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X-RAY DIAGNOSIS
X-RAY THERAPY
RADIUM THERAPY
RADIOACTIVE ISOTOPES
COBALT THERAPY
SPECIAL PROCEDURES

F. R. CZESWIK
BUSINESS MANAGER

August 29, 1978

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40-01493-02

FCRL:FCD
(91690)

Mr. Joseph Del Medico
U. S. Nuclear Regulatory Commission
Isotope Division
Washington, D.C. 20555

Dear Mr. Del Medico:

I am enclosing Doctor Vaugn Moore's method of calibrating survey meters as requested.

In our phone conversation, you indicated we would not need to do the Technetium and Linearity check on the dose calibrator since we will not be using Technetium.

We have made arrangements with Doctor Moore to check our survey meters.

Sincerely yours,

Donald H. Breit

Donald H. Breit, M.D.

DHB/am

Method for Calibration of Survey Meters

Calibration of survey meters is performed with a 10.0 mg radium needle (Radium Chemical Model No. A226RA51) with 0.5 mm platinum wall. The active length of the needle is 1.0 cm. At any distance greater than 3.0 cm at right angles to the needle, the source behaves as a point source (within 1%). Such a source provides an exposure rate of 825 mR/hr at 10 cm. Inverse square law is valid at distances several times the dimensions of the detector volume. Distances have been calculated to provide known fixed values of exposure rate. These are indicated in the table.

Exposure Rate(mR/hr)	Distance (cm)	Exposure Rate(mR/hr)	Distance (cm)	Exposure Rate(mR/hr)	Distance (cm)
1000	9.1	80	32.1	4	143.6
800	10.2	40	45.4	2	203.1
400	14.4	20	64.2	1.5	234.5
200	20.3	15	74.2	1.0	287.2
150	23.5	10	90.8	.4	454.2
100	28.7	8	101.6		

Calibration at the higher exposure rates (up to 1000 mR/hr) requires placing the center of the chamber up to 9 cm from the source. Although the source behaves as a point source, the detector may not perform as a point detector, since the exposure rate is not constant over the volume of the chamber. This is particularly true with the large volume typical of a Cutie Pie survey instrument where the dimensions are about 14.0 cm in length by about 7.5 cm in diameter. However, at every point within the volume of the chamber, the exposure rate is predictable by inverse square law and a numerical integration averaging technique can be used to determine the average response of the chamber at any given distance. A computer program was developed to assess the error introduced by assuming that the exposure rate which was calculated by inverse square law at the center of the chamber was the average exposure rate seen by the chamber. At 9 cm the error was only 11% and falls to 5% at about 15 cm. For the dimensions typical of a GM tube used in survey meters (5.0 cm in length by 2.0 cm in diameter) the error was less than 3% at 9 cm. These errors are within the acceptable accuracy of ± 20% for the calibration of survey instruments.

Three readings are taken on each scale that can be properly calibrated. No attempt is made to calibrate above 1000 mR/hr or below 0.4 mR/hr. If the instrument does not fall within ± 20% for all of the calibration points, the calibration potentiometer(s) is (are) adjusted until the required limits are met.

For those instruments equipped with a reference check source, a meter reading of the check source is taken at the time of the calibration and recorded on the certificate.

A CERTIFICATE OF INSTRUMENT CALIBRATION will be provided.

Vaughn C. Moore, Ph.D.
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North Dakota Dept. of Health License #33-09908-01