

MS-16
T1

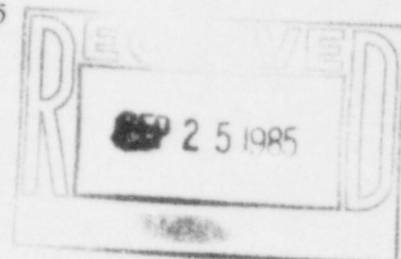
B. AHLUWALIA, PH.D.
RADIOLOGICAL PHYSICIST

Certified By:
American Board of Radiology
American Board of Science of Nuclear Medicine
Radiation Physics Services
Diagnostic Radiology, Nuclear Medicine
Radiation Therapy, Safety, Computer Applications

DEPARTMENT OF RADIOLOGICAL SCIENCES
UNIVERSITY OF OKLAHOMA, HEALTH SCIENCES CENTER
P.O. BOX 26901
OKLAHOMA CITY, OKLAHOMA 73190
Tele# (405) 271-6121

September 20, 1985

Material Licensing Branch
Division of Fuel Cycle and Material Safety
U. S. Nuclear Regulatory Commission
611 Ryan Plaza Drive, Suite 1000
Arlington, Texas 76011



Dear Sir:

With reference to your letter dated August 22, 1985 and Control No. 460681, related to the Co-60 teletherapy source change under NRC License No. 35-14046-01 at the St. Joseph Medical Center of Northern Oklahoma, Inc., I have been the radiological physicist involved with the acceptance of the new source and I have been responsible for the calibration and other related NRC required survey.

The information requested in the letter mentioned above is categorically provided below.

1. Dosimetry System;

My equipment is often used by another physicist, and likewise I use their equipment. The dosimeter system belonging to "Oklahoma Radiation Corporation" was used.

A. Manufacturer's Name and Model No.:

Keithley Electrometer, Model 35614, Sr. #17936
Probe; Nuclear Enterprise Ltd.; Model 2571, Sr. #630.

B. Date of Last Calibration:

April 25, 1984 calibrated by K and S Associated, Inc.

C. Calibration Standards:

Cobalt-60
Cesium-137
X-rays of different energies.

D. Calibration Certificate:

Full calibration report is attached. Pertinent parts of this were filed with the letter dated June 17, 1985.

2. Teletherapy Unit Description:

Manufacturer's Name: Picker
Cat. No. 6296 - D/C9M/80
Head, 590-E, Sr. #206.

8510230014 850930
REG4 LIC30
35-14046-01 PDR

460681

3. Phantom Description:

Size: 33 x 33 x 33 cm

Composition: Water.

4. Teletherapy Facility Surroundings:

All areas have been marked. The teletherapy facility is located in the northeast corner.

	<u>Area Description</u>
North Wall	Outside
East Wall	Outside
Part of South Wall	Outside
Part of South Wall	Control Booth
West Wall	Stairwell.

Please let me know if any other information is required.

Thank you.

Sincerely yours,

B. Wally Ahluwalia, Ph.D.

B. Wally Ahluwalia, Ph.D.
Radiological Physicist
Diplomate ABR and ABSNM

BA/db

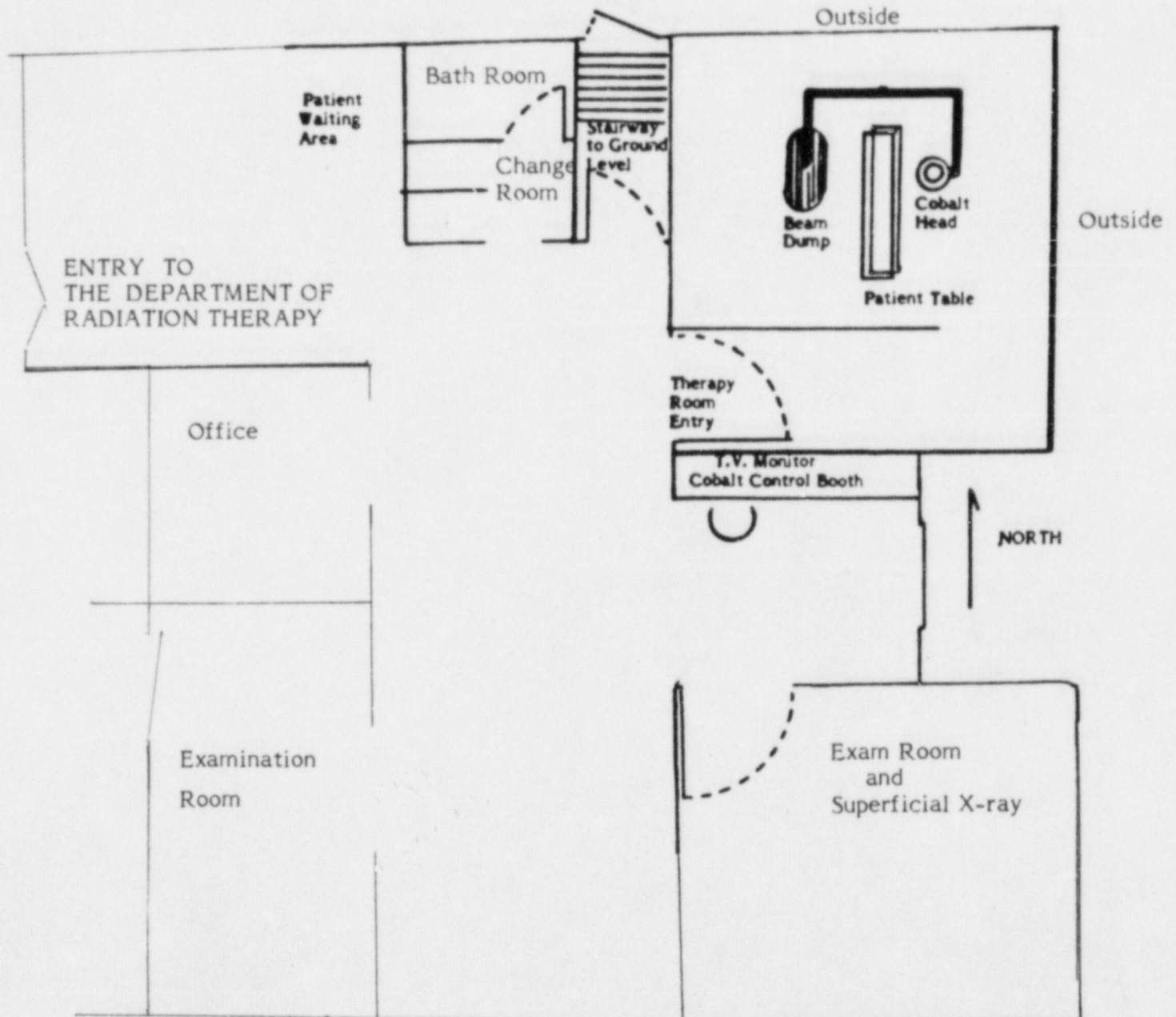
Attachment

xc: George C. Guntly
President
St. Joseph Regional Medical Center

Dr. Ellis Oster, M.D.
Ms. Connie Johnson

St. Joseph Medical Center
14th and Hartford
Ponca City, Oklahoma 74602

PLAN OF RADIATION THERAPY AREA
(Not to scale)



35614 CALIBRATION 18571			
DATE 4-20-84		BY LEP R11	
FUNCTION	CORRECTION FACTOR		CORRECTION FACTOR
10 ⁻⁸ C	1.002C/RDG		
K & S ASSOCIATES, INC. ACCREDITED DCSIMETRY CALIBRATION LABORATORY			
READY TAPE R-500+ BLUE STRIP® BT			

PRELIMINARY CALIBRATION REPORT

Submitted by St. Anthony Hospital
Oklahoma City, Oklahoma

INSTRUMENTS

Keithley 35614, # 18571
NEL 2571, # 630

TEST NO. 84062

DATE 4-25-84

This report is provided as a convenience to the user for the purpose of transmitting preliminary results only. Further review and possible modification of the stated factors may occur prior to the issuance of the formal report. The formal report should be reviewed carefully upon receipt for any such modification of the values stated in this report.

CALIBRATION 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 reference point*, in the absence of the chamber, the calibration factor is applied directly to the instrument reading corrected for temperature and pressure:

$$\text{Exposure} = \text{RDG} \times \text{R/RDG} \times \text{TPC}$$

where TPC = temperature-pressure correction

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

$$\text{Exposure} = \text{RDG} \times \text{R/C} \times \text{C/RDG} \times \text{TPC}$$

where C/RDG = calibration factor of electrometer
TPC = temperature-pressure correction

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:

Unless otherwise indicated, the calibration field size is 10 cm x 10 cm for Co-60 and 10 cm diameter circle for x-rays. 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 exposure reference point is at the geometrical center of the chamber volume, except when stated otherwise in the calibration report.

The exposure rate at the calibration position was measured with a transfer-quality ionization chamber which has a calibration that is directly traceable to the National Bureau of Standards.

BEAM QUALITY:

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 (homogeneity coefficient-H.C.) and the kilovoltage are also given.

The half-value thicknesses were determined under "good geometry" narrow beam conditions with high purity certified aluminum or copper attenuators. The focus-attenuator distance was approximately 50 cm, and the focus-chamber distance was approximately 100 cm.

ATMOSPHERIC COMMUNICATION:

All chambers are tested for communication to the atmosphere prior to calibration.

CALIBRATION ACCURACY CLASSIFICATION:

The accuracy of the calibration factors stated in this report are described in terms of classifications and represent the maximum deviation from the national dosimetry standard.

The classifications assigned by the ADCL are based on the precision of the laboratory and on the precision, accuracy, and reproducibility of the instrument or system submitted for calibration.

	Cobalt-60	Cesium-137	X-rays
CLASS I	+/- 0.5 %	+/- 0.5 %	+/- 1.0 %
CLASS II	+/- 0.5 %	+/- 0.5 %	+/- 2.0 %
CLASS III	+/- 1.0 %	+/- 1.0 %	+/- 2.0 %
CLASS III A	+/- 2.0 %	+/- 2.0 %	+/- 2.0 %
CLASS IV	-	+/- 5.0 %	+/- 5.0 %
CLASS V	-	+/- 10.0 %	+/- 10.0 %

ION COLLECTION EFFICIENCY:

The ion collection efficiency (A_{ion})¹ stated in this report is based on measurements of the currents (or charges) produced in a Cobalt-60 beam with the stated exposure rate and polarizing potential and has been calculated using the two-voltage method of Boag² and Greening³ for continuous radiation.

$$A_{ion} = \frac{((V_1/V_2)^2 - \text{Ratio})}{((V_1/V_2)^2 - 1)}$$

where V_1 = full polarizing potential

V_2 = reduced polarizing potential

Ratio = the current (or charge) at V_1
divided by the current
(or charge) at V_2

REFERENCES

1. Task Group 21, Radiation Therapy Committee, American Association of Physicists in Medicine, "A protocol for the determination of absorbed dose from high-energy photon and electron beams," Med. Phys., Vol. 10, p. 742 (1983).
2. Boag, J. W., Radiation Dosimetry, 2nd ed., edited by F. Attix and W. Roesch (Academic, New York, 1966), Vol. II.
3. Greening, J. R., Phys. Med. Biol., Vol. 9, p. 143 (1964).

IONIZATION CHAMBER CALIBRATION

4-20-84

CHAMBER:

Mfgr: NEL
Model No. 2571 (0.6 ml, graphite)
Serial No. 630

SUBMITTED BY:

St. Anthony Hospital
Oklahoma City, Oklahoma

ORIENTATION/CONDITIONS: black line toward source

ION COLLECTION EFFICIENCY (A_{ion}): 0.999

POLARIZING POTENTIAL: -354V CHAMBER LEAKAGE: $-1.1 \times 10^{-14}A$

Beam Quality		kVp	Exposure Rate (R/min)	SCD (cm)	CALIBRATION FACTOR	Class
HVT (mm)	H.C.					

*Co-60	-	-	57.6	74	$4.760 \times 10^9 R/c$	II
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COMMENTS: *With Delrin buildup cap (#630)

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ELECTROMETER CALIBRATION

CALIBRATION FACTORS:

C/RDG: This factor is given in coulomb/unit of reading of the electrometer on the indicated switch settings and scales. To obtain the corrected charge in coulomb, the calibration factor is applied directly to the instrument reading of the appropriate scale:

$$\text{Coulomb} = \text{TRUE RDG} \times \text{C/RDG}$$

POLARIZING POTENTIAL:

Polarizing potential was measured using a calibrated digital voltmeter and is reported as the potential of the thimble with respect to the circuit low or guard.

ELECTROMETER LEAKAGE:

Electrometer leakage is indicated in ampere for the indicated setting, and is the net charge in coulomb divided by the time interval in seconds.

LINEARITY:

Linearity is specified as a percentage of the full scale. If the electrometer is nonlinear on a portion of the scale, a linearity correction factor is given. To correct for nonlinearity, the linearity correction factor is applied to the reading as follows:

$$\text{TRUE RDG} = \text{RDG} \times \text{Linearity Correction Factor}$$

ELECTROMETER CALIBRATION REPORT

4-20-84
DATE

INSTRUMENT:

Mfgr: Keithley
Model No. 35614
Serial No. 18571

SUBMITTED BY:

St. Anthony Hosp
Oklahoma City, Oklahoma

SCALES, SWITCH POSITIONS, CONDITIONS:

ON; FUNCTION: $10^{-8}C$; RANGE: .2, 2, 20; UNITS: NA;
CURRENT SUPPRESS: OFF; BIAS: +, 100 PERCENT

POLARIZING POTENTIAL: - 364.5V

LEAKAGE: $+6.0 \times 10^{-15}A$

LINEARITY: within $\pm 0.1\%$ of full scale or the precision of the reading, whichever is greater

CHARGE CALIBRATION FACTOR:

<u>FUNCTION</u>	<u>FACTOR (C/unit of reading)</u>
<u>$10^{-8}C$</u>	<u>1.002 C/RDG</u>

COMMENTS: _____

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