A	$0.3 * 10^{-14}$ A	0.99_2
10^{-9}C	$0.3 * 10^{-14}$ A	$0.3 * 10^{-14}$ A	0.99_6

NOTES: Coulomb/rdg is a dimensionless multiplicative correction factor. The electrometer and digital multimeter were calibrated as a system. Overall linearity from 1.0 to 15.0 times indicated scale was within 0.05%.

DATA BOOK: UW ADCL 5 PAGE(s): 130-131

S. J. Goetsch
Calibrated by S.J. Goetsch, Ph.D.
Chief Physicist

L A DeWerd
Reviewed by L.A. DeWerd, Ph.D
Director

L.A.Weiss Memorial Hospital
Chicago, Illinois 60640

NRC # 12-02418-02

CONTROL NO. 79321

L.A.Weiss Memorial Hospital
Chicago, Illinois 60640

Exhibit 6(D)

NRC # 12-02418-02

Date : 6/14/85

Output Measurements of Co-60 in Air

Probe Used : Capintec PR06C Calibration Factor (N_c) : 4.972 R/nC

Electrometer Assembly : capintec 192 - factor = 0.996 nC/Rdg

Electrometer Connections :

Electrometer Calibration Factor (N_a) :

Temperature (T) : 26 °C ; Pressure (P) : 745 mm Hg

Timer Correction $\Delta t = (Q_2 t_1 - Q_1 t_2)/(n Q_1 - Q_2)$ ..... (I)

Where t_1 = time of single exposure ; t_2 = Total time of n exposures

and Q_1 and Q_2 are respective Electrometer Readings

Absorbed Dose Rate in Medium (m) : D_m (note this is in a miniphantom)

$D_m = [Q/(t + \Delta t)] \cdot N_c \cdot N_a \cdot (760/P) \cdot [(273+T)/295] \cdot A_{en} \cdot f_m$ ..... (II)

Note $A_{en} = 0.985$; $f_w = 0.966$ (water) and $f_T = 0.957$ (tissue)

Distance from source to center of probe (SAD) : 80.5 cm

Build up Cap : Yes / No ; Δt-Timer Correction : 0.003 Min.

Field Size cm	Time t Min	Electrometer Readings Q, (nC)	Ave. Q (nC)	Exposure R/Min	D_w Rads/Min	Remarks Build up Factor
10x10	0.50	15.42, 15.37, 15.41, 15.38, 15.37	15.39	156.7	149.1	1.000
	2+0.25	15.48, 15.43, 15.62, 15.46, 15.38	15.48			
4x4	0.5	14.50, 14.47, 14.51	14.49	~~14.49~~	140.4	0.942
6x6	0.5	14.96, 14.98, 14.96	14.97	~~14.97~~	145.0	0.973
8x8	0.5	15.20, 15.20, 15.18	15.19		147.2	0.987
12x12	0.5	15.65, 15.60, 15.64	15.63		~~14~~ 151.4	1.016
15x15	0.5	16.00, 15.97, 15.96	15.98		154.8	1.038
20x20	0.5	16.36, 16.35, 16.34	16.35		158.4	1.062
25x25	0.5	16.65, 16.66, 16.65	16.65		161.3	1.082
30x30	0.5	16.85, 16.85, 16.85	16.85		163.2	1.095
35x35	0.5	16.93, 16.91, 16.95	16.93		164.0	1.100

Ram Bavaveta

6-14-85

EXHIBIT 6(E)

The University of Texas System Cancer Center
M. D. Anderson Hospital and Tumor Institute
Texas Medical Center • 6723 Bertner Avenue • Houston, Texas 77030
Department of Physics

Instrument submitted by:

Ram Basavatia, Physicist
St. Joseph Hospital - Radiotherapy
333 N. Madison St.
Joliet, IL 60435

ACCREDITED DOSIMETRY CALIBRATION LABORATORY

Report of Calibration

Date instrument received for calibration: April 4, 1983

Date instrument calibration completed: April 28, 1983

Date calibration report completed: June 3, 1983

Description of instrument:

Capintec Exposure/Exposure Rate Meter Model 192, Serial # 77C486
Capintec Chamber Model PR-06C (0.6 ml, AE plastic), Serial # CII.61t58
Polystyrene Buildup Cap, # 1658

NOTE: Proper function and reliability of the radiation measuring devices described in this document are highly dependent upon handling and use. Therefore, the duration of responsibility of The University of Texas System Cancer Center, M. D. Anderson Hospital and Tumor Institute, and its employees for the calibration results extends only to the time the instruments leave the M. D. Anderson Hospital premises. It is recommended that the instrument user establish an appropriate technique of monitoring the constancy of the instrument response before and after its submission to the Accredited Dosimetry Calibration Laboratory and on a regular basis thereafter. In addition, it is the express responsibility of the instrument user to assure himself (by personal communication, if necessary) that his interpretation of the information in this document is consistent with the interpretation intended by the Accredited Dosimetry Calibration Laboratory.

NOTE: Polarizing voltage low (170 V); battery should be replaced.

L.A.Weiss Mem Hosp
Chicago, IL 60640

NRC # 12-02418-02

ACCREDITED DOSIMETRY CALIBRATION LABORATORY
M. D. ANDERSON HOSPITAL AND TUMOR INSTITUTE

BRATION FACTORS:

R/rdg: Roentgen/reading calibration factors apply to the chamber-electrometer-readout system as a unit, with scales, switch settings and output mode specified. To obtain the exposure in roentgens at the geometrical center of the ion chamber volume*, in the absence of the chamber, the calibration factor is applied directly to the instrument reading corrected for temperature and pressure.

R/C: Roentgen/coulomb calibration factors apply to the ion chamber alone. To obtain the exposure in roentgens at the geometrical center of the ion chamber volume*, in the absence of the chamber, an appropriately calibrated (coulomb/reading) electrometer must be used.

TEMPERATURE-PRESSURE CORRECTION FACTOR:

For chambers open to the atmosphere, the instrument readings were normalized to 760 millimeters of mercury and 22 degrees Celsius. Use of the chamber at other pressures and temperatures requires correction by the following multiplicative factor:

$$\frac{T + 273.15}{295.15} \times \frac{760}{P}$$

where T is the temperature in degrees Celsius, and P is the chamber pressure in millimeters of mercury.

No corrections were made for air humidity.

CALIBRATION CONDITIONS:

Calibration field size is given by the dimension across the field from one 50-percent intensity line to the other (in air) measured at the calibration distance. Stem effect was not investigated; the calibration factor applies only to the field size stated.

During calibration the chamber was centered in the beam with the stem perpendicular to the beam direction, except for end-window chambers which are calibrated with the stem parallel to the beam direction.

The sign of the polarizing voltage indicates the thimble potential relative to the collecting electrode, although the thimble may actually be grounded.

The exposure rate at the calibration position was measured with a transfer-quality ionization chamber which was calibrated at the National Bureau of Standards.

The overall accuracy of the calibration factors assigned by the Accredited Dosimetry Calibration Laboratory is believed to be within 2.5%, which includes the uncertainty inherent in the determination of the roentgen.

BEAM QUALITY:

Medium energy x-ray beam quality is described in terms of the first half-value thickness in millimeters of aluminum or copper, the ratio of the first to the second half-value thickness, and the peak filtration.

The half-value thicknesses were determined with a 2 cm diameter aperture and high purity aluminum or copper absorbers. The aperture and ion chamber were positioned at 50 cm and 100 cm, respectively, from the tube.

*The center of end-window chambers is normally designated by a circular groove.

L.A.Weiss Mem Hosp
Chcigo, IL 60640

NRC # 12-02418-02
Page 3 of 4
Report # 156

ACCREDITED DOSIMETRY CALIBRATION LABORATORY
M. D. ANDERSON HOSPITAL AND TUMOR INSTITUTE

Report of Calibration

INSTRUMENT:

Capintec Chamber Model PR-CCC (0.6 m^3, AE plastic), Serial # CII.[illegible]658
Polystyrene Buildup Cap, # [illegible] (0.5 g/cm^2 wall thickness)

SCALES, SWITCH POSITIONS, AND CONDITIONS:

Chamber Only

Field Size: 10 x 10 cm^2

Preirrad. Leakage: -1×10^{-14} A

Orientation: Air hole toward beam

Nominal Full Scale: N/A

Polarizing Voltage: -300 V
(on thimble)

BEAM QUALITY HVT(mm)	Isc/Ion	kVp	EXPOSURE RATE (R/min)	CALIBRATION* FACTOR (R/C)	% FULL SCALE or (Total Exposure)
2.02 Al	0.65	75	35	$4.74_0 \times 10^9$	N/A
3.17 Al	0.56	125	76	$4.72_5 \times 10^9$	N/A
1.86 Cu	0.64	250	62	$4.97_7 \times 10^9$	N/A
Cobalt-60			32	$4.97_9 \times 10^9$	N/A

*At 22°C, 760 mmHg: The chamber was determined to be open to atmospheric communication.

DATA BOOK 17/10 :PAGE(s) 207/08

Robert J. Shalek

L.A.Weiss Memorial Hospital
Chicago, Illinois 60640

NRC # 12-02418-02

ACCREDITED DOSIMETRY CALIBRATION LABORATORY
M. D. ANDERSON HOSPITAL AND TUMOR INSTITUTE

Report of Calibration

INSTRUMENT:

Capintec Exposure/Exposure Rate Meter Model 192, Serial # 770486

SCALES, SWITCH POSITIONS, AND CONDITIONS:

Electrometer Switch: Position

PROBE SELECTOR: ELECTROMETER
COMPENSATION FACTOR: 1.00
METER RANGE: NORMAL or EXTENDED } (10.99 or 199.9 full
EXPOSURE LEVEL: MEDIUM } scale, respectively)
MODE: TOTAL

NOTE: ZERO ADJUST and BACKGROUND were adjusted in accordance with the Capintec 192 Operation Manual. However, any zero offset or zero drift should be taken into account, if significant to the reading being taken.

CHARGE CALIBRATION FACTOR:

0.996×10^{-9} C/unit of reading

NOTE: The charge sensitivity was constant to within ± 0.1% over the range of readings from 02.01 to 199.5.

EXAMPLE: Assume that the chamber described on page 3 is being used with the electrometer and switch settings described above with EXTENDED, that the temperature-pressure correction is 1.000, and that the reading is 100.0 (i.e. 50% full scale); then the exposure for Cobalt-60 radiation would be 100.0 x 0.996 x 10(-9) x 4.972 x 10(+9) = 495 R. Nominal full scale is 990 R.

DATA BOOK 15 ;PAGE 279

Robert J. Shalek

L.A.Weiss Memorial Hospital
Chicago, Illinois 60640 Exhibit 7 NRC License # 12-02418-02

Cobalt 60 Teletherapy Unit

EMERGENCY OPERATION

If it is necessary to halt treatment before the preset time has elapsed or if the beam does not turn "off" after the normal exposure cycle has been completed:

Press the "EMERGENCY" Bar on the Control Unit.

Should the beam still remain "on":

1. **Quickly remove the patient from the treatment room.**

Warning

Avoid direct exposure to the beam; do not remain in the treatment room longer than absolutely necessary while the beam is "on."

2. After leaving the treatment room, lock the door or post a guard to prevent unauthorized entry.
3. Call Dr. Yashbir Mehta, M.D. or the Radiation Safety Officer. X-2325

If the patient cannot be removed, **close the Shutter manually by turning the Emergency Shutter Handwheel on the front of the Head in the clockwise direction indicated by the arrows.**

Caution

Because the treatment table may be quickly and easily moved, the operator, rather than first taking the patient from the room, may attempt to close the Shutter manually with the handwheel (also easily turned when power fails) while simultaneously removing him from direct exposure to the beam. The operator is therefore cautioned that **concern for the patient's safety must always remain the paramount consideration.**

If the Shutter still does not close (the red marker on the handwheel is "up" when it is closed):

1. **Move the machine so that the beam does not fall directly on the patient.**
2. Leave the room, close the door, and post a guard to prevent unauthorized entry.

ATC -1-800-321-5803 - Service Department

3. Notify Dr Yashbir Mehta, M.D. and Picker X-Ray Service.- 364-0700
   Department Head Home Phone 530-0321
   Radiation Safety Officer, Arun Kaluskar, Ph.D. 363-3087

CONTROL NO. 79321

Medical Technology, Inc.
Betatron Corporation
Advanced Medical Systems, Inc.
One Factory Row • Geneva, Ohio 44041
(216) 951-0247 TWX 810-427-2183

Exhibit 8(A)

June 11, 1985

Louis A. Weiss Memorial Hospital
4646 North Marine Drive
Chicago, IL 60640

NRC License # 12-02418-02

Attention Dr. Kaluskar

ATC Medical Group has received the Picker C-9 teletherapy unit in on trade from Louis A. Weiss Memorial Hospital, 4646 North Marine Drive, Chicago, Illinois. The C-9 unit, stretcher and VPI 2526 ~~RHM~~ curie source was received by ATC Medical Group and removed from the premises of Louis Weiss Hospital on 6/14/85 DATE.

Signed upon receipt by both parties:

SIGNATURE

James Fisher

ATC MEDICAL GROUP

6/14/85

DATE

SIGNATURE

O J Kaluskar

LOUIS WEISS HOSPITAL

6/14/85

DATE

ATC medical group
Advanced Medical Systems, Inc.
1020 London Road
Cleveland, OH 44110
(216) 692-3268

Exhibit 8(B)

Louis A. Weiss Memorial Hospital
4646 North Marine Drive
Chicago, IL. 60640

NRC License # 12-02418-02

Radiation Therapy Department (Cobalt)

Received from the above-named facility as of NPI 20 5800w Model # one 60-Cobalt teletherapy source, Model Number ___, Serial Number T-275.

Advanced Medical Systems, Inc., is authorized to receive the above-mentioned source under N.R.C. License number 34-19089-01.

Signed: James Cook
for. Advanced Medical Systems, Inc.

Dated: 6/14/85

CONTROL NO. 7 9321