3/18-ACS

02867

James M. Fischer
Radiology Department
Brown County General Hospital
Home Street
Georgetown, Ohio

Dr. John Cooper
United States Regulatory Commission
Office of Inspection and Enforcement
799 Roosevelt Road
Glen Ellyn, Illinois 60137

Dear Dr. Cooper:

Enclosed please find a copy of the methods for calibration of the dose calibrator that we will use at Brown County General Hospital in Georgetown, Ohio. Also please find a copy of the procedures that we will use for ordering and receiving radioactive material, and the memorandum that our security department will have posted concerning the receipt of packages containing radioactive materials.

Dr Shegog will provide for you in another letter a copy of the training that he had received in the field of radiation safety and Nuclear Medicine.

We greatly appreciate your assistance in preparing, and processing our license application, and trust that this information that we have provided for you as a result will be complete.

Sincerely,

James M. Fischer, R. T.

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Radiology Department

PROCEDURE FOR ORDERING AND RECEIVING RADIOACTIVE MATERIAL
BROWN COUNTY GEN ERAL HOSPITAL

1. The Chief Technologist of Nuclear Medicine must place all orders for radioactive material and must ensure that the requested materials and quantities are authorized by the license and that possession limits are not exceeded.

2. During normal working hours, carriers must be instructed to deliver radioactive materials and packages directly to the Nuclear Medicine Department.

3. During off-hour deliveries, Security Department must accept delivery of radioactive packages in accordance with the procedures outlined in the memorandum on the following page, entltled Receipt of Packages Containing Radioactive Materials.

MEMORANDUM FOR: Security Department

FROM: Jim Fischer, R. T., Nuclear Medicine

SUBJECT: Receipt of Packages Containing Radioactive Material

Any packages containing radioactive material that arrive after the Department of Nuclear Medicine is closed shall be signed for by the Security guard on duty and taken immediately to the Nuclear Medicine Department. Unlock the door, place the package immediately to the right of the door, and relock the door.

If the package is wet or appears to be damaged, immediately contact the hospital Radiation Safety Officer. Ask the carrier to remain at the hospital until it can be determined that neither he nor the delivery vehicle is contaminated.

RADIATION SAFETY OFFICER: Dr. D. Shegog

OFFICE PHONE: 378-6121 X-ray

HOME PHONE : 513-242-9100

BROWN COUNTY HOSPITAL
NUCLEAR MEDICINE DEPARTMENT
QUALITY CONTROL

METHODS FOR CALIBRATION OF DOSE CALIBRATOR

All radiopharmaceuticals must be assayed for activity to an accuracy of 10%. The most common instrument for accomplishing this is an ionization type dose calibrator. The instrument must be checked for accurate operation at the time of installation and periodically thereafter.

A. Test for the following:
   1. Instrument linearity (at installation and quarterly)
   2. Geometrical variation (at installation)
   3. Instrument accuracy (at installation and annually).

B. After repair or adjustment of the dose calibrator, repeat all of the appropriate tests listed above (dependent upon the nature of the repairs).

C. Daily or before each use of the the instrument:
   1. Measure and record the activity of at least one reference source (e.g., 1-2 mCi of Co-57). This check should be repeated during the day whenever sample readings are not within 10% of the anticipated assay. Variation greater than 5% in this test will indicate the need for instrument repair, adjustment or recalibration.

2. Measure and record the apparent activity of a long-lived standard radionuclide such as Cs-137 or Radium-226 at all of the commonly used radionclide settings (when the unit was first calibrated against NBS-traceable standards). Choose a source with activity in the 100 μCi range

D. Inspect the instrument on a quarterly basis to ascertain that the measurement chamber liner is in place and that instrument zero is properly set (see manufactuer's instructions).

E. Test of Instrument Linearity

The linearity of a dose calibrator should be ascertained over the entire range of activities employed. This test will utilize a vial of Tc-99m whose activity is equivalent to the maximum anticipated activity to be assayed (e.g., the first elution from a new generator).

1. Assay the Tc-99m vial in the dose calibrator and subtract background level to obtain net activity in millicuries.

2. Repeat step 1 at time intervals of 6, 24, 30, and 48 hours after the initial assay.

3. Using the 30 hour activity measurement as a starting point calculate the predicted activities at 0, 6, 24, and 48 hours using the following table:

Assay Time (hrs.)	Correction Factor
0	32
6	16
24	2
30	1
48	0.125

Example: if the net activity measured at 30 hrs. was 15.625 millicuries, then the predicted activity for 6 and 48 hours would be 15.625 mCi x 16 = 250 mCi and 15.625 mCi x 0.125 = 1.95 mCi respectively.

4. Plot the measured net activity for each time interval versus the predicted activity on ~~log~~-log graph paper.

5. The activities plotted should be within ± 5% of the predicted curve if the instrument is linear and functioning properly. Errors greater than ± 5% indicate the need for repair or adjustment of the instrument.

6. If instrument linearity cannot be corrected, it will be necessary in routine assays to either assay an aliquot of the eluate that can be accurately measured, or to use the graph constructed in step 4 to relate measured activities to true activities.

G. Test for Geometrical Variation

There may be significant geometrical variation in activity measured as a function of sample volume or configuration, depending on the volume and size of the ionization chamber used in the dose calibrator. The extent of geometrical variation should be ascertained for commonly used radionuclides and appropriate correction factors computed if variations are significant, i.e., greater than ± 2% (even though correction factors may be provided by the manufacturer, the accuracy of these should be checked).

To measure variation with volume of liquid, a 30 cc vial containing 2 mCi of Co-57 or other appropriate radionuclide in a volume of 1 ml will be used.

1. Assay vial at the appropriate instrument setting and subtract background level to obtain net activity.

2. Increase the volume of liquid in the vial in steps to 2, 4, 8, 10, 20 and 25 ml by adding the appropriate amount of water or saline. After each addition, gently shake vial to mix contents and assay as in step 1.

3. Select one volume as a standard (such as the volume of reference standard used in performing the test for instrument accuracy) and calculate the ratio of measured activities for each volume to the reference volume activity. This represents the volume correction factor.

   Example: if activities of 2.04, 2.02, and 2.00 mC are measured for 4, 8, and 10 ml volumes and 10 ml is the reference volume selected, then

$$4 \text{ ml Volume CF} = \frac{2.00}{2.04} = 0.98$$

4. Plot the correction factors against the volume on linear graph paper. Use this graph to select the proper volume correction factors for routine assay of that radionuclide.

5. The true activity of a sample is calculated as follows:
True Activity = Measured Activity x CF
Where the CF used is for the same volume and geometrical configuration as the sample measured.

6. Similarly, the same activity of Co-57 in a syringe may be compared with that of 10 ml in a 30 cc vial and a correction factor calculated.

7. It should be noted that differences of 200% in dose calibrator readings between glass and plastic syringes have been observed for lower energy radionuclides such as I-125. Hence adequate correction factors must be established for this type of syringe.

An alternate to providing syringe calibration factors is to simply assay the stock vial before and after filling the syringe. The activity in the syringe is then the difference in the two readings (with a volume correction if significant).

H. Test For Instrument Accuracy

The accuracy of the dose calibrator should be checked for several radionuclides such as Cs-137, Co-57, and Ba-133 using appropriate reference standards whose activity is traceable to NBS. The

activity levels of the reference sources used should approximate those levels normally encountered, giving adequate attention to source configuration. The lower energy reference standards (Tc-99m, Xe-133, I-125) must be in vials with the same thickness of glass as the actual samples to be measured for best accuracy.

1. Assay the reference standard in the dose calibrator at the appropriate setting and subtract the background level to obtain the net activity.

2. Repeat step 1 for a total of 3 determinations and average results.

3. The average activity determined in step 2 should agree with the certified activity of the reference source within $\pm$ 5% after decay corrections.

4. Repeat the above steps for other commonly used radionuclides for which adequate reference standards are available.

5. Keep a log of these calibration checks.

6. Calibration checks which do not agree within $\pm$ 5% indicate that the instrument should be repaired or adjusted. If this

is not possible a calibration factor should be calculated for use during routine assays of radionuclides.

7. At the same time the instrument is being initially calibrated with the NBS traceable standards, place a long-lived source in the calibrator, set the instrument, in turn, at the various radionuclide settings used (Cs-137, I-131, Tc-99m, I-125, etc.) and record the readings. These values may later be used to check instrument calibration at each settings (after correcting for decay of the long lived source), without requiring more NBS traceable standards. Keep a log of these initial and subsequent readings.

I. Test for Instrument Constancy

Two reference sources such as Cs-137 and Co-57 should be assayed using a reproducible geometry before each daily use of the instrument.

1. Assay each reference source using the appropriate instrument setting (i.e., Cs-137 setting for Cs-137).

2. Measure background level at same instrument setting.

3. Calculate net activity of each source subtracting out background level.

4. For each source plot net activity versus the day of the year on semi-log graph paper.

5. Log the background levels.

6. Indicate the predicted activity of each source based upon decay calculations and the ± 5% limits on the graph as illustrated.

7. Repeat the procedure for the Cs-137 source for all of the commonly used radionuclide settings.

8. Variations greater than ± 5% from the predicted activity indicate the need for instrument repair or adjustment.

9. Higher than normal background levels should be investigated to determine their origin and eliminated if possible by decontamination, relocation, etc.