Republic of the Philippines
PHILIPPINE NUCLEAR RESEARCH INSTITUTE
Department of Science and Technology
Address: Commonwealth Avenue Tel. No.: 97-60-11 to 15
Diliman, Quezon City Fax No.: 95-16-46

NRLSD BULLETIN 90-01 **USE OF SURVEY METER IN BRACHYTHERAPY**

A. ADDRESSEES

All licensees in possession of brachytherapy source for therapeutic use, and any other small sealed sources.

B. PURPOSE

This Bulletin is issued to reiterate requirements in the regulations that licensees shall assure that sufficient calibrated and operable radiation survey instruments to carry out the radiation surveys required by the PNRI Regulations and the conditions of his license are available and functioning properly while operations are being carried out under his license.

C. DESCRIPTION OF CIRCUMSTANCES

Recent regulatory inspections and audits conducted by PNRI revealed that out of 6 brachytherapy licensees, only 1 has survey meter of his own. The other 5 licensees do not own a survey meter but 1 is borrowing the survey instrument of its Nuclear Medicine Department.

In view of these findings, the LRE required those licensees without survey instruments to submit their procurement program to comply with the requirement on possession of a survey instrument.

D. DISCUSSIONS

To ensure the safety from unnecessary exposure of the patients, technicians and other hospital personnel, and the public at large, the licensee is required by the regulations

to conduct dose rate measurements in different areas and occasions such as:

a) From the time the source leaves the safe to go to the patient until it is returned to the safe;

b) After the patient is removed from the implantation room;

c) During the time the patient is in the hospital;

d) Before discharge of the patient.

In (a), it often happens in hospital work that brachytherapy sources are not given the care that their value and potential danger merit. Opportunities for loss are many in a busy hospital. The safety of the source has to be assured from the time it leaves the safe to go to the patient until it returns to the safe since during this time it may pass through a number of hands.

In spite of the greatest care, however, the small sources may be accidentally lost by, for instance, removal from the ward among the refuse, washing down the sink to become lodged in the trap beneath. To prevent such loss, monitoring of the refuse from the wards, the sink trap, and other possible places where the source may be misplaced must be performed.

In (b), when fine wire sources or seeds are implanted, a radiation survey of the operating room or loading room should be performed after the patient is removed to ensure that no sources are misplaced.

In (c), every precaution should be taken to ensure that sources are not lost during the time the patient is in the hospital. Needles and applicators should be securely attached to the patient; he should be alerted to the possibility of a source becoming loose or dislodged and asked to report any such occurrence. The patients' activities should be restricted and under no circumstances should he have access to ordinary toilets and bathing facilities. Particular attention is required in caring for psychotic patients since they may attempt to remove the sources.

In (d), portable radiation detection survey instruments should be available for use in ensuring that all temporary implants are removed from patients before discharge.

Possession of Survey Instruments

A licensee authorized to use radioactive material for implant therapy shall have in

its possession a portable radiation detection survey instrument capable of detecting dose rate over the range 0.1 millirem per hour to 100 millirem per hour, and a portable radiation measurement survey instrument capable of measuring dose rates over the range 1 millirem per hour to 1,000 millirem per hour.

An ideal survey meter would be portable, rugged, sensitive, simple in construction and reliable. All these features may not be available in any one instrument, but there are many that have most of them. The most common survey instruments are ion chamber and GM types.

1. Characteristics of Survey Instruments

Geiger-Mueller (GM) Instrument

The instrument using a GM tube as a probe is extremely sensitive. It can detect alpha and beta particles when fitted with a very thin "window". Such counter is efficient for beta particle counting but are less efficient for gamma radiation. This instrument does not give uniform response for different energies and is accurate only for the type of radiation for which it is calibrated. For example, if it were calibrated for Co-60, it will not be reliable for I-131.

Moreover, the GM counters respond to the number of ionizing events within them and give no information about the energy associated with the events. Therefore, they do not respond with equal count rates to equal exposure rates from photons of different energies. They are generally used only for detection rather than measurement. GM counters are used in surveys for detection of x-and gamma-ray fields. This generally limits their use to exposure rates in the range from background up to a few mR/h.

An undesirable feature of the instrument is that it can become "saturated" in a field of high intensity radiation. The result is that it will read zero when placed very close to a source of radiation, which gives a false sense of security to the user at the point where the danger is greatest. GM instruments are generally of the low-range type of survey meters.

Ionization Chamber (IC) Instrument

Unlike the GM, this type of instrument does not become saturated in a field of high intensity radiation. Before using a survey meter of this type, precautions must be taken to ensure that the value indicated is the correct one. It should be allowed to "warm up", the meter adjusted to zero, and scale selector position switch checked before reading radiation dose rates.

The ionization chamber instrument can operate at relatively low voltages, which makes it particularly useful in places where atmospheric conditions are subject to large variations. This, coupled with the robustness of the instrument and the fact that it can be powered by batteries, makes it particularly versatile as a portable instrument.

The IC instrument is more accurate than the GM, hence it is commonly referred to as a measurement instrument. Most
of the gamma ray exposure measurements are made with small ionization chambers.

2. Calibration and Check of Survey Instruments

Since the characteristics of individual components cause variations in instrument response it becomes necessary to calibrate each instrument for the intended use periodically. For use in brachytherapy, survey meters must be calibrated at intervals of no longer than six months. Survey instruments must be checked for proper operation with the dedicated check source each day of use.

Calibration certificates generally include the following:

1. Calibration factor for each scale or decade for deviations of 10% or less from the true value or if greater than 10% but not more than 20%;

2. A plot on a graph paper of the meter readings against the calculated intensities. With this calibration curve, the user determines the "true" radiation intensity which is the dose rate to be recorded as required by the regulations;

3. The orientation of the instrument with respect to the source;

4. Dose rate from a dedicated check source. The value is obtained right after the calibration procedure and is used to check for proper working condition of the instrument.

3. Maintenance and Care

The survey meter is a delicate instrument and should be treated with care at all times. It can prevent unnecessary exposure of the user only when in proper working condition and if used correctly. Before use, all survey meters should be checked by the user to ensure that:

1. There are no physical defects;

2. Batteries are not weak;

3. The instrument is in proper working condition. If the survey meter is not in proper working condition, it cannot be used to meet a regulatory requirement because there is no assurance that it will accomplish the task for which it will be used.

4. Correct Use of Survey Instruments

Some considerations to be observed in order to ensure correct use of survey instruments:

1. Allow the instrument to warm up;

2. Ensure that the power supply is not weak;

3. Use the dedicated operational check source to verify instrument operability and check the constancy of its calibration;

4. Use the instrument in the same orientation as when it was calibrated;

5. Adjust the window to OPEN or CLOSE as when it was calibrated;

6. For work in low-energy radiation field, use an instrument which was calibrated with low-energy standard source;

7. Always convert instrument readings to their true values, using the appropriate calibration factor for the meter scale used.

E. REQUIRED LICENSEE ACTIONS

In response to this Bulletin, licensees shall:

1. Submit a list of their survey instruments including the detector type (i.e. ionization chamber,Geiger-Mueller (GM), scintillation, etc.), exposure range, model number and serial number;

2. Reiterate commitments to:

a) Have the survey instruments calibrated before first use, annually and following repair and maintain a record of each survey instrument calibration report for two years;

b) Make a radiation survey of the patient and the area of use to confirm that no sources have been misplaced. The licensee shall make a record of each survey;

c) Make a radiation survey of the patient to confirm that all sources have been removed before release from confinement;

d) Monitor waste material and soiled linen before these are removed from wards;

e) Submit survey procedures for (b), (c), and (d) above.

F. COMPLIANCE SCHEDULE

Licensees shall inform the Institute of the actions taken to comply with this Bulletin within 60 calendar days after receipt hereof.

19 January 1990

Technical Contact:

DOMINGO B. DOMONDON
Chief, Standards Development
Nuclear Regulations Licensing and Safeguards Division
Tel. 97-60-11 to 15 local 227