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 NO. 92-05 RADIATION SAFETY IN IMPLANT THERAPY

A. ADDRESSEES

All licensees using sealed sources in implant brachytherapy.

B. PURPOSE

This bulletin intends to guide the licensees on the proper measures for radiation safety in implant therapy as required in **Sections 15(g) and 15(i) of CPR Part 2, "Licensing of Radioactive Material"**. It is aimed to minimize unnecessary radiation exposure and contamination of patients, the radiation workers concerned, and the general public.

C. DESCRIPTION OF CIRCUMSTANCES

Inspection of brachytherapy facilities revealed some failures by licensees in implementing radiation safety measures in accordance with PNRI regulations, the requirements of their licenses, and accepted medical practice.

Some of the findings are the following:

1. Procedures to ensure proper accounting of radioactive sources were not followed or were not available. There were no records to show that after implanting the sources in the patient, a radiation survey of the patient and the area of use was conducted. Such practice could result to the loss of radioactive sources which may cause significant unintentional exposure to a number of people;

2. Measures to prevent exposures of visitors were not strictly implemented. Visitors were allowed to come near a radioactive patient without being warned about radiation exposure;

3. Nursing personnel without the appropriate training and instructions on radiation safety were allowed to attend to patients undergoing implant therapy.

Such circumstances could result to significant safety problems involving loss of radioactive materials or unnecessary radiation exposures.

D. DISCUSSION

Sealed sources for implant therapy are capable of delivering significant unintentional exposures when radiation protection procedures are not followed. **Section 15 (i) of Part 2 of the Code of PAEC Regulations** requires that licensees shall establish an adequate radiation protection program in each licensed facility.

Such program should include the following:

1. Organization and Training
2. ALARA Program
3. Personnel Monitoring Program
4. Adequate Equipment and Facilities
5. Leak Testing Procedures
6. Transport Procedures
7. Source Inventory
8. Area Surveys
9. Radiation Safety Precautions (Attachment 2)
10. Emergency Procedures (Attachment 3)

Descriptions of the above are given in **Attachment 1**.

E. REQUIRED LICENSEE ACTION

Licensees are expected to:

a) Review this bulletin for applicability to their own program;

b) Distribute this bulletin to those responsible for radiation safety, all authorized users, and facility management; and

c) Consider corrective actions, as appropriate.

Licensees are required to submit to the **Licensing, Review and Evaluation Section of the Nuclear Regulations, Licensing, and Safeguards Division** an updated copy of their Radiation Protection Program for further review. If there are questions regarding this matter, please contact:

OSROXZON L. AMPARO
Head, Standards Development Section
Nuclear Regulations, Licensing, and Safeguards Division
Philippine Nuclear Research Institute
Tel. No. **97-60-11 to 15 local 227**

August 26, 1992

ATTACHMENTS

I - Radiation Protection Program
II - Radiation Safety Precautions
III - Emergency Procedures

ATTACHMENT I - RADIATION PROTECTION PROGRAM

1. Organization and Training

The duties and responsibilities of various persons (e.g., authorized users, technologists, RHSO, licensee management) within the licensee's organization should be specified as they apply to ALARA. They should be provided with the proper instructions on radiation safety in the handling of radioactive sources and use of equipment.

All personnel who work with or in the vicinity of the facility should be provided continuing education and training.

2. ALARA Program

Occupational radiation exposures should be maintained "as low as reasonably achievable (ALARA). Licensee activities should include measures to track and reduce exposures. Periodic reviews of performance should be conducted to be sure that efforts have been made to achieve ALARA goals. The licensee should also demonstrate that administrative controls designed to help keep doses to individuals well below the dose limits have been specified as part of the radiation protection program and that a procedure for investigating conditions that cause or permit these levels to be exceeded has been established.

3. Personnel Monitoring Program

Personnel monitoring devices (e.g., thermoluminescent dosimeter (TLD) or film badge) should be worn by individuals who enter radiation areas. Before entering a high radiation area, the radiological health and safety officer should be consulted regarding the need for special personnel monitoring equipment.

All reported cases of apparently high exposure should be investigated by the **RHSO** and his findings and conclusions should be reported to the **Institute** and made a part of the personnel monitoring record.

4. Adequate Equipment and Facilities

a. Storage Facilities

Brachytherapy sources and applicators containing sources should be stored in a shielded, locked enclosure, safe or vault, of such material and thickness as may be necessary to reduce exposure rates to permissible levels.

Storage Enclosure. The outer surface of the storage enclosure should be made of fire-proof materials. The shielded storage enclosure should be located near the preparation workbench to reduce the exposure of personnel during transfers of sources. Where a large number of sources are stored, a lead-lined safe with lead-filled trays may be used. Separate compartments should be provided for different source activities. Each compartment should be marked so as to permit immediate and easy identification of its contents from the outside.

Important factors that should be considered for personnel protection are:

1) Distribution of the sources;

2) Shielding of subdivided amounts;

3) Time required by personnel to remove sources from, and return sources to the enclosure;

4) Amount of radiation that is scattered around the protective barriers.

Storage Room. The shielded locked enclosure should be installed in a room provided with means to prevent unauthorized access to the sources in storage.

Storage rooms, particularly for intracavitary and interstitial applicators for brachytherapy sources, should include a sink for cleaning. The sink should be provided with a filter or trap suitable for preventing loss of sources. The trap should be easy to dismantle, and should be easily accessible for routine monitoring.

b. Handling Equipment

Radiation exposure can be reduced significantly by the proper use of suitable handling equipment. The equipment required will depend on the number and type of brachytherapy sources and the frequency of their use. These equipment should be designed to permit the necessary operations to be carried out expeditiously at a distance from the source, and, whenever advantageous and practicable, behind protective barriers. Brachytherapy sources

should never be handled with the hands; **remote handling equipment** should be used.

c. Calibrated Survey Instruments

Radiation survey instruments used in the facility should be calibrated at intervals not to exceed **six (6) months** and after each instrument servicing. Records of each calibration should be maintained for **two (2) years**. These records should show the date of the calibration, a description of the source used, results of the calibration (e.g., calibration factor, check source reading, and others), and the name of the individual/organization that provided the service.

5. Leak Testing

Periodic leak tests on all sealed sources should be performed. Sealed sources must be tested for leakage and contamination at intervals not to exceed **six (6) months**, or at other intervals approved by the Institute.

The appropriate test must be selected for a particular source. Sealed brachyhterapy sources are generally tested for source leakage by wipe or immersion tests, however, for radium sources, leak-testing shall be conducted by tests specific for radon detection. If the source leakage is less than **185 Bq** (0.005 uCi) or, in the case of radium sources, less than 1 nanocurie of radon in 24 hours, the source may be considered leak-free. Whenever a source is leaking, it should be sealed in an airtight container, kept separate from other sources and returned to the supplier for repair or disposal as per instruction and agreement with the supplier. All equipment which has been in contact with the leaking source should be checked for contamination and decontaminated if necessary. Records of the tests identifying each source tested must be maintained for **five (5) years** for inspection by PNRI.

6. Transport Procedures

Transportation of radioactive sources should be done in such a manner that the exposure to any individual does not exceed the primary dose limits. Account should be taken of the exposure during actual transport time. Protection should be provided during transportation by distance and/or by shielded containers. Transport containers should be suitably designed and labeled.

Insertion of sources into transport containers, and the removal of sources from such containers, should be carried out in such a way as to minimize exposure. The lid of the container should be securely fastened to prevent spillage of sources during transportation.

7. Source Inventory

A source inventory must be promptly conducted after every removal of the source from the patient. This is to ensure that all the sources that had been removed from storage had been returned. A record of the brachytherapy use should be made and retained for **two years.**

Likewise, a physical inventory to account for all sealed sources and devices received and possessed should be conducted **quarterly**. Each inventory record should be retained for **five years**.

8. Area Surveys

The ambient dose rates in all areas where brachytherapy sources are stored or used should be measured **quarterly**. Record of each survey should be retained for **two years**.

9. Radiation Safety Precautions (See Attachment 2)

General precautions should be noted during the following stages in the clinical application of brachytherapy sources:

a. Transfer of Sources

b. Preparation of Sources

c. Application of Sources to the Patient

d. Treatment of Patient

e. Removal of Sources from the Patient

10. Emergency Procedures (See Attachment 3)

a. Loss of Sources

b. Breakage of Sources

ATTACHMENT 2 - RADIATION SAFETY PRECAUTIONS

1. Transfer and Preparation of Sources

There is an unavoidable exposure associated with the handling of brachytherapy sources, and the exposure resulting from a specific procedure depends largely on the skill of the operator. The following precautions should be

noted:

a. Plan ahead all steps of the procedure of source handling, making sure that the sources are exposed without shielding for the shortest possible time;

b. Keep careful and constant account of:

   i) The activity and date of manufacture of sources;

   ii) The sources removed from and returned to the safe.

c. Have the different sources easily identifiable by shape, size or color;

d. Document the movements of the sources from the time they leave the safe until their return;

e. Avoid use of:

   i) Too long, too heavy, or otherwise cumbersome instruments because they will frequently increase the time of the operation;

   ii) Lead rubber gloves because they provide insignificant protection and they handicap the operator.

f. Take care not to allow the worker to perform radiation work without suitable protective devices;

g. Carry out all steps possible in the preparation and assembly of an applicator before the insertion of the source;

h. When multiple needles and capsules of the same appearance but of different activities are used, they should be identified by different colored threads and marked with numbered tags at the time of loading.

2. Application of Sources to the Patient

a. All personnel caring for the patient undergoing implant therapy should be provided with the necessary radiation safety instructions.

b. All practical physical protection (e.g., protective barriers) should be provided and their use required, including proper handling instruments.

c. A record log for brachytherapy source use, that includes the names of individuals properly trained, instructed, and permitted to handle the sources should be maintained.

d. Immediately after implanting the sources in a patient, a radiation survey of the patient and the area of use should be made to confirm that no sources have been misplaced.

3. Treatment of Patient

a. The bed, cubicle, or room of the hospital patient should be marked with convenient tags or signs indicating the presence of brachytherapy sources.

b. The patient's chart should indicate what radioactive substance is being used, the number and nature of the sources, the total amount of activity, the time and date of application and anticipated removal, and any remark that would enable the source custodian to retrieve sources.

c. The patient with brachytherapy sources must be segre- gated to an extent depending on the type of source and total activity, its location on the patient, how long it is to be there, how long other persons stay near him, and to what other exposure those persons are subject to.

d. A patient being treated with brachytherapy sources should always carry a wristband or similar suitable identification which identifies him as a carrier of radioactive sources.

e. A patient with removable sources in or upon his body should not be permitted to leave the room unless accompanied by a trained hospital attendant. He should not be allowed to leave the hospital until after removal of the sources.

f. Persons who have short-lived sources which are not removable from their bodies may be allowed to leave the hospital, provided the dose rate at one meter from the patient does not exceed .025 mSv (2.5 mrem) per hour and the necessary precautions to prevent contamination of other persons are observed.

4. Removal of Sources from the Patient

a. After the sources are removed from the patient, conduct a radiation survey of the patient to confirm that all sources have been removed, and survey the area of use, to include linens, disposable, and debris, to prevent the inadvertent disposal of a source into regular trash.

b. In cases where many sources are used, check for the complete removal of sources by a radiograph of the treated region or use of an appropriate survey meter.

c. Return brachytherapy sources to the storage area promptly upon their removal, and count the number returned to ensure that all sources taken from storage have been returned.

d. Maintain a record to include the number and activity of sources removed, date of removal and return, the number and activity of sources remaining in storage after removal and return, and the initials and title of the individuals who removed and returned the sources.

e. If a patient dies before the brachytherapy is complete:

a) The source should be removed at once if the application was a temporary one;

b) If the application is a permanent one and its activity is high, the tissue containing the implant should be removed before the body leaves the hospital.

ATTACHMENT 3 - EMERGENCY PROCEDURES

1. Loss of Sources

a. Any loss of a source should be reported immediately to the Radiation Health and Safety Officer.

b. All linen, dressings, clothing, equipment, and trash containers should be kept within the room of a patient until all sources are accounted for.

c. Each installation should have available a sensitive portable instrument capable of detecting beta and gamma radiation.

d. The incident should be immediately reported to the Institute.

2. Breakage of Sources

Emergency Measures

Proper precautions should be taken immediately if one suspects disruption of a sealed source (e.g., spillage of radioactive material) has occurred. If the RHSO or a qualified expert is not immediately available, the following emergency measures should be carried out at once:

a. All windows should be closed and fans and air conditioners should be

shut off in order to prevent airborne spread of contamination.

b. All persons should leave the room and all doors should be closed and locked. No immediate attempt should be made to clear the spill. Entrance to the contaminated area should be prohibited until authorized by the qualified expert.

c. If powdered or gaseous sources are involved, the door and all other openings leading into the room should be sealed with wide masking tape or adhesive tape and heavy wrapping paper.

Personnel Decontamination

a. All persons suspected of having been contaminated should be surveyed.

b. Contaminated clothing should be removed carefully and placed in a labeled disposable container and sealed.

c. Contaminated persons should be taken to a suitable area for decontamination, after which survey should be performed for residual contamination. They should be referred to a physician.

Area Decontamination

The following recommended procedures should be carried out under the guidance of the RHSO to facilitate the clean-up of a radioactive material especially when it is in the form of a powder:

a. A traffic-control program should be instituted immediately to minimize tracking of radioactive contamination.

b. The following equipment should be assembled: respirators, coveralls, shoe covers, vacuum cleaner, and steel drums for refuse.

c. Dry vacuum cleaning should be performed before wet mopping or scrubbing with a detergent and collating agent to remove remaining radioactive contamination.

d. Repeat surveys with appropriate radiation detection instruments should be performed to check the progress of decontamination and the readings should be recorded.

References:

Protection Against Radiation from Brachytherapy Sources, NCRP Report No. 40 (1972).