RADIATION SAFETY MANUAL

TULANE UNIVERSITY HEALTH SCIENCES CENTER
1430 TULANE AVENUE
NEW ORLEANS, LA 70112

REVIEWS AND APPROVED

13 September 2007

LOUISIANA LICENSE NO.: LA-0004-L01

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Chairman, Radiation Safety Committee

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Radiation Safety Officer
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I. OBJECTIVE OF RADIATION PROTECTION

A. General

The specific objectives of radiation protection are: (1) to prevent, to the extent practicable, the occurrence of severe radiation-induced nonstochastic diseases by adhering to dose equivalent limits that are below the apparent practical threshold dose equivalent levels; and (2) to limit risk of the stochastic effects, fatal cancer and genetic effects, to a reasonable level in comparison with non-radiation risks and in relation to societal needs, benefits gained and economic factors. These objectives are achieved by applying individual dose equivalent limits for occupational and nonoccupational (general public) exposures.

It is emphasized that for the purposes of radiation protection, a cautious assumption is made, the reliability of which has not been established. This is the assumption that the dose-risk relationship is strictly proportional (linear) without threshold throughout the range of radiation protection. Furthermore, doses and the probability of response (risk) are assumed to accumulate linearly. At higher doses, received acutely, such as in accidents, more complex (non-linear) dose-risk relationships may apply.

Under these assumptions, any selected dose equivalent limit will have an associated level of risk. Tulane University Health Sciences Center endorses the following: (1) the need to justify any activity which involves radiation exposure on the basis that the expected benefits exceed the predicted cost (justification); (2) the need to reduce the total radiation detriment from such justifiable activities or practices to AS LOW AS IS REASONABLY ACHIEVABLE (ALARA), economic and social factors being taken into account and (3) the need to apply individual effective dose equivalent limits to ensure that the procedures for justification and ALARA do not result in individuals or groups of individuals exceeding levels of acceptable risk.

B. ALARA

Tulane University Health Sciences Center is committed to keeping exposures ALARA. The Radiation Safety Committee (RSC) will perform an annual review of the radiation safety program. This shall include review of summaries of the types and amounts of radioactive material used, occupational dose reports, and continuing education and training for all personnel who work with or in the vicinity of radioactive material. The purpose of the review is to ensure that individuals make every reasonable effort to maintain occupational doses, doses to the general public and releases of radioactive material ALARA, taking into account the state of technology and the cost of improvements in relation to benefits. Modification to operating procedures or to equipment and facilities will be made where they will reduce exposures unless the cost is considered to be unjustified. In addition to maintaining doses to individuals as far below the limits as is reasonably achievable, the sum of the doses received by all exposed individuals will also be maintained at the lowest practicable level.

The RSC will delegate authority to the Radiation Safety Officer (RSO) for enforcement of the ALARA concept.

The RSC will support the RSO in those instances where it is necessary for the RSO to assert his authority. Where the RSO has been overruled, the RSC will record the basis for its action in the minutes of the RSC’s quarterly meeting.
# ALARA LEVELS

Investigational Levels (mrem per calendar quarter)

<table>
<thead>
<tr>
<th></th>
<th>Level I</th>
<th>Level II</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whole body; head and trunk; active blood-forming organs; lens of eye; gonads</td>
<td>125</td>
<td>375</td>
</tr>
<tr>
<td>Hands and forearms; feet and ankles</td>
<td>375</td>
<td>1125</td>
</tr>
<tr>
<td>Skin of whole body*</td>
<td>1250</td>
<td>3750</td>
</tr>
</tbody>
</table>

*Not normally applicable to nuclear medicine operations except those using significant quantities of beta emitting nuclides.

The following actions will be taken at the Investigational Levels stated in the ALARA LEVELS Table above.

1. **QUARTERLY EXPOSURE OF INDIVIDUALS TO LESS THAN INVESTIGATIONAL LEVEL I.**

   Except when deemed appropriate by the RSO, no further action will be taken in those cases where an individual's exposure is less than values for Investigational Level I.

2. **PERSONNEL EXPOSURE EQUAL TO OR GREATER THAN INVESTIGATIONAL LEVEL I, BUT LESS THAN INVESTIGATIONAL LEVEL II.**

   The RSO will review the exposure of each individual whose quarterly exposures equal or exceed Investigational Level I. He will report the results of his review at the first RSC meeting following the quarter when the exposure was recorded. If the exposure does not equal or exceed Investigational Level II, no action related specifically to the exposure is required unless deemed appropriate by the RSC. The RSC will, however, consider each exposure in comparison with those of others performing similar tasks as an index of ALARA program quality and will record the review in the RSC minutes. No written notification of the exposure will be forwarded to the individual.

3. **PERSONNEL EXPOSURE GREATER THAN INVESTIGATIONAL LEVEL II.**

   The RSO will review techniques/procedures and make recommendations for reducing exposure. The RSC will review the recommendations and indicate appropriate follow-up. A written notification of the exposure will be forwarded to the individual.
C. ALARA REVIEW FORM

Name:_____________________________________________________ SS No.: _________________________
Date:___________________________

This individual has exceeded the doses listed below.

ALARA Dose in mRem (mSv)/quarter

<table>
<thead>
<tr>
<th>Area</th>
<th>Level I</th>
<th>Level II</th>
<th>Dose Received</th>
</tr>
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<tbody>
<tr>
<td>Whole body (Including Gonads, Lens of Eyes, Red Bone Marrow)</td>
<td>125 (1.25)</td>
<td>375 (3.75)</td>
<td>_____________</td>
</tr>
<tr>
<td>Hands, Feet</td>
<td>375 (3.75)</td>
<td>1125 (11.25)</td>
<td>_____________</td>
</tr>
<tr>
<td>Skin of Whole Body</td>
<td>1250 (12.5)</td>
<td>3750 (37.5)</td>
<td>_____________</td>
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</table>

Reasons for excessive exposure: _______________________________________________________________________
_________________________________________________________________________________________________

Protective Considerations: Yes No N/A

1. Can time in the work area be reduced? ___ ___ ___
2. Will special dosimetry or area monitoring be required? ___ ___ ___
3. Can special tools/equipment be employed? ___ ___ ___
4. Can additional shielding/distance be employed? ___ ___ ___

Corrective action(s) taken:____________________________________________________________________________
_________________________________________________________________________________________________

____________________ ________________________________
Date Radiation Safety Officer

Acknowledgment

THIS REPORT IS FURNISHED TO YOU UNDER THE PROVISIONS OF THE LOUISIANA RADIATION PROTECTION REGULATIONS. YOU SHOULD RETAIN THIS REPORT FOR FURTHER REFERENCE.
II. RADIATION SAFETY COMMITTEE (RSC)

The control of radionuclides and radiation safety at Tulane University Health Sciences Center is the responsibility of the RSC. Refer to Appendix A for a listing of the RSC members.

The RSC is responsible for ensuring that all individuals who work with or in the vicinity of sources of radiation have sufficient training and work experience to enable them to perform their duties safely and in accordance with regulations and conditions of the license. The RSC is also responsible for ensuring that all use of sources of radiation is conducted in a safe manner and in accordance with regulations and conditions of the license.

The RSC shall:

a. Be familiar with all pertinent regulations, the terms of the license, and information in support of the request for the license and its amendments.

b. Review the training and experience of any individual who uses radioactive material (including physicians, technologists, physicists, and pharmacists) and determine that the qualifications are sufficient to enable them to perform their duties safely and in accordance with regulations and conditions of the license.

c. Establish a program to ensure that all individuals whose duties may require them to work in the vicinity of radioactive material (e.g., nursing, security and housekeeping personnel) are properly instructed.

d. Review and approve all requests for use of radioactive material within the institution.

e. Prescribe special conditions that will be required during a proposed use of radioactive material such as requirements for bioassays, physical examinations of users and special monitoring procedures.

f. Review the entire radiation safety program at least annually to determine that all activities are being conducted safely and in accordance with regulations and conditions of the license. The review shall include examination of all records, reports from the RSO, results of inspections, written safety procedures and management control systems.

g. Recommend remedial action to correct any deficiencies identified in the radiation safety program.

h. Maintain written records of all committee meetings, actions, recommendations and decisions. Minutes of the RSC meetings shall include: the date of the meeting, listing of the members present, listing of the members absent, a summary of the deliberations, a record of the recommended actions and the numerical results of any ballots.

i. Ensure that the radioactive material license is amended when necessary, prior to any changes in facilities, equipment, policies, procedures and personnel.

j. Include representatives from Nuclear Medicine, Radiology/Radiation Oncology, Nursing, Research and Management. The RSO shall also be a member of the RSC. A quorum of the RSC must include: the RSO, a representative from management and fifty percent (50%) of all RSC members.

The RSC shall meet as often as necessary to conduct its business, but not less than quarterly, or as often as the Joint Commission of Accreditation of Healthcare Organizations requires (JCAHO).
III. RADIATION SAFETY OFFICER (RSO)

The RSO will be responsible for radiological safety. General surveillance over all activities involving radioactive material and determining compliance with rules and regulations, license conditions and conditions or projects as approved by the RSC are the responsibilities of the RSO.

The RSO is responsible for providing advice regarding procurement, safe handling, monitoring, use and disposal of all radioactive sources. He will furnish in-service education on all aspects of radiation protection to personnel at all levels of responsibility.

The RSO will maintain records of personnel exposure, and will notify individuals of exposures approaching maximum permissible amounts. An annual inventory of all radionuclides shall be maintained in order to assure the quantity on hand has been authorized by the license.

The RSO shall be notified in case of accidents and shall be responsible for the primary considerations involved in the prevention of spread of contamination. The RSO shall have one or more deputies.

The RSO will investigate all overexposures, accidents, losses, misadministrations or other excursions from good radiation safety. The maintenance of a procedure file on all matters relating to the radionuclide program from receipt to final disposition is the responsibility of the RSO. This also includes performance checks on survey equipment as well as in-service education. The RSO will review the radiation safety program in its entirety once per year.

The RSO is also responsible for the accuracy and completeness of other tasks required by regulation and will verify review by his signature on key documents. This does not mean that the RSO performs tasks, but rather that the record has been reviewed. Documents requiring the signature of the RSO:

A. Sealed source inventory.
B. Sealed source wipe/leak test.
C. Survey of sealed source storage areas.
D. Dose calibrator linearity.
E. Dose calibrator accuracy.
F. Dose calibrator geometry.
G. The RSO will:
   1. Ensure that surveys shall be conducted in unrestricted areas.
   2. Maintain records of radionuclide disposal by release to sewer which shall include (a) log of sewer disposal quantities by type of radionuclide (b) the daily effluent rate (c) monthly average concentration.
   3. Maintain records of misadministrations of radionuclides and of the corrective actions taken.
IV. GUIDELINES FOR NUCLEAR MEDICINE ACTIVITIES INVOLVING TECHNOLOGISTS AND OTHER PARAMEDICAL PERSONNEL

A. An authorized physician may permit technologists and other paramedical personnel to perform the following activities:

1. Preparation and quality control testing of radiopharmaceutical sources of radiation.
2. Measurements of radiopharmaceutical doses prior to administration.
3. Use of appropriate instrumentation for the collection of data to be used by the physician.
4. Administration of radiopharmaceuticals from radionuclide sources to patients, within the limits permitted under applicable laws. Whenever a technologist or other paramedical person administers a radiopharmaceutical to a patient by injection, a physician (not necessarily the authorized user of radionuclides) shall be immediately accessible.

B. Authorized physicians who permit activities to be performed by technologists and other paramedical personnel shall:

1. Prior to such permission, determine that such technologists and other paramedical personnel have been properly trained to perform their duties. This training shall include training in the following subjects as applicable to the duties assigned:
   a. General characteristics of radiation and radioactive material.
   b. Physical, chemical and pharmaceutical characteristics of each radiopharmaceutical to be used.
   c. Mathematics and calculations basic in the use and measurement of radioactivity, including units of quantity of radioactivity (Curies, millicuries, microcuries, Becquerels) and units of radiation dose and radiation exposure (Roentgens, Rad, Rem, Gray and Sievert).
   d. Use of radiation instrumentation for measurements and monitoring, including operating procedures, calibration of instruments and limitation of instruments.
   e. Principles and practices of radiation protection.
   f. Additional training in the above subjects, as appropriate, when new duties are added.
2. Assure that such technologists and other paramedical personnel receive appropriate retraining in the subjects listed to maintain proficiency and to keep abreast of developments in the field of nuclear medicine.
3. Keep records showing the bases for such determinations of proper retraining.
4. Retain responsibility as authorized user for the satisfactory performance of such activities. Certification in Nuclear Medicine Technology by the American Registry of Radiologic Technology (ARRT) or the Nuclear Medicine Technology Certification Board (NMTCB) will satisfy the above training requirements.

C. Personnel (Technologists and other paramedical) approved for radionuclide injections are listed in Appendix B.
V. NUCLEAR MEDICINE ROUTINE FOR ORDERING, RECEIVING, OPENING PACKAGES CONTAINING RADIOACTIVE MATERIAL; PROCEDURE FOR DOCUMENTING USE OF MATERIAL

A. ORDERING

1. Nuclear Medicine Technologists of the Nuclear Medicine Department will place all orders for radioactive material and will ensure that the requested materials and quantities are authorized by the Radioactive Material License. Possession limits are not to be exceeded.

2. A written record that identifies the radionuclide, chemical form and activity level shall be maintained.

3. A written request will be obtained from the physician who ordered the procedure. If a therapeutic procedure has been ordered, a written request will be obtained as well from the physician who will perform the procedure.

B. RECEIVING

1. During normal working hours, carriers will be instructed to deliver radioactive packages directly to the Nuclear Medicine Department.

2. During off-duty hours, security personnel or other designated individuals will accept delivery of radioactive packages in accordance with the procedures outlined in the sample memorandum, Section V.E.

C. MONITORING

Special requirements must be followed for packages containing quantities of radioactive material in excess of the Type A quantity limits, as defined in Radiation Regulations (e.g. more than 20 Curies of $^{99}$Mo, $^{99m}$Tc, uncompressed $^{133}$Xe or more than 3 Curies (3 Ci) of $^{131}$Xe, $^{131}$I or $^{125}$I. The licensee shall make arrangements to receive:

1. the package when the carrier offers it for delivery, or

2. the notification of the arrival of the package at the carrier's terminal and to take possession of the package expeditiously.

Such packages must be monitored for external radiation levels and surface contamination within three (3) hours after receipt if received during working hours or within eighteen (18) hours if received after working hours. The Division must be notified if removable contamination exceeds 0.01 $\mu$Ci (22,000 dpm)/100 cm$^2$.

D. PROCEDURE FOR OPENING PACKAGES CONTAINING RADIOACTIVE MATERIAL

1. Put on impermeable disposable gloves to prevent hand contamination.

2. Visually inspect packages for any sign of damage (e.g. wetness, crushed). If damaged is noted, stop procedure and notify RSO.

Radiation Safety Officer: Charles F. Reindl
Office: 988-5486

Deputy Radiation Safety Officer: Jay Folse
Office: 988-5486
3. Measure the exposure rate from the package at one meter (1m) and at the package surface. If it is higher than expected, stop and notify the RSO. (The transport index noted on packages with Yellow II or Yellow III labels is the approximate dose rate, in mR/hr at one meter (1m) from the package surface). The surface dose rate for such packages should not exceed 200 mR/hr. The dose rate from packages with "White I" labels should be less than 0.5 mR/hr at the package surface.

4. Open the package with the following precautionary steps:
   a. Remove the packing slip.
   b. Open the outer package following the suppliers' instructions, if provided.
   c. Open the inner package and verify that the contents agree with the packing slip.
   d. Check the integrity of the final source container. Look for broken seals or vials, loss of liquid, condensation or discoloration of the packing material.
   e. If anything is other than expected, stop and notify the RSO.

5. If there is any reason to suspect contamination, wipe the external surface of the final source container and remove the wipe sample to a low-background area. Assay the wipe sample to determine if there is any removable radioactivity. The licensee should specify in the procedure manual which instrument (e.g. a thin-window G-M survey meter, a Sodium Iodide Thallium activated crystal and ratemeter, a liquid scintillation counter, or a proportional flow counter) should be used for these assays. The detection efficiency must be determined to convert wipe sample counts per minute (cpm) to disintegrations per minute (dpm). Note that a dose calibrator is not sufficiently sensitive for this measurement. Take precautions against the potential spread of contamination.

6. Check the user request to ensure that the material received is the material that was ordered.

7. Monitor the packing material and empty packages for contamination with a survey meter prior to discarding.
   a. If contaminated, treat this material as radioactive waste.
   b. If not contaminated, remove or obliterate the radiation labels before discarding as in-house trash.

8. Record receipt of radioactive material on the proper form.
E. MEMO TO SECURITY

TO: Director of Security
FROM: Radiation Safety Officer

SUBJECT: RECEIPT OF PACKAGES CONTAINING RADIOACTIVE MATERIAL

Any packages containing radioactive material that arrive between 1630 hours and 0700 hours or during the weekend shall be accepted by the Security guard on duty and taken immediately to the Nuclear Medicine Department. Unlock the door, place the package on top of the counter and relock the door.

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

RADIATION SAFETY OFFICER: Charles F. Reindl, M.S.
Office: 988-2867
Home: 837-8516

NUCLEAR MEDICINE PHYSICIAN: Harold Neitzschman, M.D.
Office: 988-7627
Home: 593-9257

NUCLEAR MEDICINE TECHNOLOGIST: Cheryl Albert, R.T.(N)
Office: 988-5715
Home: 785-8336

F. PROCEDURES FOR DOCUMENTING USE OF RADIOACTIVE MATERIAL

1. A record of receipt, use, transfer, disposal and assay of all radioactive material shall be maintained for three (3) years.

2. See Appendix C for appropriate form.
VI. INSTRUCTIONS FOR ADMINISTRATION OF RADIOPHARMACEUTICALS FOR DIAGNOSTIC AND THERAPEUTIC PROCEDURES

A. Before writing a prescription, the authorized user or physician under the supervision of an authorized user will personally review the patient's case to establish that the medical use is indicated for the patient.

B. Before administering a radiopharmaceutical, the authorized user or the physician under the supervision of an authorized user will personally make and date a prescription. If changes are required, they will be recorded in writing in the patient's chart or in another appropriate record, and will be dated and signed.

C. Before administering a radiopharmaceutical, the identity of the patient, the radiopharmaceutical, and the dosage will be confirmed by the person administering the radiopharmaceutical to establish agreement with the prescription. Any dose that differs from the prescribed dose by more than ten percent (10%) shall not be administered.

D. ASSAY OF RADIOPHARMACEUTICAL DOSAGES

1. Assay, within thirty (30) minutes before medical use, the activity of each radiopharmaceutical dosage that contains more than 10 μCi (370 kBq) of a photon-emitting radionuclide.

E. RECORD REQUIREMENTS

Retain a record of assays three (3) years. To satisfy this requirement, the record shall contain the following:

1. The patient’s name and identification number (if one has been assigned).

2. The generic name or trade name, radiopharmaceutical abbreviation, lot number and expiration date of the radiopharmaceutical.

3. The prescribed dosage and activity of the dosage at the time of assay, or a notation that the total activity is less than 10 μCi (370 kBq).

4. The date and time of administration of the radiopharmaceutical.

5. The initials of the individual who performed the assay.
VII. LABORATORY RULES FOR USE OF RADIOACTIVE MATERIAL

A. Wear laboratory coats or other protective clothing at all times in areas where radioactive materials are used.

B. Wear impermeable disposable gloves at all times while handling radioactive material.

C. Monitor hands and clothing for contamination after each procedure or before leaving the area.

D. Use syringe shields for preparation of patient doses and administration to patients, except in circumstances (e.g., pediatric cases) where their use would compromise the patient's well-being.

E. Do not eat, drink, smoke or apply cosmetics in any area where radioactive material is being stored or used.

F. Do not pipette by mouth.

G. Assay each patient dose in dose calibrator prior to administration. Do not use any dose that differs from the prescribed dose by more than ten percent (10%). Check the patient's name and identification number and the prescribed radionuclide, chemical form and dosage prior to administration.

H. Wear personnel monitoring devices (dosimeter badge or thermoluminescent dosimeter [TLD]) at all times while in areas where radioactive materials are used or stored. These should be worn on the lapel. When not being worn to monitor occupational exposures, personnel monitoring devices should be stored in the work place in a designated low-background area.

I. Wear a ring badge when:
   1. Eluting a generator
   2. Preparing Kits (Radionuclide labeling)
   3. Injecting mCi activities
   4. When holding patients during procedures

J. Dispose of radioactive waste only in specifically designated, labeled and properly shielded receptacles.

K. Use plastic backed absorbent paper to cover the work area to absorb radioactive material in the event of a spill.

L. Confine the radioactive solutions in shielded containers that are clearly labeled. Radiopharmaceutical multidose diagnostic vials and therapy vials should be labeled with the isotope, the name of the compound, the date and time of receipt or preparation. A log book should be used to record the preceding information and total prepared activity, assay in mCi/cc at a specific time, total volume prepared, total volume remaining, the measured activity of each patient dosage and any other appropriate information. Syringes and unit dosages should be labeled with the radiopharmaceutical name or abbreviation, type of study or patient's name and identification number.

M. Always transport radioactive material in shielded containers.

N. Always keep flood sources, syringes, waste and other radioactive material in shielded containers.

O. Perform required Radiation Area and Contamination Surveys.
P. The spread of contamination is a matter of good housekeeping.

1. Keep the laboratory neat and clean. Keep the work area free of equipment and material not required for the immediate procedure.

2. Wash hands and arms thoroughly before handling any object which goes to the mouth, nose or eyes. Monitor the hands whenever contamination is suspected and decontaminate immediately.

3. Keep fingernails short and clean. Do not work with radioactive material if there is a break in the skin below the wrist unless the wound is so protected that radioactive material cannot gain access to the body. Cover the break with an appropriate bandage (plastic or adhesive) and wear impermeable disposable gloves.

4. Food containers are not permitted in the laboratory. Refrigerators should not be used jointly for food and radioactive material storage.

Q. Radioactive Specimens, Excreta or Body Fluids

1. Excreta and Body Fluids may be disposed in the sanitary sewer.

2. Specimens shall be labeled with the radionuclide, activity in $\mu$Ci, date and special instructions to the pathologist.

3. All waste shall be disposed in accordance with Section XX of the RSM.
VIII. RESTRICTION AND LABELING OF RADIATION AREAS

A. All radiation areas are to be properly labeled and as such are to be restricted from entrance by unauthorized personnel.

B. A sign bearing the radiation caution symbol and the words "Caution High Radiation Area" will be posted when the level is such that a major portion of the body could receive in any one (1) hour a dose in excess of 100 mR (1 mSv).

C. A sign bearing the radiation caution symbol and the words "Caution Radiation Area" will be posted when the level is such that a major portion of the body could receive in any one (1) hour a dose in excess of 5 mR (0.05 mSv) or 100 mR/five (5) days.

D. A sign bearing the radiation caution symbol and the words "Caution Airborne Radioactivity Area" will be posted in any room, enclosure or operating area which has airborne radioactive materials in excess of the amounts specified in radiation regulations.

E. A sign bearing the radiation caution symbol and the words "Caution Radioactive Materials" will be displayed in all rooms and on containers in which radioactive material is stored or used.

F. Notice to Employees will be posted in areas utilizing radioactive materials. See Appendix H.
IX. PERSONNEL MONITORING POLICY

A. REQUIREMENTS FOR MONITORING INDIVIDUALS

Personnel Monitoring is recommended for individuals for whom there is a reasonable probability of exceeding ten percent (10%) of the occupational dose equivalent limit of 5 rems/yr (50 mSv/yr) in the course of their work.

Personnel who work with radiation sources and may exceed ten percent (10%) of the occupational dose equivalent limit shall wear a personnel monitoring device (dosimeter badge or TLD) to assess actual exposure during work or as a check against unplanned exposures.

B. LOCATION OF PERSONNEL MONITORING DEVICE

All personnel monitoring devices are to be worn at the lapel. Whenever protective lead aprons are worn, the personnel monitoring devices shall be worn on the outside of the apron at the lapel.

For DECLARED PREGNANT WOMEN, a second personnel monitoring device shall be issued. The personnel monitoring device shall be worn at the waist under any protective apron in order to monitor embryo/fetal radiation dose.

C. RING BADGES

Any individual eluting a generator, preparing kits, injecting doses in the mCi or larger range or individuals performing invasive radiological procedures in which the hands of the individual could inadvertently become exposed to direct radiation shall be issued a ring badge for extremity (hand) monitoring.

D. EXCHANGE

Hospital/clinic monitoring devices and ring badges shall be exchanged at monthly intervals. Research personnel may exchange monitoring devices at quarterly intervals. All monitoring devices shall be returned no later than two (2) days after issue of new monitoring devices. New monitoring devices shall be worn within ±two (2) days of issue date.

E. ISSUE OF PERSONNEL MONITORING DEVICES; MAINTENANCE OF RECORDS

The RSO or Deputy RSO shall issue all personnel monitoring devices and (2) maintain results of monthly and annual dose summaries for all monitored individuals.

F. THYROID MONITORING

Individuals involved in vented operations which utilize, at any one time, more than one millicurie (1 mCi) of $^{125}\text{I}$ and/or $^{131}\text{I}$ or unvented laboratory operations involving 0.1 mCi of $^{125}\text{I}$ and/or $^{131}\text{I}$ in an aqueous form shall have bioassays performed within 72 hours following a single operation and every two (2) weeks if use of these amounts continue. Records of the bioassay shall be maintained for inspection by the RSO and the action point listed below shall be observed.

INITIAL ACTION LEVEL: Greater than 0.12 $\mu$Ci of $^{125}\text{I}$ or 0.04 $\mu$Ci of $^{131}\text{I}$.

IF INITIAL ACTION LEVEL IS EXCEEDED

1. An investigation of the operations involved, including air sampling surveys to determine the causes of exposure and to evaluate the potential for further exposures.
2. If investigation indicates, the licensee shall restrict the worker from further exposure until the source of exposure is discovered and corrected.

3. Corrective actions that will eliminate or lower the potential for further exposures shall be implemented.

4. A repeat bioassay shall be taken within two (2) weeks of the previous measurement in order to confirm the effectiveness of the corrective action taken and to obtain an estimate of effective half-life.

5. Reports or notification shall be provided as required by Radiation Regulations.

FINAL ACTION LEVEL: Greater than 0.5 µCi of $^{125}$I or 0.14 µCi of $^{131}$I.

IF FINAL ACTION LEVEL IS EXCEEDED

1. Prevent the individual from any further handling of $^{125}$I or $^{131}$I until the thyroid burden is below the limits.

2. As soon as possible, refer the case to appropriate medical consultant for recommendations regarding therapeutic procedures in order to accelerate removal of radioactive iodine from the body. This should be done within two to three (2-3) hours after exposure when the time of exposure is known so that any prescribed thyroid blocking agent would be effective.

3. Carry out repeated measurements at approximately one (1) week intervals until the thyroid is less than 0.12 µCi of $^{125}$I or 0.04 µCi of $^{131}$I.

Individuals involved in administration of encapsulated $^{125}$I and/or $^{131}$I shall not require thyroid monitoring unless the integrity of the capsule is broken. If this occurs, Section F.1 shall be observed.
X. LIMITS FOR EXPOSURE TO IONIZING RADIATION:

Summary of Recommendations

A. Occupational exposures (annual)
   1. Effective dose equivalent limit (stochastic effects) 50 mSv (5 rem)
   2. Dose equivalent limits for tissues and organs (nonstochastic effects)
      a. Lens of eye 150 mSv (15 rem)
      b. All others (e.g. red bone marrow, breast, lung, gonads, skin and extremities) 500 mSv (50 rem)
   3. Guidance: Cumulative exposure 10 mSv x age (1 rem x age)

B. Planned special occupational exposure, effective dose equivalent limit 100 mSv (10 rem)

C. Guidance for emergency occupational exposure 100 mSv (10 rem)

D. Public exposures (annual)
   1. Effective dose equivalent limit, continuous or frequent exposure 1 mSv (0.1 rem)
   2. Effective dose equivalent limit, infrequent exposure 5 mSv (0.5 rem)
   3. Remedial action recommended when:
      a. Effective dose equivalent >5 mSv (>0.5 rem)
      b. Exposure to radon and its decay products >0.007Jhm-3 (>2 WLM)
   4. Dose equivalent limit for lens of eye, skin and extremities 50 mSv (5 rem)

E. Education and training exposures (annual)
   1. Effective dose equivalent limit 1 mSv (0.1 rem)
   2. Dose equivalent limits for lens of eye, skin and extremities 50 mSv (5 rem)

F. Declared Pregnant Females (Embryo-fetus exposures)
   1. Total dose equivalent limit 5 mSv (0.5 rem)
   2. Dose equivalent limit in a month 0.5 mSv (0.05 rem)

G. Negligible Individual Risk Level (annual)
   1. Effective dose equivalent per source or practice 0.01 mSv (0.001 rem)

---

Excluding medical exposures.

See below for recommendations on Q.

Sum of external and internal exposures.

Including background but excluding internal exposures.
### RECOMMENDED VALUES OF Q FOR VARIOUS TYPES OF RADIATION

<table>
<thead>
<tr>
<th>Type of radiation</th>
<th>Approximate value of Q</th>
</tr>
</thead>
<tbody>
<tr>
<td>X rays, α rays, β particles and electrons</td>
<td>1</td>
</tr>
<tr>
<td>Thermal neutrons</td>
<td>5</td>
</tr>
<tr>
<td>Neutrons (other than thermal), protons, alpha particles and multiple-charged particles of unknown energy</td>
<td>20</td>
</tr>
</tbody>
</table>
XI. RADIATION AND CONTAMINATION AREA SURVEYS, NUCLEAR MEDICINE

A. All elution, preparation, and injection areas will be surveyed with a low range thin window G-M survey meter and decontaminated if necessary. NOTE: Each survey meter instrument shall be checked for proper operation with a dedicated check source before each use. Records of these checks are not required.

B. All areas where radionuclides are routinely prepared for use or administered shall be surveyed at the end of each day of use.

C. All areas where radionuclides are routinely prepared for use or administered including radionuclide storage locations shall be surveyed for removable contamination at the end of each week of use.

D. Measurement of radiation levels with the survey meter shall be sufficiently sensitive to detect 0.1 mR/hr. The method for performing wipe tests will be sufficiently sensitive to detect 37 Bq/100 cm² (.001 μCi) for the contaminant involved.

E. A record will be kept of all survey results, including negative results. The record shall be maintained for three (3) years and will include:

1. Location, date and type of equipment used.
2. Name of person conducting the survey.
3. Drawing of area surveyed, identifying relevant features such as active storage areas, active waste areas, etc.
4. Measured exposure rates keyed to location on the drawing and at least one reading in an unrestricted area.
5. Detected contamination levels, keyed to locations on the drawing.
6. Corrective action taken in the case of contamination or excessive exposure rates, reduced contamination levels or exposure rates after corrective action, and any appropriate comments.

F. The area shall be considered contaminated if the ACTION LEVELS below are exceeded. The RSO shall be notified immediately if direct survey or contamination action levels are exceeded.

<table>
<thead>
<tr>
<th>ACTION LEVEL</th>
<th>Direct Survey:</th>
<th>2 X Bkg. @ Surface</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACTION LEVEL</td>
<td>Removable Contamination:</td>
<td>37 Bq(0.001 μCi)</td>
</tr>
</tbody>
</table>
XII. DECONTAMINATION PROCEDURES

A. GENERAL CONSIDERATIONS

1. Prevent spread of contamination: The RSO should be called for assistance as soon as possible whenever a spill occurs. The first consideration shall include tracking by persons, movement by air currents (hoods, fans, etc.), water, mopping and other physical actions. To confine it, decontaminate spill from outside toward center.

2. Monitoring: Make full use of instruments and available assistance. Each step of the decontamination should be monitored. One person should be kept clean to operate instruments and do other monitoring. When instruments become contaminated, any progress is hopeless. Protective clothing, footwear, gloves and assault masks should be used as needed.

3. Records: Complete records should be made of each action. Copies should be sent to the RSO. In most cases, the RSO will be involved in the clean-up, thus a joint report can be filed.

4. Waste disposal: Provisions must be made for disposal of cleaning solutions and contaminated articles. In some instances, it may be judged better to dispose of a contaminated article rather than to attempt to decontaminate.

B. SPECIFIC PROCEDURES

1. Skin and hands as contaminated areas.
   a. Decontaminating agent - mild soap and water or detergent and water. If necessary, follow by soft brush, heavy lather and tepid water.

   b. Remarks - Wash two to three (2 - 3) minutes and monitor. Do not wash over three (3) or four (4) times. Use light pressure with heavy lather. Wash for two (2) minutes, three times. Rinse and monitor. Use care not to scratch or erode skin.

   c. Maximum permissible levels of contamination:
      
      Alpha - 150 dpm/100 cm²

      Beta-Gamma - Average less than 0.3 mR/hr for each hand surface or 100 cm² of skin surface, using GM survey meter.

2. Wounds (cuts and breaks in skin)
   a. Decontaminating agent - running tap water. Report to physician and RSO.

   b. Remarks - wash wound with large volumes of running water. Spread wound to permit flushing action by water.

   c. Maximum permissible levels of contamination - keep wound contamination as low as possible.

3. Ingestion by swallowing
   a. Decontaminating agent - immediately induce vomiting. Drink large quantities of liquids to dilute activity.

   b. Remarks - urine and feces analysis will be necessary to determine amount of radionuclides in body.
XIII. CONTAMINATED EQUIPMENT

A. Radioactive contamination is defined as the deposition of radioactive material in any place where it is not desired and particularly in any place where its presence may be harmful. Under no circumstances shall contaminated equipment be in the laboratory or be returned to a stock room.

B. Equipment that may be reused should be decontaminated.

C. Contaminated equipment which is no longer of any use may be discarded in the dry active waste can. If too large for such disposal, request a survey and disposal information from the RSO.

D. Equipment to be repaired by shop and maintenance personnel or by a commercial contractor shall be demonstrated to be free of contamination prior to servicing.

E. If it becomes necessary to make emergency repairs on contaminated equipment, the work will be supervised by the RSO who will assure that the necessary safeguards are taken. It is the responsibility of the laboratory personnel to request this supervision.
XIV. EMERGENCY PROCEDURES

A. WHOM TO CALL

In the event of an emergency, i.e., spills, bodily injury and contamination involving a radiation source, fires, etc., notify the RSO.

RSO: Charles F. Reindl, M.S.
Office: 988-5486

Deputy RSO: Jay Folse
Office: 988-5486

B. LOSS OF SOURCE

Immediately upon discovery of a loss of a sealed source, an appropriate plan of action should be initiated. An example of such a plan would be as follows:

1. Call the RSO immediately.

2. Make a list of all possible places in which the source might have been and where it might be found.

3. Choose the most sensitive and appropriate portable survey instruments (e.g. mR meters or portable scintillation detectors for gamma or high energy beta emitters) for conducting the search.

4. If the source had been transported, check the entire route of travel;

5. If the source had been used with a patient, survey the patient, the patient's room and all bandages, linen, bedding and trash from the patient's room.

6. Survey the entire route from the patients room to the laundry and the laundry facility.

7. Survey the entire route from the patient's room to the incinerator, the incinerator, trash awaiting incineration and the incinerator ash.

8. Survey the entire route from the patient's room to the dumpster and the trash in the dumpster. If needed, request Security to impound the dumpster until the search can be completed.

9. If instruments had been used with the patient, survey the entire route from the patient’s room to the instrument cleaning and sterilization areas.

10. Survey all areas where the source might be found, such as sink drains or plumbing fixtures, elevator shafts, waste cans, trash bins and vacuum cleaners or house vacuum systems.

11. Continue the search until the source is found or the search is terminated by the RSO.

12. The RSO shall notify the Radiation Protection Division.
C. STORAGE IN ANTICIPATION OF NATURAL CATASTROPHY

In the event of hurricane, flooding or other disaster, all radioactive material should be returned to the storage site. Individual amounts of material should be stored in double containers and sealed as well as possible to prevent leakage. Each container should be labeled with the name of the radionuclide, its chemical form and activity present on a specified date. The storage safe or cabinet should be locked and sealed with waterproof tape. If time permits, a list of the radionuclides placed in the storage area should be posted with the date and activity present. If a suitable storage area does not exist, contact the RSO.

D. MINOR SPILLS

1. NOTIFY: All persons in the area that a spill has occurred.
2. PREVENT THE SPREAD: Cover the spill with absorbent paper.
3. CLEAN UP: Use disposable gloves and remote handling tongs. Carefully fold the absorbent paper and pad. Insert into a plastic bag and dispose of in the radioactive waste container. Include all other contaminated materials such as impermeable disposable gloves.
4. SURVEY: With a G-M survey meter, check the area around the spill, hands, clothing and shoes for contamination.
5. REPORT: Report incident to the RSO.

E. MAJOR SPILLS

1. CLEAR THE AREA: Notify all persons not involved in the spill to vacate the room.
2. PREVENT THE SPREAD: Cover the spill with absorbent pads; do not attempt to clean. Confine the movement of all personnel potentially contaminated to prevent the spread.
3. SHIELD THE SOURCE: If possible, the spill should be shielded, but only if it can be done without further contamination or increased radiation exposure.
4. VENTILATION SYSTEM: Switch off all fans and air conditioners.
5. CLOSE THE ROOM: Leave the room and lock the door(s) to prevent entry.
6. CALL FOR HELP: Notify the RSO immediately.
7. PERSONNEL DECONTAMINATION: Contaminated clothing should be removed and stored for further evaluation by the RSO. If the spill is on the skin, flush thoroughly and wash with mild soap and tepid water.
F. ACCIDENT INVOLVING RADIOACTIVE DUSTS, MISTS, FUMES, ORGANIC VAPORS AND GASES

1. NOTIFY all other persons to vacate the room immediately.
2. HOLD BREATH and close return air vents, switch off air circulating devices, etc., if time permits.
3. VACATE the room.
4. NOTIFY the RSO.
5. Ascertain that all DOORS GIVING ACCESS TO THE ROOM ARE CLOSED and post conspicuous warnings or guards to prevent accidental opening of doors.
6. REPORT at once all known or suspected inhalations of radioactive material.

G. INJURIES TO PERSONNEL INVOLVING RADIATION HAZARD

1. WASH MINOR WOUNDS immediately under running water while spreading the edges of the wound.
2. REPORT all radiation accidents involving personnel (wounds, overexposures, ingestion, inhalation) to the RSO.
3. CALL A PHYSICIAN qualified to treat radiation injuries.
4. Permit no person involved in a radiation injury to return to work without approval of the RSO and attending physician.

H. FIRES

2. NOTIFY the RSO.
3. GOVERN THE FIRE-FIGHTING OR OTHER EMERGENCY EQUIPMENT observing restrictions of the RSO.
4. Following the emergency, monitor the area and determine the protective devices necessary for safe decontamination.
5. Decontamination shall be supervised by the RSO.
XV. INSTRUCTIONS FOR MAINTENANCE

A. Maintenance personnel should enter the laboratories employing radioactive sources only for authorized and necessary purposes.

B. When radioactive sources are properly stored, it is not dangerous to enter these areas. If in doubt concerning hazards present, contact the RSO.

C. General maintenance work may be performed only when all radioactive materials have been returned to their shielded containers. Contact the technologist before initiation of cleaning or general maintenance work.

D. If sign below is posted, entry is prohibited.

E. Maintenance personnel shall notify the RSO before any alterations to shielding or to shielded areas.

DO NOT ENTER
XVI. INSTRUCTIONS FOR HOUSEKEEPING

Radiation, as we know it today, is found in many forms and amounts. Radiation has always been present to some degree in nature, our food, building materials and our bodies. Even though levels of radioactivity in most areas are very low, personnel should use caution and have respect for the possible hazard. As part of this caution:

A. DO observe warning signs.

B. DO report to your supervisor anything you think is not right.

C. DO NOT empty waste cans labeled with the radiation sign.

D. DO NOT dispose of any packages or other containers labeled with an undefiled radiation sign. If you are in doubt, contact your supervisor.

E. DO NOT clean any spills, either wet or dry, in areas that use radioactive material, until you have been assured that the spill is not radioactive.

F. DO NOT handle or move containers with the radiation sign.

G. DO contact the RSO if you have any questions or concerns.
XVII. ESCORT PERSONNEL

Prior to transporting a patient with an implanted radioactive source, the escort should be informed of the location of the implanted source. The escort should be given a personnel monitoring device to wear and should be instructed on its use. Escort personnel should observe the following:

A. Minimize their exposure by staying as far from the source as is possible while transporting the patient (unless otherwise advised by the RSO or the medical staff individual assisting the patient).

B. Use designated patient elevators.

C. If public elevators are used, the general public should be excluded.

D. The least crowded corridors should be selected for passage.
XVIII. INSTRUCTIONS FOR VISITORS

A. No visitors are permitted in any laboratory using a radiation source unless accompanied by a qualified individual familiar with the hazards involved.

B. All visitors shall be issued a personal monitoring device when they enter an area in which radioactive materials are located in such amounts that they constitute a potential personal hazard or increase the possibility of spread of contamination. Accumulated doses shall be recorded for the visitor along with the individual's name, age and address. This information shall be sent in a written memorandum to the RSO to be kept on file.

C. Pregnant female visitors shall not be permitted in laboratories using a radiation source.
XIX. STORAGE OF RADIONUCLIDES

All areas where radioactive materials are used and stored shall be locked when not attended by authorized personnel.

A. LIQUIDS AND SOLIDS

1. All radioactive samples must be clearly labeled at all times with pertinent information about the contents, such as the name of the isotope, its chemical form and the quantity of radioactive material as well as the name of the responsible individual.

2. Storage sites for large amounts of radioactive material should be as remote from occupied areas as is practical.

3. The background radiation in unrestricted areas shall be such that individuals continuously present in the area will not receive a dose in excess of 2 mR in any one hour or will not receive a dose in excess of 100 mR in any seven (7) consecutive days. The whole body exposure in unrestricted areas shall be such that any individual will not receive a dose in excess of 0.5 rem in any period of one (1) calendar year.

4. The storage place should be chosen as to minimize risk from fire. The storage place should have a suitable means of egress.

5. The storage areas shall be well marked with a "Caution Radioactive Materials" sign. If necessary, entrance requirements shall be posted.

B. GASES

1. The general storage requirements listed above apply as well as the following considerations:

   a. Radioactive solutions that emit gases shall be labeled and kept in approved hoods which are provided with filters and have adequate ventilation.

   b. In general, only such amounts of material as are necessary for immediate experiments or diagnostic exams should be stored in the laboratory area.

   c. For maximum permissible concentrations in air, consult the RSO.
XX. RADIONUCLIDE DISPOSAL

The following general guideline and procedure may be used for disposal of radioactive waste.

There are four (4) commonly used methods of waste disposal: (1) release to the environment through the sanitary sewer or by evaporative release (2) decay-in-storage (DIS) (3) transfer to a burial site or back to the manufacturer and (4) release to in-house waste. With the exception of patient excreta and generally licensed in vitro kit exemptions, nothing in these guidelines relieves the licensee from maintaining records of the disposal of licensed material.

A. GENERAL GUIDANCE

1. Follow "UNIVERSAL PRECAUTIONS" while handling all waste.

2. Records of all amounts in μCi of all radionuclides must be maintained.

3. All radioactivity labels must be defaced or removed from containers and packages prior to in-house waste disposal. If waste is compacted, all labels that are visible in the compacted mass must be defaced or removed.

4. Remind employees that nonradioactive waste such as leftover reagents, boxes and packaging material should not be mixed with radioactive waste.

5. Occasionally monitor all procedures to ensure that radioactive waste is not created unnecessarily. Review all new procedures to ensure that waste is handled in a manner consistent with established policies.

6. In all cases, consider the entire impact of various available disposal routes. Consider occupational and public exposure to radiation, other hazards associated with the material and routes of disposal (e.g., toxicity, carcinogenicity, pathogenicity, flammability and expense).

B. PROCEDURE FOR DISPOSAL OF LIQUIDS AND GASES

Liquids may be disposed of by release to the sanitary sewer or evaporative release to the atmosphere. This does not relieve licensees from complying with other regulations regarding toxic or hazardous properties of these materials.

1. Material must be readily water soluble or readily dispersible biological material in water. There are monthly limits based on the total sanitary sewerage release of your facility. (Excreta from patients undergoing medical diagnosis or therapy is exempt from all the above limitations). Make a record of the date, radionuclide and estimated activity that was release in μCi or mCi and of the sink or toilet at which the material was released.

2. Limits on permissible concentrations in effluents to unrestricted areas are enumerated in the regulations. These limits apply at the boundary of the restricted area. Make a record of the date, radionuclide, estimated activity that was released in μCi or mCi and of the vent site at which the material was released.
C. PROCEDURE FOR DISPOSAL BY DECAY-IN-STORE (DIS)

Short-lived material may be disposed of by DIS. If you use this procedure, keep material separated according to half-life.

1. Use separate containers for different types of waste, e.g., capped needles and syringes in one container, other injection paraphernalia such as swabs and gauze in another, and unused dosages in a third container. Smaller departments may find it easier to use just one container for all DIS waste. Because the waste will be surveyed with all shielding removed, the containers in which waste will be disposed of must not provide any radiation shielding for material.

2. When the container is full, seal it with tape and attach an identification tag that includes the date sealed, the longest-lived radioisotope in the container and the initials of the individual sealing the container. The container may then be transferred to the DIS area.

3. Decay the material for at least ten (10) half-lives.

4. Prior to disposal as in-house waste, monitor each container as follows:
   a. Check your radiation detection survey meter for proper operation.
   b. Plan to monitor in a low-level (<0.05 mR/hr) area.
   c. Remove any shielding from around the container.
   d. Monitor all surfaces of each individual container.
   e. Discard as in-house waste only those containers that cannot be distinguished from bkg. Record the date on which the container was sealed, the disposal date and type of material (e.g., paraphernalia, unused dosages). Check to be sure no radiation labels are visible.
   f. Containers that can be distinguished from background radiation levels must be returned to the storage area for further decay or transferred for other disposal.

5. If possible, $^{99m}$Mo/$^{99m}$Tc generators should be held 60 days before being dismantled due to the occasional presence of a long-lived contaminant. When dismantling generators, keep a radiation detection survey meter (preferable with a speaker) at the work area. Dismantle the oldest generator first, then work forward chronologically. Hold each individual column in contact with the radiation detection survey meter in a low-background (<0.05 mR/hr) area. Log the generator date and disposal date for your waste disposal records. Remove or deface the radiation labels on the generator shield.

D. PROCEDURE FOR TRANSFER FOR BURIAL

Except for material suitable for DIS and some animal carcasses, solids must be transferred to a burial site. Follow the packaging instructions you received from the transfer agent and the burial site operator. For your records of disposal, keep the consignment sheet that the transfer agent remitted to you.
E. PROCEDURE FOR RETURNING GENERATORS TO THE MANUFACTURER

Used $^{99m}$Mo/$^{99m}$Tc generators may be returned to the manufacturer. This permission does not relieve the licensee from the requirement to comply with Department of Transportation (DOT) regulations.

1. Retain the records needed to demonstrate that the package qualifies per DOT regulations.
2. Assemble the package in accordance with the manufacturer's instructions.
3. Perform the dose rate and removable contamination measurements.
4. Label the package and complete the shipping papers in accordance with the manufacturer's instructions.

F. TRANSFER TO UNIT DOSE PHARMACY OR COMMERCIAL DISPOSAL AGENCY

1. Only unused doses, oral therapy doses and containers and bulk $^{99m}$Tc may be returned to the pharmacy.
2. Brachytherapy sources may be transferred to supplier provided DOT regulations are satisfied.
3. Records shall be maintained of amounts of radioactive materials transferred to commercial disposal agency licensed to receive radioactive waste materials.

G. SPECIFIC WASTES

1. BACTEC $^{14}$C TEST VIALS
   a. Autoclave all vials to destroy pathogens.
   b. Liquids may be disposed via sanitary sewer system. On no single day will more than 1 mCi be released in the sewer system. Over a period of one (1) month, the activity released, when diluted by the average monthly quantity of water, will not exceed a concentration of $3 \times 10^{-4}$ $\mu$Ci/ml of $^{14}$C.
   c. After autoclaving and rinse, the vials shall be placed in plastic bags for disposal with other laboratory waste material.
   d. Care should be exercised to protect vials from breakage during autoclaving and rinsing procedures.
   e. Vials may alternatively be incinerated.
2. $^{3}$H, $^{14}$C
   a. 0.05 $\mu$Ci or less of the above radioactive material/g of medium used for scintillation counting may be disposed without regard to radioactivity providing that all regulations governing any other toxic or hazardous property of these materials are observed.
H. INFECTIOUS, HIGHLY TOXIC, HAZARDOUS SUBSTANCES

1. Plans for proper disposal of infectious agents, highly toxic and/or hazardous substances shall be made early in the design stage of an experiment. Proposed procedures involving unusual problems will be considered individually by the RSC.

I. INCINERATION

1. Radioactive waste is accepted in Room 1105 of the Medical School, Tuesday and Thursday from 8:30 to 10:30 a.m.

2. In order to ensure that air activity limits for unrestricted areas are not exceeded, limits on activity incinerated per hour are imposed based on the following equation: 2858 cfm X 60 min/hr X 28,320 ml/cubic foot = 4.85 X 10^9 ml/hr. For example, the maximum concentration of H-3 in unrestricted air = 1 X 10^7 µCi/ml; 1 X 10^7 µCi/ml X 4.85 X 10^9 ml/hr = 485 µCi/hr; other radionuclides are limited by use of the same equation: maximum concentration X 4.85 X 10^9 ml/hr = allowable burn/hr.

3. A sample of the resulting ash from the ash bin must be collected and analyzed for the radionuclide(s) burned. The ash must not be released until it is at or below the effluent concentration limit for water. Ash may be held until a decay calculation yields an activity concentration at or below this limit. If this is not possible, the ash must be packaged for disposal as radioactive waste.

4. The activity amount of each radionuclide burned must be totaled and divided by the total activity amount allowed to be burned during that time period. This fraction is equivalent to Concentration in Air/Maximum Allowable Concentration. The fraction for each isotope must be totaled and recorded. Although unity may be exceeded during some weeks, the average for the year shall not exceed unity.
XXI. SAFETY RULES: FIXED RADIOGRAPHIC

A. Particular care should be taken to limit the useful beam to the smallest area consistent with clinical requirements and to align accurately the X-ray beam with the patient and film.

B. Gonadal shielding should be used for the patient when appropriate, but never as a substitute for adequate beam collimation and alignment.

C. When a patient must be held in position for radiography, mechanical supporting or restraining devices should be used. If the patient must be held by an individual, that individual shall be protected with appropriate shielding devices, such as protective gloves and apron. The individual should be so positioned that no part of his body will be struck by the useful beam and that his body is as far as possible from the edge of the useful beam.

D. Special precautions, consistent with clinical needs, should be taken to minimize exposures of the embryo or fetus in patients known to be or suspected of being pregnant.

E. Use the maximum source-skin distance consistent with the conditions of the examination.

F. Only persons whose presence is necessary shall be in the radiographic room during exposure. All such persons shall be protected.

G. The radiographer shall stand behind the barrier provided for his/her protection during radiographic exposures.

H. Special care shall be taken to insure adequate filtration in multi-purpose machines. Particular care shall be taken to insure adequate filtration in any machine equipped with a beryllium window tube.
XXII. SAFETY RULES: FIXED FLUOROSCOPIC

A. Particular care should be taken to limit the useful beam to the smallest area consistent with clinical requirements and to align accurately the X-ray beam with the patient and film.

B. Gonadal shielding should be used for the patient when appropriate, but never as a substitute for adequate beam collimation and alignment.

C. When a patient must be held in position for radiography, mechanical supporting or restraining devices should be used. If the patient must be held by an individual, that individual shall be protected with appropriate shielding devices, such as protective lead gloves and an apron. The individual should be so positioned that no part of his body will be struck by the useful beam and that his body is as far as possible from the edge of the useful beam.

D. Special precautions, consistent with clinical needs, should be taken to minimize exposures of the embryo or fetus in patients known to be or suspected of being pregnant.

E. Use the maximum source-skin distance consistent with the conditions of the examination.

F. Protective aprons of at least 0.5 mm lead equivalent should be worn in the fluoroscopy room by each person (except the patient). X-ray monitoring devices shall be worn by all persons in the X-ray room (except the patient) on the outside of the protective apron on the lapel.

G. Only persons whose presence is required should be in the fluoroscopic room.

H. The hand of the fluoroscopist should not be placed in the useful beam unless the beam is attenuated by the patient and a protective glove of at least 0.5 mm lead equivalent.

I. Fluoroscopy should not be utilized as a substitute for radiography. Fluoroscopy is to be reserved for the study of dynamics, special relationships or guidance in spot filming of critical details.

J. In cineradiography, special care must be taken to limit patient exposure when, as is often the case, tube currents and potentials employed are higher than those normally used in fluoroscopy.

K. Image intensification shall always be provided on mobile fluoroscopic equipment. It shall be impossible to operate mobile fluoroscopic equipment unless the useful beam is intercepted by the image intensifier.
XXIII. SAFETY RULES: OPERATORS OF MOBILE RADIOGRAPHIC EQUIPMENT

A. Particular care should be taken to limit the useful beam to the smallest area consistent with clinical requirements and to align accurately the X-ray beam with the patient and film.

B. Gonadal shielding should be used for the patient when appropriate, but never as a substitute for adequate beam collimation and alignment.

C. When a patient must be held in position for radiography, mechanical supporting or restraining devices should be used. If the patient must be held by an individual, that individual shall be protected with appropriate shielding devices, such as protective lead gloves and an apron. The individual should be so positioned that no part of his body will be struck by the useful beam and that his body is as far as possible from the edge of the useful beam.

D. Special precautions, consistent with clinical needs, should be taken to minimize exposures of the embryo or fetus in patients known to be or suspected of being pregnant.

E. Use the maximum source-skin distance consistent with the conditions of the examination.

F. Mobile X-ray equipment shall not be used for fluoroscopy, unless it meets the requirements for mobile fluoroscopes.

G. Mobile equipment should be used only for examinations where it is impractical to transfer patients to permanent radiographic installations.

H. Patients in adjoining beds should be at least twelve (12) feet away from the central ray of the primary beam. If the beds cannot be moved, adjacent patients shall be furnished with a 0.5 mm lead equivalent apron.

I. Prior to making the X-ray exposure, the technologist will announce his/her intention to do so. No exposure is to be made if any person, other than the patient is within a twelve (12) foot radius of the X-ray beam and is not properly shielded.
XXIV. SAFETY RULES: OPERATORS OF MOBILE FLUOROSCOPIC EQUIPMENT

A. Particular care should be taken to limit the useful beam to the smallest area consistent with clinical requirements and to align accurately the X-ray beam with the patient and film.

B. Gonadal shielding should be used for the patient when appropriate, but never as a substitute for adequate beam collimation and alignment.

C. When a patient must be held in position for radiography, mechanical supporting or restraining devices should be used. If the patient must be held by an individual, that individual shall be protected with appropriate shielding devices, such as protective lean gloves and an apron. The individual should be so positioned that no part of his body will be struck by the useful beam and that his body is as far as possible from the edge of the useful beam.

D. Special precautions, consistent with clinical needs, should be taken to minimize exposures of the embryo or fetus in patients known to be or suspected of being pregnant.

E. Use the maximum source-skin distance consistent with the conditions of the examination.

F. Stand as far as possible from the patient, the tube and the useful beam. Wear a protective apron or stand behind a suitable shield of at least 0.5 mm lead equivalent.
XXV. SAFETY RULES: PERSONS IN THE VICINITY OF MOBILE X-RAY EQUIPMENT

A. Vacate the room if possible.

B. If in the room, stand as far as possible from the patient, the X-ray tube and the useful beam.

C. Declared pregnant women shall not hold patients.

D. Follow all instructions given by the X-ray technologist.

E. When a patient must be held in position for radiography, mechanical supporting or restraining devices should be used. If the patient must be held by an individual, that individual shall be protected with appropriate shielding devices, such as protective lead gloves and an apron. The individual should be so positioned that no part of his body will be struck by the useful beam and that his body is as far as possible from the edge of the useful beam.
XXVI. SPECIFIC INSTRUCTIONS FOR ALLIED MEDICAL WORKERS

Housekeeping Personnel:

All housekeeping personnel should be aware of the locations of all restricted area in order to practice good radiation protection measures.

The measures are:

1) Get user permission and instructions from the RSO before cleaning any spill in restricted area.

2) Do not clean counter tops, hoods, refrigerators or sinks in restricted areas unless specifically requested and instructed by the area supervisor or RSO.

3) Do not remove bedclothes, dishes, trash or other items from rooms posted with radiation signs unless specifically instructed by a member of the radiation safety staff.

Security Personnel:

All security personnel should be aware of the locations of all restricted areas and be able to recognize packages containing radioactive material in order to practice good radiation protection measures.

Maintenance Personnel:

All maintenance personnel should be aware of the locations of all restricted areas so that they may practice good radiation protection measures.

These measures are:

1) Obtain permission before working in an area that is in or adjacent to a restricted area.

2) Be aware of hoods, sinks, refrigerators and storage areas used for radioactive materials or sources.

Clerical Personnel:

All clerical personnel in the departments that use radiation should be aware of the locations of restricted areas so that they may practice good radiation protection measures.

Good practice includes:

1) Do not eat, drink, smoke or apply cosmetics in areas where radioactive materials are used.

2) Do not store food or drink in refrigerators where radioactive materials are stored.
Radiation and allied medical staff who may be exposed to radiation should contact the RSO if they become pregnant or are planning to become pregnant. The mother assumes all risk until she specifically declares her pregnancy in a written and signed statement to her supervisor or the RSO. At that time, the hospital is responsible for assuring that the duties of a female staff member will not result in a dose equivalent that is more than 500 mrem to the fetus.

THE MOST RADIOSENSITIVE PERIOD FOR THE EMBRYO/FETUS IS FROM EIGHT TO FIFTEEN (8-15) WEEKS GESTATION AGE.

Guidelines for protecting the embryo/fetus are: (Observe Checked Items)

___ 1. Distance protection shall be practiced at all times.
___ 2. At no time shall any part of the body be so positioned that allows exposure from the primary beam from X-ray sources or unshielded radioactive sources.
___ 3. Holding patients for immobilization shall be prohibited.
___ 4. Mobile X-ray or Fluoroscopy work must be performed with protection of a 0.5 mm lead equivalent wrap-around apron.
___ 5. The personal monitoring device (dosimeter badge) shall be worn at the lapel outside of the protective apron.
___ 6. An additional monitoring device shall be worn at waist level under the protective apron (when apron is worn) to determine exposure directly to the fetus.
___ 7. Impermeable disposable gloves shall be worn and pipetting device used while performing manipulations involving radionuclides.
___ 8. Generator elution shall not be performed during the first trimester.
___ 9. Kit preparation shall not be performed during the first trimester.
___ 10. Therapeutic amounts of radionuclides shall not be administered.
___ 11. Ventilation imaging shall not be performed.
___ 12. Millicurie amounts of $^3$H, $^{14}$C, $^{125}$I, or $^{131}$I shall not be used.
___ 13. Extra care shall be observed to avoid spillage, vaporization and internal/external contamination.

I SHALL OBSERVE ITEMS CHECKED ABOVE.

________________________________________EMPLOYEE ___________________________DATE

________________________________________RSO
The possibility of pregnancy must be taken into account by the attending physician when he/she is deciding on examinations that involve the lower abdomen and pelvis of women of reproductive capacity. The ten (10) day interval following the onset of menstruation is the time when it is most improbable that such women could be pregnant. Therefore, it is recommended that all lower abdomen and pelvic radiological examinations of women of reproductive capacity which are not of importance in connection with the immediate illness of the patient be limited to this period when pregnancy is improbable. The examination that will be appropriate to delay until the onset of the next menstruation are the few that could without detriment be postponed until the conclusion of a pregnancy, or at least until its later half.

Representative X-Ray Procedures
Grouped According to Degree of Embryo/Fetal Hazard

<table>
<thead>
<tr>
<th>High Dose</th>
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<tbody>
<tr>
<td>Lumbar Spine</td>
<td>Pelvis and Abdomen</td>
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<td>Pelvis and Abdomen</td>
<td>Hip and Femur</td>
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<td>Hip and Femur</td>
<td>Urography</td>
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<td>Urography</td>
<td>Pyelography</td>
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<td>Pyelography</td>
<td>Urethrocystography</td>
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<td>Urethrocystography</td>
<td>Barium Enema</td>
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<th>Moderate Dose</th>
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<tr>
<td>Stomach</td>
<td>Upper Gastrointestinal Tract</td>
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<td>Upper Gastrointestinal Tract</td>
<td>Cholecystography</td>
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<td>Cholecystography</td>
<td>Chest, Fluoroscopy</td>
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<td>Chest, Fluoroscopy</td>
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<th>Low Dose</th>
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<tr>
<td>Skull</td>
<td>Cervical Spine</td>
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<td>Cervical Spine</td>
<td>Dorsal Spine</td>
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<td>Dorsal Spine</td>
<td>Extremities</td>
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<td>Extremities</td>
<td>Chest, Radiography</td>
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<td>Chest, Radiography</td>
<td>Dental</td>
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XXIX. PATIENT PREGNANCY SCREENING

Purpose: To assure that all precautions are taken to prevent the exposure of a pregnant female.

Policy: All females in the childbearing years shall pass a pregnancy screen prior to examination.

Procedures: All females in childbearing years will be questioned as to the possibility of pregnancy prior to initiation of a Radiographic/Fluoroscopic and/or Nuclear Medicine Study.

In the event the patient indicates a possibility of pregnancy, the attending physician must be notified for approval prior to the exam. A verbal order for the performance of a pregnancy test may be obtained and the examination postponed pending results.
The patient who is or thinks she might be pregnant, or who is nursing, should be encouraged to give this information to her attending physician when the examination history is taken.

The nursing woman should suspend breast feeding for an appropriate period of time following a nuclear medicine examination. The nuclear medicine physician or certified radiological physicist can advise the nursing woman on the length of time that nursing should be suspended.

The attending physician can use nuclear medicine consultation request forms in non-emergency situations to record the pregnancy and nursing status of a woman of childbearing age. In addition, the attending physician should encourage the patient to provide this information. If there is a medical emergency, if the nuclear medicine examination will contribute vital information to the diagnosis and if there are no alternative methods for obtaining this information that would result in lower radiation exposure, the examination generally should be performed regardless of the patient's pregnancy state. Attention must be paid to technical modifications of the procedure that will minimize radiation exposure.

The nuclear medicine technologist, in the absence of information about the patient's pregnancy or nursing status, should be encouraged to ask the patient if she is or may be pregnant or if she is nursing. If the patient replies that she is or may be pregnant or is nursing, the technologist must notify the physician in charge at once.

The nuclear medicine physician should be aware of appropriate alternatives prior to conducting a nuclear medicine procedure on a pregnant or potentially pregnant woman or one who is nursing. The nuclear medicine physician should be prepared to consult with the attending physician on possible alternatives which include:

A. Requesting the use of a radionuclide that delivers a lower radiation dose or one that is less likely to cross the placental barriers than the radionuclide usually used, if the diagnostic objectives can still be met.

B. In the case of a known pregnancy, assessing the possibility of deferring the examination until pregnancy is concluded.

C. In the case of a possible but unconfirmed pregnancy, deferring the examination that is not immediately needed until the pregnancy is ruled out.

D. Canceling the nonemergency examination once aware that the patient is or may be pregnant.

E. Directing the nursing woman to suspend breast feeding for the period of time that radioactivity is present in the milk.

F. Ascertaining the advisability of using other clinical modalities to diagnose the patient's condition.
XXXI. QUALITY CONTROL PROCEDURES

A. Calibration of dose Calibrator

Test for the following at the indicated frequency. Consider repair, replacement or arithmetic correction if the dose calibrator falls outside the suggested tolerances. (These recommended tolerances are more restrict than those in the regulations to ensure that corrective action will be taken before the dose calibrator is outside permissible tolerances).

1. Constancy at least once each day prior to assay of patient dosages (±5%).
2. Linearity at installation and quarterly thereafter (±5%).
3. Geometry variation at installation (±10%).
4. Accuracy at installation and at least annually thereafter (±5%).

After repair, adjustment or relocation of the dose calibrator, repeat above test as required.

**Constancy** means reproducibility in measuring a constant source over a longer period of time. Assay at least one relatively long-lived source (\(^{137}\)Cs, \(^{60}\)Co, \(^{57}\)Co or \(^{226}\)Ra) using a reproducible geometry each day before using the calibrator. Consider the use of two (2) or more sources with different photon energies and activities. Use the following procedure:

1. Assay each reference source using the appropriate dose calibrator setting (use the \(^{137}\)Cs setting to assay \(^{137}\)Cs).
2. Measure bkg at the same setting and subtract or confirm the proper operation of the automatic bkg. Subtract circuit if it is used.
3. For each source used, either plot on graph paper or log in a book the bkg level for each setting checked and the net activity of each constancy source.
4. Using one of the sources used, repeat the above procedure for all commonly used radioisotope settings. Plot or log the results.
5. Establish an action level or tolerance for each recorded measurement at which the individual performing the test will automatically notify the chief technologist or authorized user of suspected malfunction of the calibrator.

Inspect the instrument on a quarterly basis to ascertain that the measurement chamber liner is in place and that the instrument is zeroed according to the manufacturer's instructions.

**Linearity** means that the calibrator is able to indicate the correct activity over the range of use of that calibrator. This test is done using a vial or syringe of \(^{99m}\)Tc whose activity is at least as large as the maximum activity normally assayed in a prepared radiopharmaceutical kit, in a unit dosage syringe or in a radiopharmaceutical therapy, whichever is largest.

**Decay Method**

Assay the \(^{99m}\)Tc syringe or vial in the dose calibrator, and subtract background to obtain the net activity in mCi. Record the date, time to the nearest minute and net activity on the Dose Calibrator Linearity Test Form. Perform a minimum of two assays per day until the activity is less than 10 µCi.
Shield Method

If you decide to use a set of "sleeves" of various thicknesses to test for linearity, it will first be necessary to calibrate them.

1. Begin the linearity test as described in the decay method above. After making the first assay, the sleeves can be calibrated as follows. Steps 2 through 4 below must be completed in six (6) minutes.

2. Put the base and sleeve one (1) in the dose calibrator with the vial. Record the sleeve number and indicated activity.

3. Remove sleeve one (1) and put in sleeve two (2). Record the sleeve number and indicated activity.

4. Continue for all sleeves.

5. Complete the decay method linearity test steps 2 through 7 above.

6. From the graph made in step d of the decay method, find the decay time associated with the activity indicated with sleeve one (1) in place. This is the "equivalent decay time" for sleeve one (1). Record that time with the data recorded in step b.

7. Find the decay time associated with the activity indicated with sleeve two (2) in place. This is the "equivalent decay time" for sleeve two (2). Record that time with the data recorded in step c.

8. Continue for all sleeves.

9. The table of sleeve numbers and equivalent decay time constitutes the calibration of the sleeve set.

The sleeve set may now be used to test linearity of the dose calibrator.

1. Assay the $^{99m}$Tc syringe or vial in the dose calibrator and subtract bkg to obtain net activity in mCi. Record the net activity.

2. Steps 3 through 5 below must be completed within six (6) minutes.

3. Put the base and sleeve one (1) in the dose calibrator with the vial. Record the sleeve number and indicated activity.

4. Remove sleeve one (1) and insert sleeve two (2). Record the sleeve number and indicated activity.

5. Continue for all sleeves.

6. On a sheet of semilog graph, label the logarithmic vertical axis in mCi and label the linear horizontal axis in hours elapsed. At the top of the graph, note the date, manufacturer, model number and serial number of the dose calibrator.

7. Plot the data using the equivalent decay time associated with each sleeve.

8. Draw a "best fit" straight line through the data points. For the point farthest from the line, calculate its deviation from the value on the line \( \frac{(A_{-\text{observed}} - A_{-\text{line}})}{A_{-\text{line}}} = \text{deviation} \).
9. If the worst deviation is more than ±0.05, the dose calibrator should be repaired or adjusted. If this cannot be done, it will be necessary to make a correction table or graph that will allow you to convert from activity indicated by the dose calibrator to "true activity".

**Geometric Variation** means that the indicated activity does not change with volume or configuration. This test should be done using a syringe and a vial. Vial measurements should be made over a range of useful volumes, for example, 1 cc to 20 cc. A geometrical correction for syringe measurements should also be determined.

**Accuracy**, for a given calibrated reference source, means the indicated mCi value is equal to the mCi value determined by the National Institute of Standards and Technology (NIST) or by the supplier who has compared that source to a source that was calibrated by the NIST. Certified sources are available from the NIST and from radioisotope suppliers. At least two (2) sources with different principal photon energies (\(^{57}\)Co, \(^{60}\)Co or \(^{137}\)Cs) should be used. The regulations require that one source must have a principal photon energy between 100 keV and 500 keV. The regulations also require that if \(^{226}\)Ra is used, it must be at least ten (10) \(\mu\)Ci; other sources must be at least 50 \(\mu\)Ci. Consider using at least one (1) reference source whose activity is within the range of activities normally assayed.

1. Assay a calibrated reference source at the appropriate setting (i.e., use the \(^{57}\)Co setting to assay \(^{57}\)Co) and remove the source and measure bkg. Subtract bkg from the indicated activity to obtain net activity.
   Record this measurement on a Dose Calibrator Geometry and Accuracy Form. Repeat for a total of three (3) determinations.

2. Average the three (3) determinations. The average value should be within five percent (5%) percent of the certified activity of the reference source, mathematically corrected for decay.

3. Repeat the procedure for other calibrated reference sources.

4. If the average value does not agree within five percent (5%) of the certified value of the reference source, the dose calibrator may require repair or replacement. Regulations requires repair or replacement if the error exceeds ten percent (10%).

5. At the same time the accuracy test is performed, assay the source that will be used for the daily constancy test (it need not be certified reference source) on all commonly used radioisotope settings. Record the settings and indicated mCi values with the accuracy data.

The RSO will review and sign the records of all geometric variation, linearity and accuracy tests.

**B. Quality Control, Scintillation Camera**

1. **Total System Uniformity (Daily)**
   a. **Materials**

      (1) Flood phantom: fill with water and add 1 to 5 (1-5) mCi of \(^{99m}\)Tc, count rate should be less than 20,000 cps, or \(^{57}\)Co flood source, or \(^{99m}\)Tc point source of 100 to 200 \(\mu\)Ci; count rate of no greater than 20,000 cps.

      (2) Collimator; low energy, parallel hole.
b. **Procedure**

(1) Place collimator on detector and invert detector head.

(2) Place $^{57}$Co flood source or $^{99m}$Tc flood phantom on collimator. If flood phantom is used, protect against contamination by interposing plastic-backed absorbent paper between the phantom and the detector.

(3) Set and visually verify appropriate pulse height analyzer setting with a 20% window.

(4) Set appropriate intensity.

(5) Collect one million uncorrected counts if a camera with a standard field of view is used; collect two million uncorrected counts for a camera with a large field of view.

c. **Data Treatment**

(1) Visually inspect film for nonuniformities.

2. **System Spatial Resolution (Weekly)**

   a. **Materials**

(1) Flood phantom: fill with water and add 1 to 5 (1-5)mCi of $^{99m}$Tc; count rate should be less than 20,000 cps, or $^{57}$Co flood source, or $^{99m}$Tc point source of 100 to 200 $\mu$Ci; count rate of no greater than 20,000 cps.

(2) Collimator; low energy, parallel hole.

(3) Bar phantom.

b. **Procedure**

(1) Attach low-energy parallel-hole collimator and invert detector.

(2) Arrange bar phantom and $^{99m}$Tc flood source on face of detector.

(3) Set and visually verify appropriate PHA setting using a 20% window.

(4) Set appropriate intensity.

(5) Collect one million uncorrected counts if a camera with a standard field of view is used; collect two million uncorrected counts for a camera with a large field of view.

c. **Data Treatment**

(1) Visually inspect films for degree of resolution.

(2) Are bars straight? Did collimation correct "barreling" or wavy lines noted in intrinsic resolution studies (if available)?
C. Quality Control of In-House Prepared Radiopharmaceuticals

1. $^{99m}$Tc Generators
   a. Molybdenum breakthrough shall be performed on all generator eluents before administration to patients. Permissible limits: $0.07 \mu$Ci of $^{99m}$Mo per mCi of $^{99m}$Tc not to exceed $2.5 \mu$Ci of $^{99m}$Mo per dose.
   b. Aluminum breakthrough shall be performed on all generator eluents before administration to patients. Permissible limits: $10 \mu$g of aluminum per ml of eluent.

2. Chromatography
   a. Chromatography shall be employed for radiochemical impurities. Determination of percentage $^{99m}$Tc tagged or labeled shall be performed on all "kit" prepared radionuclides. Permissible limits: greater than $90\%$ $^{99m}$Tc bound.

3. Radiopharmaceuticals for clinical procedures shall comply with the product label or package insert regarding physical form, route of administration and dosage range.

D. Sealed Sources; Leakage/Contamination

Each sealed source with a half-life greater than thirty days and in any form other than gas, shall be tested for leakage/contamination prior to initial use and at intervals not to exceed six (6) months. Notwithstanding the periodic leak test required, any sealed source is exempt from such leak tests when the source contains $100 \mu$Ci or less of beta and/or gamma emitting material or $10 \mu$Ci or less of alpha emitting material. If at any time, there is reason to suspect that a sealed source may have been damaged or may be leaking, the source shall be tested for leakage before further use. In the absence of a certificate from a transferor indicating that a leak test has been made within six (6) months prior to the transfer, the sealed source shall not be put into use until tested.

E. Procedures for Calibration of Survey Instruments

1. The source must be approximately a point source.

2. Either the apparent source activity or the exposure rate at a given distance must be traceable by documented measurements to a standard certified within 5 percent (5%) accuracy by the NIST.

3. The inverse square law and the radioactive decay law must be used to correct for change in exposure rate due to changes in distance or source decay.

4. A record must be made of each survey meter calibration.

5. A single point on a survey meter scale may be considered satisfactorily calibrated if the indicated exposure rate differs from the calculated exposure rate by less than 10 percent (10%).

Readings above 1,000 mR/hr need not be calibrated. However, such scales should be checked for operation and approximately correct response.

At the time of calibration, the apparent exposure rate from a built-in or owner-supplied check source must be determined and recorded.

The report of a survey meter calibration should indicate the procedure used and the data obtained.
XXXII. PROCEDURES FOR NURSING STAFF AND PATIENT CARE

A. Diagnostic Procedures

Since there is minimal external hazard to others from routine diagnostic doses of radionuclides, there are no restrictions on the patient's activities or his/her contacts with other people. Nursing personnel are not required to wear personnel monitoring devices.

The following procedures apply when a patient receives radioactive material for diagnostic purposes:

1. Questions concerning the use of radionuclides for diagnostic nuclear medicine procedures should be presented to Nuclear Medicine.

2. If radioactive contamination is suspected, nursing personnel should use impermeable disposable gloves to handle items and contact Nuclear Medicine. Particular care should be exercised for handling vomitus during the first 24 hours following administration of a radionuclide.

3. Special diagnostic procedures will be evaluated on an individual basis and appropriate written instructions may be issued.

B. Therapeutic Procedures

1. Patients Receiving Brachytherapy Sources

   a. Sealed source therapy will be offered by approved Radiation Therapy Consultants. The RSC will advise Administration of those radiation therapists that are approved for use of sealed source therapy.

   b. The RSC will use in part the following criteria for evaluation of radiation therapists:

      (1) All rules and regulations of the Medical Staff relative to record keeping are observed.

      (2) Written verification of leak test of sealed sources must be maintained at six (6) month intervals.

      (3) Sealed sources that are transported to the Hospital shall be transferred in containers which will limit the radiation level at one meter (1m) from the center of the container to 2 mR/hr or less.

      (4) At least 48 hours notification shall be provided to Radiation Safety so that appropriate preparation and precautionary measures may be initiated. Notification shall include:

         (a) The number, loading and type of sealed source to be transferred

         (b) The name and location of the patient to which the material will be transferred

         (c) The time of source insertion and removal.

         (d) At least 48 hours notification shall also be provided to the Operating Room Supervisor and Head Nurse for sources to be inserted in Surgery.
c. The RSO shall be responsible for:

(1) Maintaining a log book in Nuclear Medicine to indicate the number, loading and type of sealed source that has been transferred as well as the location (name of patient), time of source insertion and removal

(2) Completing the Radioactivity Precaution Tag to be attached to the door of the patient's room and attaching the Caution, Radioactive Materials label to the cover of the patient's chart

(3) Surveying the patient's room and surrounding areas as soon as practical after administration of the radionuclide and at conclusion of treatment and completing the Radionuclide Therapy Survey form.

2. Patients receiving radionuclide therapy as solution, colloid or microsphere

   a. Prior to therapy, the form Therapeutic Radionuclide Consultation Form is to be completed and becomes a part of the patient's chart.

   b. The RSO shall be responsible for:

      (1) Assuring that the responsible physician has completed the appropriate Appendices to become a part of the patient's chart.

      (2) Completing the Radioactivity Precautions Tag to be attached to the foot of the patient's bed or to door of room and attaching the Caution, Radioactive Materials label to the cover of the patient's chart.

      (3) Surveying the patient's room and surrounding areas as soon as practical after administration of the radionuclide and at discharge of the patient. In addition, the RSO shall completing the form Radionuclide Therapy Survey.

3. Patients requiring emergency surgery after therapy

   a. Consultation shall be made with the Nuclear Physician who shall notify the RSO.

4. Death of patient after therapy

   a. Consultation shall be made with the Nuclear Physician who shall notify the RSO.
XXXIII. TRAINING PROGRAM: PERSONNEL WORKING IN THE VICINITY OF RADIOACTIVE MATERIAL

A. Personnel to be included in Training

1. Nuclear Medicine Technologists.

2. Any Ancillary Personnel whose duties may require them to work in the vicinity of radioactive material.

B. Frequency of Training

Personnel will be instructed:

1. Before assuming duties with, or in the vicinity of, radioactive materials.

2. During an annual refresher course.

3. Whenever there is a significant change in duties, regulations or the terms of the license.
Charcoal traps can significantly reduce air contamination. They can also become saturated or be spoiled by improper use, humidity, chemicals or inadequate maintenance.

1. If the trap effluent is monitored by a radiation detector designed to monitor effluent gas, check the detector according to the manufacturer's instructions. Keep a record of the checks.

2. If you do not monitor the trap effluent, check it on receipt and once each month. Collect the effluent from the trap during one patient study in a plastic bag and monitor the activity in the bag by holding the bag against a camera, with the camera adjusted to detect noble gas. Compare the bag’s cpm to bkg cpm with no other radioactivity in the area. Keep a record of the date, bkg cpm, and bag cpm.

3. The RSO will establish an action level based on cpm or a multiple of bkg cpm. If you measure a significant increase in the bag cpm, the trap is breaking down and must be replaced.

4. Follow the trap manufacturer's instructions for replacing the trap.
APPENDIX A

RADIATION SAFETY COMMITTEE

James J. Balsamo, Jr., MPH, R.T.
Sharon Hafner, R.T., Radiology
Lucien Nedzi, M.D., Radiation Therapy
Rita Preiksaitis, R.N.
Charles F. Reindl, M.S., RSO
Brian Rogers, M.D., Radiology
Brian Rowan, Ph.D.
Robert Sanford, Ph.D., Radiation Therapy
James A. Terry, Ph.D., Chairman
Vicki L. Traina-Dorge, Ph.D.
APPENDIX B

TECHNOLOGISTS APPROVED FOR RADIONUCLIDE INJECTIONS

Cheryl Albert, R.T. (N)
Courtney Aysenne, R.T. (N)
Raymond Qiana, R.T. (N)
APPENDIX C

DAILY INCOMING/OUTGOING SHIPMENT INSPECTION LOG

SURVEY INSTRUMENT ___________________________ CONVERSION FACTOR ____________________________

ACTION LEVELS:
- 10 mR/hr at three feet
- 200 mR/hr at surface
- Wipe test of 2,220 dpm or 0.001 microcuries

IF ANY ACTION LEVEL IS EXCEEDED, STOP AND NOTIFY THE RADIATION SAFETY OFFICER

<table>
<thead>
<tr>
<th>INCOMING</th>
<th>OUTGOING</th>
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<tbody>
<tr>
<td>Date</td>
<td>Product</td>
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</table>

Eluate mCi/cc ________________________ @ ___________________ AM/PM.

Kit Assay ________________________ @ ___________________ AM/PM.

Total Volume of Eluate _____________________________________________

Prepared by ______________________________________________

Total Activity ________________________________________________

Total Volume of Vial ____________________________________________
APPENDIX E

RADIATION EXPOSURE HISTORY REQUEST FORM

___________________________________ DATE: ________________________________

___________________________________

___________________________________

___________________________________

In order to complete the radiation history on the following individual, a record of their radiation exposure is needed from your institution. Attached is an authorization for the release of this information.

PERSONAL DATA

NAME _________________________________________________________________________________________

DATE OF BIRTH ________________________________________________________________________________

SOCIAL SECURITY NO. __________________________________________________________________________

EMPLOYED DATES ______________________________________________________________________________

DEPARTMENT __________________________________________________________________________________

MONITORING PERIOD ___________________________________________________________________________

TOTAL ACCUMULATED DOSE DEEP (mRem) ________________ SHALLOW (mRem) _________________

RESULTS OF BIOASSAY/THYROID MONITORING, IF PERFORMED

<table>
<thead>
<tr>
<th>RADIONUCLIDE</th>
<th>CRITICAL ORGAN</th>
<th>TOTAL BODY BURDEN (mRem)</th>
<th>ESTIMATED EXPOSURE (mRem)</th>
<th>BIOASSAY DATE</th>
</tr>
</thead>
</table>

Thank you for your assistance.

Very truly yours,

Radiation Safety Officer
APPENDIX F

DOSIMETER BADGE MONITORING SERVICE REQUEST

Radiation Regulations require your past radiation exposure in order to initiate dosimeter badge service. Please complete this form, sign, and return to the Radiation Safety Officer.

FULL LEGAL NAME ____________________________________________________________________________

Last               First               Middle/Maiden

SOCIAL SECURITY NO. __________________________________________________________________________

BIRTH DATE ___________________________ SEX __________________

DEPARTMENT __________________________ PHONE ___________________

PREVIOUS EMPLOYMENT(S) INVOLVING RADIATION EXPOSURE AS MONITORED BY RADIATION DOSIMETER

1. Indicate NONE, if never monitored: ____________________________

2. Previously monitored locations:

   EMPLOYER __________________________________________________________________________________

   DEPARTMENT _______________________________________________________________________________

   MAILING ADDRESS __________________________________________________________________________

   DATE OF EMPLOYMENT: FROM:_______________________________ TO:_______________________________
   (Use back of sheet if more than one employer)

3. If previously monitored, estimate your previous calendar quarter exposure: ____________mRem

I HEARBY AUTHORIZE THE RELEASE OF MY RADIATION EXPOSURE HISTORY TO ____________________

__________________________________________________________________________________________

SIGNATURE __________________________________________

OCCUPATIONAL TITLE __________________________________

DEPARTMENT ___________________________ DATE _____________

Page 63
APPENDIX G
RADIONUCLIDE DISPOSAL FORM

LOCATION _____________________________________

<table>
<thead>
<tr>
<th>Radionuclide</th>
<th>Date placed in Storage</th>
<th>Activity in microcuries or surface exposure rate in mR/hr</th>
<th>Date of Disposal</th>
<th>Activity in microcuries or surface exposure rate in mR/hr @ Date of Disposal</th>
<th>Background exposure rate in mR/hr</th>
<th>Survey meter or assay instrument used (including serial number)</th>
<th>Person performing disposal (Signature)</th>
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APPENDIX H

NOTICE TO EMPLOYEES
LOUISIANA DEPARTMENT OF ENVIRONMENTAL QUALITY
LICENSING & REGISTRATIONS SECTION
RADIATION NOTICE
STANDARDS FOR PROTECTION AGAINST RADIATION
NOTICES, INSTRUCTIONS & REPORTS TO WORKERS; INSPECTIONS

In the Louisiana Administrative Code LAC 33:XV (Louisiana Radiation Regulations), the Secretary has established standards for your protection against radiation hazards and has established certain provisions for the options of workers engaged in work under a license or registration certificate issued by the Department.

YOUR EMPLOYER’S RESPONSIBILITY

Your employer is required to—

1. Apply these regulations and the conditions of his/her license or registration certificate to work involving sources of radiation.
2. Post, or otherwise make available to you, a copy of LAC 33:XV (Louisiana Radiation Regulations), licenses, registration certificates and operating procedures which apply to work in which you are engaged and to explain their provisions to you. These documents are available at
3. Post all notices of violation involving radiological working conditions, proposed imposition of civil penalties and orders.

YOUR RESPONSIBILITY AS A WORKER

You should familiarize yourself with those provisions of LAC 33:XV (Louisiana Radiation Regulations) and the operating procedures which apply to the work in which you are engaged. You should observe their provisions for your own protection and the protection of your co-workers.

WHAT IS COVERED BY THESE REGULATIONS

1. Limits on exposure to radiation and radioactive material in restricted and unrestricted areas;
2. Measures to be taken after accidental exposure;
3. Personnel monitoring, surveys and equipment;
4. Caution signs, labels and safety interlock equipment;
5. Exposure records and reports;
6. Options for workers regarding Department inspections; and
7. Related matters.

REPORTS ON YOUR RADIATION EXPOSURE HISTORY

1. LAC 33:XV (Louisiana Radiation Regulations) require that your employer give you a written report if you receive a radiation dose in excess of any applicable limit as set forth in the regulations or in the license or registration certificate. The basic limits for radiation dose to employees are set forth in Chapter 4 of the regulations. This chapter specifies limits on radiation dose and exposure to concentrations of radioactive material in air and water.
2. If you work where personnel monitoring is required, and if you request information on your radiation doses,
   (a) Upon termination of your employment, your employer must give you a written report of your radiation doses, and
   (b) Your employer must advise you annually of your dose from radiation.

INSPECTIONS

All licensed or registered activities are subject to inspection by representatives of the Department. In addition, any worker or representative of workers who believes that there is a violation of the Louisiana Nuclear Energy and Radiation Control Law, the regulations issued thereunder, or the terms of the employer’s license or registration certificate with regard to radiological working conditions in which the worker is engaged, may request an inspection by sending a notice of the alleged violation(s) to the Department. The request must set forth the specific grounds for the notice and must be signed by the worker or a representative of the worker. During inspections, Department inspectors may confer privately with workers, and any worker may bring to the attention of the inspectors any past or present condition which he believes contributed to or caused any violation as described above.

INQUIRIES

Inquiries dealing with the matters outlined above can be directed to:

EMERGENCY & RADIOLOGICAL SERVICES DIVISION
P. O. BOX 4312
BATON ROUGE, LOUISIANA  70821-4312
225-219-3041

AFTER HOURS EMERGENCY TELEPHONE NUMBER
225-765-0160

Copies of this notice must be posted in a sufficient number of places in every establishment where employees are employed in activities licensed or registered by the Department, pursuant to Chapters 2 and 3 of LAC 33:XV (Louisiana Radiation Regulations), to permit employees working in or frequenting any portion of a restricted area to observe a copy on the way to or from their place of employment.

DRC-3 (Rev. 1/06)
APPENDIX I

DIAGNOSTIC AND/OR THERAPEUTIC PROCEDURE
MISADMINISTRATION REPORT

EVENT __________________________________________ REPORT DATE _______________________________

SERVICE PHYSICIAN ____________________________________________________________

INVOLVED TECHNOLOGIST _______________________________________________________

TYPE OF MISADMINISTRATION:  WRONG PATIENT _____
                              WRONG RADIOPHARMACEUTICAL _____
                              WRONG ROUTE _____
                              DOSAGE DIFFERING FROM PRESCRIBED BY 50% _____

INTENDED PROCEDURE _____________________________________________________________

INTENDED RADIOPHARMACEUTICAL/DOSAGE __________________________________________

RADIOPHARMACEUTICAL/DOSAGE __________________________________________________

PROCEDURE PERFORMED __________________________________________________________

REFERRING PHYSICIAN ___________________________________________________________

PATIENT ______________________________________ SOCIAL SECURITY NUMBER ______________________

RESPONSIBLE TECHNOLOGIST ____________________________________________________

CONTRIBUTING FACTOR _________________________________________________________

_______________________________________________________________________________
_______________________________________________________________________________

ACTION TAKEN TO PREVENT RECURRENCE ___________________________________________

_______________________________________________________________________________
_______________________________________________________________________________

EFFECTS ON PATIENT ____________________________________________________________

_______________________________________________________________________________
_______________________________________________________________________________

SIGNATURE __________________________________ DATE __________________________

RADIATION SAFETY OFFICER

TELEPHONE NUMBER ____________________________________________________________
APPENDIX J

THERAPEUTIC RADIONUCLIDE CONSULTATION FORM

PATIENT ________________________________ DATE ______________________________

HOSPITAL NUMBER __________________________ WARD __________________________

IS REFERRED TO YOU. OUR FINDINGS IN THE CASE ARE AS FOLLOWS: ______________________________

_________________________________________________________________________________________________

REQUEST FOR TREATMENT WITH THERAPEUTIC RADIOISOTOPE:

<table>
<thead>
<tr>
<th>RADIOISOTOPE</th>
<th>FORM</th>
<th>AMOUNT</th>
<th>METHOD AND DATE OF ADMINISTRATION</th>
</tr>
</thead>
</table>

CURRENT MEDICATIONS ______________________________________________

IS PATIENT PREGNANT? __________

DATE OF LAST MENSTRUAL PERIOD ______________________

HAS PATIENT BEEN INSTRUCTED TO AVOID PREGNANCY PRIOR TO TREATMENT AND FOR TWO MONTHS AFTER TREATMENT? __________

RATIONALE FOR OTHER THAN ROUTINE USE ______________________________________________

_________________________________________________________________________________________________

PHYSICIAN’S SIGNATURE ____________________________________________

TO (PHYSICIAN) ____________________________________________

THERAPIST ____________________________________________

ASSISTANTS ____________________________________________

_________________________________________________________________________________________________

<table>
<thead>
<tr>
<th>DATE</th>
<th>TIME</th>
<th>RADIONUCLIDE</th>
<th>DOSE</th>
<th>TECHNIQUE</th>
</tr>
</thead>
</table>

_________________________________________________________________________________________________

REMARKS:
APPENDIX K
QUALITY MANAGEMENT PROGRAM

Guidelines for Brachytherapy Applications, $^{90}$Sr Applicator, Radiopharmaceutical Therapy and Administration of Greater than 30 µCi of $^{125}$I or $^{131}$I.

I. Written Directive

The physician will issue a written directive in the patient's Radiation Oncology treatment chart and/or hospital chart prior to the administration of any brachytherapy or radiopharmaceutical. This directive will be signed and dated by the physician.

II. Patient Identification

Before administration of any dose, the patient's identity will be determined by more than one method by the person administering the dose. The methods of identification used are noted on the quality management checklist for administration of brachytherapy treatments or radiopharmaceuticals (see attached forms). This checklist becomes part of the patient's chart.

III. Verification of Dose

Final plans for treatment and/or dose calculation for brachytherapy are signed by the physician as verification of agreement with the written directive. For administration of radiopharmaceuticals, the quality management checklist is completed to verify the dose ordered in the written directive.

IV. Verification of Administration

Brachytherapy sources are loaded into the applicators or placed interstitially according to the treatment plan/dose calculation that follows the written directive. On-site brachytherapy sources are located in the storage safe according to a posted "map" of the contents of each drawer and are color-coded according to activity. The number and activity of the sources removed from the safe are verified by completing the source utilization log, which accounts for all sources remaining in the safe. Special-order sources are verified upon receipt for agreement with treatment plan and are intended to be patient-specific. The packing list of sources are filed in the source receipt log with a copy of a dose-calibrator print-out. Placement of the applicators and after-loaded sources in the patient are determined and verified by radiography using dummy sources. The source loading and its time of insertion and removal are documented in the patient's hospital chart. Radioactive seed applications are radiographed after surgery for verification of seed placement and dose calculation. For radiopharmaceutical administration, a copy of the dose-calibrator print-out is attached to the quality management checklist. For $^{90}$Sr the treatment time and treatment dose shall be documented in the patient's hospital chart as well as on the $^{90}$Sr Ophthalmic Applicator Therapy Record.

V. Deviation from Written Directive

Any deviation from the written directive, intended or otherwise, is documented on the treatment plan and noted in the patient's hospital chart. The physician is consulted as to the appropriate measures to be taken.

VI. Quality Management Program Review (QMPR)

The QMPR will be reviewed annually for completeness and appropriateness by the radiation physicist, oncologist and RSO (see attached review form). Changes will be made as needed and submitted to the division within 30 days of the modification.
APPENDIX L

ANNUAL REVIEW FORM

QUALITY MANAGEMENT PROGRAM

DATE: ________________________________

____ Written program (policies and procedures)
____ Program approved by management
____ Incorporated into license
____ Modifications submitted within 30 days
____ Minutes of annual review
____ Review sample of patient administrations
____ Review of QM objectives and effectiveness
____ Review misadministrations
____ Review recordable events
____ Event facts written up within 30 days
____ Event corrective action recommended and evaluated
____ Record of patient dose
____ Written directive for brachytherapy dose
____ Written directive for radiopharmaceutical therapy dose
____ Record for \(^{125}\text{I}\) and \(^{131}\text{I}\) greater than 30 microcuries
____ Patient identity verified by two (2) means
____ Therapy plans by directive
____ Unintended deviation from plan evaluated
____ Retention of records for three (3) years

____________________________________
Management

____________________________________
RSO
APPENDIX M

Quality Management Checklist for Administration of Sodium Iodide ($^{125I}$, $^{131I}$)
Activities Greater than 30 µCi

Date: ____________________________________________________________________________________________

Patient: __________________________________________________________________________________________

Social Security Number: ____________________________________________________________________________

Date of Birth: _____________________________________________________________________________________

PATIENT IDENTIFICATION: (completed by person verifying patient identity).

The above patient's identity has been verified by at least two of the following methods: (Circle appropriate number)

1. Asking patient to state and spell his/her name and compare with patient's record/objective.
2. Comparing stated date of birth with patient's record/directive.
3. Comparing stated SS# with patient's record/directive.
4. Comparing stated address with patient's record/directive.
5. Comparing photographic identification (ex. driver's license) with patient’s appearance.
   Name of attester: _______________________________________ Relationship: ___________________________
   Signature of staff verifying the patient's identity: ______________________________________________________

RADIOPHARMACEUTICAL PRESCRIPTION: (completed by person administering radiopharmaceutical).

Procedure: _______________________________________________________________________________________

Attending Physician: _______________________________________________________________________________

Ordering Physician: ________________________________________________________________________________

Radiopharmaceutical Prescribed: _____________________________________________________________________

Route of Administration: ____________________________________________________________________________

Dosage Ordered: ___________________________________________________________________________________

Signature of Administrator: __________________________________________________________________________

Radiopharmaceutical Dosage Verification (Completed by person administering radiopharmaceutical):

COMPLICATIONS/COMMENTS/NOTES:

______________________________________________________________________________________________

ATTACH DOSE CALIBRATOR SLIP
APPENDIX N

INSTRUCTIONS FOR BRACHYTHERAPY

A. Before prescribing a procedure, the authorized user or the physician will personally review the patient's case to establish that the medical use is indicated for the patient's medical condition.

B. Before administering the radionuclide, the physician will personally make and date a prescription.

C. Before implanting the sealed sources, a qualified person will verify that the radionuclide and source strength of the sources to be used are as prescribed. (NOTE: The licensee may use any appropriate verification method, such as checking the serial number behind a shield, using a radiation detector or using clearly marked storage spaces for each type of sealed source).

D. Any change in the prescription will be recorded in writing in the patient's chart or in another appropriate record and will be dated and signed by the physician or qualified individual.

E. Radiographs will be obtained and used as the basis for calculating the delivered dose (this may not apply to sources used for surface application).

F. After implantation, a qualified person under the supervision of an authorized user will promptly update and sign the patient's record to reflect the actual loading of the sealed sources and record any change in the prescription.

G. After administering the brachytherapy dose, a qualified person under the supervision of an authorized user will make, date and sign a written record in the patient's chart or in another appropriate record describing the administered dose; and this person will record the agreement, or lack thereof, between the brachytherapy administration and the prescription.

H. Before 50% of the prescribed dose has been administered, a qualified person under the supervision of an authorized user (e.g., physicist, physician, dosimetrist or technologist) will check the dose calculations.

1. MANUAL DOSE CALCULATIONS WILL BE CHECKED FOR:
   a. Mathematical errors
   b. Correct transfer of data from the prescription, tables and graphs
   c. Correct use of nomograms when applicable
   d. Correct use of all pertinent data in the calculations.

2. Computer-generated dose calculations will be checked by examining the computer printout to ensure that the correct inputs for the patient were used in the calculations. Alternatively, the dose may be manually calculated to a key point and the results compared.

3. If the manual calculations are performed using computer outputs or vice versa, the manual portion of the calculations will be checked as stated in (a) and the computer portion of the calculations will be checked as stated in (b). Emphasis will be placed upon verifying the correct output from one (computer) to be used as an input in another type of calculation (manual).
APPENDIX O

OPERATING ROOM CARE

BRACHYTHERAPY SOURCES

Method of Implantation:

Temporary:

Usually an intracavitary implantation of $^{137}$Cs or interstitial $^{192}$Ir. Implantation may be delayed if an after-loading technique is employed. This involves insertion of applicators or catheters before the radioactive sources are inserted.

Permanent:

An interstitial implantation that may be superficial, intraabdominal or intrathoracic. Prostate implants involve use of templates with the aid of ultrasound measurements. The radionuclides $^{125}$I or $^{103}$Pd are used. Permanent implants usually require only a single, simple surgical procedure. Many implants are performed under local anesthesia.

Danger to Personnel:

All radioactive sources emit radiation that is dangerous. Afterloading techniques present less hazard as sources of radioactivity are kept in shielded containers until applicator is in place. PREGNANT FEMALES ARE NOT TO ASSIST IN THE O. R.

Precautions in the O. R.:

The physician or qualified person will handle the radioactive sources.

Sterilization:

Temporary implant, intracavitary $^{137}$Cs or $^{192}$Ir, (Afterloading Technique) No source sterilization required. Applicators and catheters will be contained in sterile packaging.

Temporary implant, intracavitary $^{137}$Cs, (Afterloading Technique not employed): Radioactive sources should be soaked a minimum of ten (10) minutes in 70% ethanol. This is a disinfecting procedure; sources shall not be steam sterilized.

Temporary implant, interstitial $^{137}$Cs: Radioactive sources should be soaked a minimum of ten (10) hours in two percent (2%) glutaraldehyde. Date of activation of glutaraldehyde shall be indicated and solution not used fourteen (14) days after activation. Sources shall be carefully removed with sterile technique and adequately rinsed with sterile water to remove all glutaraldehyde residue before implantation. Sources shall not be steam sterilized.

Permanent implant, interstitial $^{125}$I, $^{192}$Ir, or $^{103}$Pd: Sources may be steam sterilized (121 degree C); follow physician's instructions.
APPENDIX P

NURSING CARE

BRACHYTHERAPY SEALED SOURCES/RADIOPHARMACEUTICAL THERAPY

Patient _______________________________________________________ Room ______________________________

Hospital Number ______________________________ Physician ________________________________________

Radionuclide _______________ Number of Sources __________ Activity _______________________________

Source Administration __________ / __________ Source Removal __________ /__________

Date Time Date Time

Exposure Rate @ 1 meter ________ mR/hr __________ / __________ By ________________________________

Date Time

I. Checked Items Required:

_____ Waste Basket, Plastic Liner
_____ Laundry Bag
_____ Impermeable Disposable Gloves
_____ Paper Towels
_____ Disposal Eating Utensils (Isolation Tray)

II. Checked Items Shall Be Observed:

_____ 1. Private room with toilet mandatory.

_____ 2. Patient may not have visitors. Exception: ______________________________________________

_____ 3. No pregnant visitors. Female visitors should be asked if they are pregnant.

_____ 4. No visitors under eighteen (18) years of age.

_____ 5. No adjacent patient or visitor shall be placed within 1.8 meters (six (6) feet) of the patient.

_____ 6. Pregnant nurses and attendants shall NOT be responsible for routine care of this patient.

_____ 7. Wear impermeable disposable gloves when handling urinals, bed pans, emesis basins or other containers having any material obtained from the body of the patient. Wash impermeable disposable gloves before removing and then wash hands. The impermeable disposable gloves must be left in the patient's room in the designated waste container. These impermeable disposable gloves need not be sterile.

_____ 8. Nurses or other attendants shall not remain in the immediate proximity, 61 cm (two (2) feet) of the patient for more than a total of ________________________________.

_____ 9. Housekeeping may not enter the room.

_____ 10. Dietary may not enter the room.
11. Dietary shall furnish an Isolation Tray. Disposable items, including disposable plates, cups and eating utensils used by the patient shall be placed in the designated waste container. Contact Nuclear Medicine Ext. ______ for proper disposal of the contents of the designated waste container.

12. All clothes and bed linens used by the patient should be placed in the laundry bag provided and left in the patient's room to be checked by Nuclear Medicine Ext. ________.

13. Surgical bandages and dressings shall be changed only by the physician in charge or another individual designated by him and trained in techniques applicable to such cases.

14. Bed bath should be omitted while sources are in place.

15. Patient shall remain in bed unless orders to the contrary are written.

16. For gynecological patients, perineal care is not ordinarily given during the treatment, but the perineal pad may be changed when necessary.

17. No sources (needles or tubes) are to be removed by anyone other than the physician named above.

18. IF A SOURCE SHOULD GET FREE, it shall immediately be picked up with forceps and put in the corner of the room or placed in a container which is to be left in the room until the arrival of the physician and/or the RSO. Immediately contact:

Doctor ___________________________ Phone ________________________
RSO _____________________________ Phone ________________________

19. Vomiting within 24 hours after administration of treatment, urinary incontinence or excessive sweating within the first 48 hours may result in contamination of linen and/or floor. If radioactive urine and/or feces is spilled, call Nuclear Medicine Ext ______. Handle all contaminated material with impermeable disposable gloves and avoid spreading contamination.

20. The same toilet should be used by the patient at all times and it should be flushed three (3) times after use.

21. Nurses or attendants suspecting that their skin or clothing, including shoes, is contaminated shall notify Nuclear Medicine Ext ______. This person should remain in the patient's room and not walk around the hospital. If hands become contaminated, wash immediately with soap and water.

22. IN THE EVENT OF DEATH OR EMERGENCY SURGERY, immediately notify ___________________________ M.D., Phone No. __________________
and RSO ___________________________ Phone No. __________________
Do not remove the body from the room in event of death.

23. No patient is to be released from the hospital until all radioactive material is removed or decayed to safe levels.

24. At the conclusion of treatment, contact Nuclear Medicine Ext ______ and request a survey of the patient and room. In addition, survey any other area occupied by the patient to ensure that all sources have been removed from the patient and the room. At this time, all radiation signs will be removed and the room will be released for general use.

25. Other instructions.
APPENDIX Q

RADIONUCLIDE THERAPY SURVEY

Survey of the patient's room and surrounding areas shall be conducted as soon as practicable after administration of radionuclide and at conclusion of treatment to ensure that all sources have been removed from the patient and that no sources remain in the patient's room or other area occupied by the patient.

PATIENT _______________________________________________ ROOM ____________________________

HOSPITAL NO. ______________________________ AGE __________ SEX ________________________

THERAPIST ______________________________________________________________________________

PERMANENT IMPLANT OR INTERNAL DOSE ___ TEMPORARY IMPLANT _____________________________

SOURCE ADMINISTRATION ____________ / ____________ SOURCE REMOVAL _________ / ________

RADIONUCLIDE _______ TREATMENT DOSE _______ TECHNIQUE _____________________________

INSTRUMENT USED ________________ MODEL ______ SERIAL ______ BKG ______mR/hr

RADIATION SURVEY OF PATIENT & RADIATION SURVEY OF PATIENT &
SURROUNDING AFTER ADMINISTRATION SURROUNDING AT CONCLUSION OF TREATMENT

DATE __________________ DATE _______________
TIME _____________________ TIME __________________
SURVEYOR __________________________ SURVEYOR_______________________

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>mR/hr</th>
<th>LOCATION</th>
<th>mR/hr</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max @ Surface of Patient</td>
<td></td>
<td>Max @ Surface of Patient</td>
<td></td>
</tr>
<tr>
<td>Max @ 1 meter from Patient</td>
<td></td>
<td>Max @ 1 meter from Patient</td>
<td></td>
</tr>
<tr>
<td>Patient's Bedside, Left</td>
<td></td>
<td>Patient's Bedside, Left</td>
<td></td>
</tr>
<tr>
<td>Patient's Bedside, Right</td>
<td></td>
<td>Patient's Bedside, Right</td>
<td></td>
</tr>
<tr>
<td>Patient's Bedside, Foot</td>
<td></td>
<td>Patient's Bedside, Foot</td>
<td></td>
</tr>
<tr>
<td>Entrance Door</td>
<td></td>
<td>Entrance Door</td>
<td></td>
</tr>
<tr>
<td>Adjacent Room</td>
<td></td>
<td>Adjacent Room</td>
<td></td>
</tr>
<tr>
<td>Adjacent Room</td>
<td></td>
<td>Adjacent Room</td>
<td></td>
</tr>
<tr>
<td>Max in Unrestricted Area</td>
<td></td>
<td>Max in Unrestricted Area</td>
<td></td>
</tr>
<tr>
<td>(Identify)</td>
<td></td>
<td>(Identify)</td>
<td></td>
</tr>
</tbody>
</table>

SKETCH: (If Applicable)

X indicates location of radiation warning sign, patient bed and chart also posted.
### APPENDIX R

**ACTIVITIES AND DOSE RATES FOR AUTHORIZING PATIENT RELEASE†**

<table>
<thead>
<tr>
<th>COLUMN 1</th>
<th>COLUMN 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACTIVITIES AT OR BELOW WHICH PATIENTS MAY BE RELEASED</td>
<td>DOSE RATE AT 1 METER, AT OR BELOW WHICH PATIENTS MAY BE RELEASED*</td>
</tr>
<tr>
<td><strong>RADIONUCLIDE</strong></td>
<td><strong>Gbq</strong></td>
</tr>
<tr>
<td>¹ⁱ¹Ag</td>
<td>19</td>
</tr>
<tr>
<td>¹⁹⁹Au</td>
<td>3.5</td>
</tr>
<tr>
<td>⁵¹Cr</td>
<td>4.8</td>
</tr>
<tr>
<td>⁶⁴Cu</td>
<td>8.4</td>
</tr>
<tr>
<td>⁶⁷Cu</td>
<td>14</td>
</tr>
<tr>
<td>⁶⁷Ga</td>
<td>8.7</td>
</tr>
<tr>
<td>¹²³I</td>
<td>6.0</td>
</tr>
<tr>
<td>¹²⁵I</td>
<td>0.25</td>
</tr>
<tr>
<td>¹²²I implant</td>
<td>0.33</td>
</tr>
<tr>
<td>¹³¹I</td>
<td>1.2</td>
</tr>
<tr>
<td>¹¹¹In</td>
<td>2.4</td>
</tr>
<tr>
<td>¹⁹²Ir implant</td>
<td>0.074</td>
</tr>
<tr>
<td>³²P</td>
<td>**</td>
</tr>
<tr>
<td>¹⁰⁷Pd</td>
<td>1.5</td>
</tr>
<tr>
<td>¹⁸⁸Re</td>
<td>28</td>
</tr>
<tr>
<td>¹⁸⁸Re</td>
<td>29</td>
</tr>
<tr>
<td>⁴⁷Sc</td>
<td>11</td>
</tr>
<tr>
<td>⁷⁵Se</td>
<td>0.089</td>
</tr>
<tr>
<td>¹⁵³Sm</td>
<td>26</td>
</tr>
<tr>
<td>¹¹⁷mSm</td>
<td>1.1</td>
</tr>
<tr>
<td>⁸⁹Sr</td>
<td>**</td>
</tr>
<tr>
<td>⁹⁹mTc</td>
<td>28</td>
</tr>
<tr>
<td>¹⁰⁷Tl</td>
<td>16</td>
</tr>
<tr>
<td>⁹⁰Y</td>
<td>**</td>
</tr>
<tr>
<td>¹⁶⁷Yb</td>
<td>0.37</td>
</tr>
</tbody>
</table>

†The activity values were computed based on 5 millisieverts (0.5 rem) total effective dose equivalent.

*If the release is based on the dose rate at 1 meter in Column 2, the licensee must maintain a record as required by 10CFR35.75© because the measurement includes shielding by tissue. See Regulatory Position 3.1, Records of Release, for information on records.

**Activity and dose rate limits are not applicable in this case because of the minimal exposures to members of the public resulting from activities normally administered for diagnostic or therapeutic purposes.

**NOTES:** The mCi values were calculated using Equations 2 or 3 and the physical half-life. The Gbq values were calculated based on the mCi values and the conversion factor from mCi to Gbq. The dose rate values are calculated based on the mCi values and the exposure rate constants.

In general, the values are rounded to two (2) significant figures. However, values less than 0.37 Gbq (10 mCi) or 0.1 mSv (10 mrem) per hour are rounded to one significant figure. Details of the calculations are provided in NUREG-1492 (Ref. 2).

Although non-byproduct materials are not regulated by the NRC, information on non-byproduct material is included in this guide for the convenience of the licensee.

Agreement State regulations may vary. Agreement State licensees should check with the State regulations prior to using these values.
### APPENDIX S

**ACTIVITIES AND DOSE RATES ABOVE WHICH INSTRUCTIONS SHOULD BE GIVEN WHEN AUTHORIZING PATIENT RELEASE**

<table>
<thead>
<tr>
<th>RADIONUCLIDE</th>
<th>Gbq</th>
<th>mCi</th>
<th>mSv/hr</th>
<th>mrem/hr</th>
</tr>
</thead>
<tbody>
<tr>
<td>¹¹¹Ag</td>
<td>3.8</td>
<td>100</td>
<td>0.02</td>
<td>2</td>
</tr>
<tr>
<td>¹⁹⁹Au</td>
<td>0.69</td>
<td>19</td>
<td>0.04</td>
<td>4</td>
</tr>
<tr>
<td>⁵¹Cr</td>
<td>0.96</td>
<td>26</td>
<td>0.004</td>
<td>0.4</td>
</tr>
<tr>
<td>⁶⁴Cu</td>
<td>1.7</td>
<td>45</td>
<td>0.05</td>
<td>5</td>
</tr>
<tr>
<td>⁶⁷Cu</td>
<td>2.9</td>
<td>77</td>
<td>0.04</td>
<td>4</td>
</tr>
<tr>
<td>⁶⁷Ga</td>
<td>1.7</td>
<td>47</td>
<td>0.04</td>
<td>4</td>
</tr>
<tr>
<td>¹²³I</td>
<td>1.2</td>
<td>33</td>
<td>0.05</td>
<td>5</td>
</tr>
<tr>
<td>¹²⁵I</td>
<td>0.05</td>
<td>1</td>
<td>0.002</td>
<td>0.2</td>
</tr>
<tr>
<td>¹²⁵I implant</td>
<td>0.074</td>
<td>2</td>
<td>0.002</td>
<td>0.2</td>
</tr>
<tr>
<td>¹³¹I</td>
<td>0.24</td>
<td>7</td>
<td>0.02</td>
<td>2</td>
</tr>
<tr>
<td>¹¹¹In</td>
<td>0.47</td>
<td>13</td>
<td>0.04</td>
<td>4</td>
</tr>
<tr>
<td>¹⁹²Ir implant</td>
<td>0.011</td>
<td>0.3</td>
<td>0.002</td>
<td>0.2</td>
</tr>
<tr>
<td>³²P</td>
<td>**</td>
<td>**</td>
<td>**</td>
<td>**</td>
</tr>
<tr>
<td>¹⁰³Pd</td>
<td>0.3</td>
<td>8</td>
<td>0.007</td>
<td>0.7</td>
</tr>
<tr>
<td>¹⁸⁶Re</td>
<td>5.7</td>
<td>150</td>
<td>0.03</td>
<td>3</td>
</tr>
<tr>
<td>¹⁸⁸Re</td>
<td>5.8</td>
<td>160</td>
<td>0.04</td>
<td>4</td>
</tr>
<tr>
<td>⁴⁷Sc</td>
<td>2.3</td>
<td>62</td>
<td>0.03</td>
<td>3</td>
</tr>
<tr>
<td>⁷⁵Se</td>
<td>0.018</td>
<td>0.5</td>
<td>0.001</td>
<td>0.1</td>
</tr>
<tr>
<td>¹⁵³Sm</td>
<td>5.2</td>
<td>140</td>
<td>0.06</td>
<td>6</td>
</tr>
<tr>
<td>¹¹⁷mSm</td>
<td>0.21</td>
<td>6</td>
<td>0.009</td>
<td>0.9</td>
</tr>
<tr>
<td>⁸⁹Sr</td>
<td>**</td>
<td>**</td>
<td>**</td>
<td>**</td>
</tr>
<tr>
<td>⁹⁹ᵐTc</td>
<td>5.6</td>
<td>150</td>
<td>0.12</td>
<td>12</td>
</tr>
<tr>
<td>²⁰¹Tl</td>
<td>3.1</td>
<td>85</td>
<td>0.04</td>
<td>4</td>
</tr>
<tr>
<td>⁹⁰⁰Y</td>
<td>**</td>
<td>**</td>
<td>**</td>
<td>**</td>
</tr>
<tr>
<td>¹⁶⁰Yb</td>
<td>0.73</td>
<td>2</td>
<td>0.004</td>
<td>0.4</td>
</tr>
</tbody>
</table>

*The activity values were computed based on 1 millisieverts (0.1 rem) total effective dose equivalent.

**Activity and dose rate limits are not applicable in this case because of the minimal exposures to members of the public resulting from activities normally administered for diagnostic or therapeutic purposes.

NOTES: The mCi values were calculated using Equations 2 or 3 and the physical half-life. The Gbq values were calculated based on the mCi values and the conversion factor from mCi to Gbq. The dose rate values are calculated based on the mCi values and the exposure rate constants.

In general, the values are rounded to two (2) significant figures. However, values less than 0.37 Gbq (10 mCi) or 0.1 mSv (10 mrem) per hour are rounded to one significant figure. Details of the calculations are provided in NUREG-1492 (Ref. 2).

Although non-byproduct materials are not regulated by the NRC, information on non-byproduct material is included in this guide for the convenience of the licensee.

Agreement State regulations may vary. Agreement State licensees should check with the State regulations prior to using these values.
### APPENDIX T

**ACTIVITIES OF RADIOPHARMACEUTICALS THAT REQUIRE INSTRUCTIONS AND RECORDS WHEN ADMINISTERED TO PATIENTS WHO ARE BREAST-FEEDING AN INFANT OR CHILD**

<table>
<thead>
<tr>
<th>RADIONUCLIDE</th>
<th>COLUMN 1 ACTIVITY ABOVE WHICH INSTRUCTIONS ARE REQUIRED</th>
<th>COLUMN 2 ACTIVITY ABOVE WHICH A RECORD IS REQUIRED</th>
<th>COLUMN 3 EXAMPLES OF RECOMMENDED DURATION OF INTERRUPTION OF BREAST-FEEDING*</th>
</tr>
</thead>
<tbody>
<tr>
<td>$^{131}$I NaI</td>
<td>0.01 MBq, 0.0004 mCi</td>
<td>0.07 MBq, 0.002 mCi</td>
<td>Complete cessation (for this infant or child)</td>
</tr>
<tr>
<td>$^{123}$I NaI</td>
<td>20 MBq, 0.5 mCi</td>
<td>100 MBq, 3 mCi</td>
<td>24 hr for 370 MBq (10 mCi)</td>
</tr>
<tr>
<td>$^{123}$I OIH</td>
<td>100 MBq, 4 mCi</td>
<td>700 MBq, 20 mCi</td>
<td>12 hr for 150 MBq (4 mCi)</td>
</tr>
<tr>
<td>$^{123}$I mIBG</td>
<td>70 MBq, 2 mCi</td>
<td>400 MBq, 10 mCi</td>
<td></td>
</tr>
<tr>
<td>$^{123}$I OIH</td>
<td>3 MBq, 0.08 mCi</td>
<td>10 MBq, 0.4 mCi</td>
<td></td>
</tr>
<tr>
<td>$^{131}$I OIH</td>
<td>10 MBq, 0.30 mCi</td>
<td>60 MBq, 1.5 mCi</td>
<td></td>
</tr>
<tr>
<td>$^{99m}$Tc DTPA</td>
<td>1,000 MBq, 30 mCi</td>
<td>6,000 MBq, 150 mCi</td>
<td>12.6 hr for 150 MBq (4 mCi)</td>
</tr>
<tr>
<td>$^{99m}$Tc MAA</td>
<td>50 MBq, 1.3 mCi</td>
<td>200 MBq, 6.5 mCi</td>
<td>24 hr for 1,100 MBq (30 mCi)</td>
</tr>
<tr>
<td>$^{99m}$Tc Pertechnetate</td>
<td>100 MBq, 3 mCi</td>
<td>600 MBq, 15 mCi</td>
<td>12 hr for 440 MBq (12 mCi)</td>
</tr>
<tr>
<td>$^{99m}$Tc DISIDA</td>
<td>1,000 MBq, 30 mCi</td>
<td>6,000 MBq, 150 mCi</td>
<td></td>
</tr>
<tr>
<td>$^{99m}$Tc Glucoheptonate</td>
<td>1,000 MBq, 30 mCi</td>
<td>6,000 MBq, 170 mCi</td>
<td></td>
</tr>
<tr>
<td>$^{99m}$Tc HAM</td>
<td>400 MBq, 10 mCi</td>
<td>2,000 MBq, 50 mCi</td>
<td></td>
</tr>
<tr>
<td>$^{99m}$Tc MIBI</td>
<td>1,000 MBq, 30 mCi</td>
<td>6,000 MBq, 150 mCi</td>
<td></td>
</tr>
<tr>
<td>$^{99m}$Tc MDP</td>
<td>1,000 MBq, 30 mCi</td>
<td>6,000 MBq, 150 mCi</td>
<td></td>
</tr>
<tr>
<td>$^{99m}$Tc PYP</td>
<td>900 MBq, 25 mCi</td>
<td>4,000 MBq, 120 mCi</td>
<td></td>
</tr>
<tr>
<td>$^{99m}$Tc Red Blood Cells</td>
<td>400 MBq, 10 mCi</td>
<td>2,000 MBq, 50 mCi</td>
<td>6 hr for 740 MBq (20 mCi)</td>
</tr>
<tr>
<td>$^{99m}$Tc Red Blood Cells</td>
<td>1,000 MBq, 30 mCi</td>
<td>6,000 MBq, 150 mCi</td>
<td></td>
</tr>
<tr>
<td>$^{99m}$Tc Sulphur Colloid</td>
<td>300 MBq, 7 mCi</td>
<td>1,000 MBq, 35 mCi</td>
<td>6 hr for 440 MBq (12 mCi)</td>
</tr>
<tr>
<td>$^{99m}$Tc DTPA Aerosol</td>
<td>1,000 MBq, 30 mCi</td>
<td>6,000 MBq, 150 mCi</td>
<td></td>
</tr>
<tr>
<td>$^{99m}$Tc MAG3</td>
<td>1,000 MBq, 30 mCi</td>
<td>6,000 MBq, 150 mCi</td>
<td></td>
</tr>
<tr>
<td>$^{99m}$Tc White Blood Cells</td>
<td>100 MBq, 4 mCi</td>
<td>600 MBq, 15 mCi</td>
<td>24 hr for 1,100 MBq (5 mCi)</td>
</tr>
<tr>
<td>$^{67}$Ga Citrate</td>
<td>1 MBq, 0.04 mCi</td>
<td>7 MBq, 0.2 mCi</td>
<td>1 month for 150 MBq (4 mCi)</td>
</tr>
<tr>
<td>$^{51}$Cr EDTA</td>
<td>60 MBq, 1.6 mCi</td>
<td>300 MBq, 8 mCi</td>
<td>2 weeks for 50 MBq (1.3 mCi)</td>
</tr>
<tr>
<td>$^{111}$In White Blood Cells</td>
<td>10 MBq, 0.2 mCi</td>
<td>40 MBq, 1 mCi</td>
<td>1 week for 7 MBq (0.2 mCi)</td>
</tr>
<tr>
<td>$^{201}$TI Chloride</td>
<td>40 MBq, 1 mCi</td>
<td>200 MBq, 5 mCi</td>
<td>2 weeks for 110 MBq (3 mCi)</td>
</tr>
</tbody>
</table>

*The duration of interruption of breast-feeding is selected to reduce the maximum dose to a newborn infant to less than 1 mSv (0.1 rem), although the regulatory limit is 5 mSv (0.5 rem). The actual doses that would be received by most infants would be far below 1 mSv (0.1 rem). Of course, the physician may use discretion in the recommendation, increasing or decreasing the duration of interruption.

**NOTES:** Activities are rounded to one significant figure, except when it was considered appropriate to use two significant figures. Details of the calculations are shown in NUREG-1492, Regulatory Analysis on Criteria for the Release of Patients Administered Radioactive Material (Ref. 2).

If there is no recommendation in Column 3 of this table, the maximum activity normally administered is below the activities that require instructions on interruption or discontinuation on breast-feeding.

Although non-byproduct materials are not regulated by the NRC, information on non-byproduct material is included in this guide for the convenience of the licensee.

Agreement State regulations may vary. Agreement State licensees should check with the State regulations prior to using these values.
Patient, _______________________________________________ observe these instructions for ____________ days.

1. Sleep alone. If employed, take ______ days off from work.

2. Whenever possible use separate toilet facilities that are not used by other members of the family.

3. Use care so that the area around the toilet is not soiled with urine. Flush the toilet three (3) times after each use.

4. Bed linens and underclothing should be washed separately after the other washing has been completed. Then the tub or washing machine should be rinsed twice.

5. Wash bathtub or shower with soap and cleanser after tub or shower bath.

6. Contact the Nuclear Medicine Department,_________________________, if you have questions.

________________________________________M.D.
Patient: _____________________________________________

A small radioactive source has been placed (implanted) inside your body. The source is actually many small metallic pellets or seeds, which are each about 1/3 to 1/4 of an inch long, similar in size and shape to a grain of rice. To minimize exposure to radiation to others from the source inside your body, you should do the following for ___________ days.

1. Stay a distance of _____ feet from______________________________________________.

2. Maintain separate sleeping arrangements.

3. Minimize time with children and pregnant women.

4. Do not hold or cuddle children.

5. Avoid public transportation.

6. Examine any bandages or linens that come into contact with the implant site for any pellets that may have come out of the implant site.

7. If you find a seed or pellet that falls out:

   DO NOT HANDLE it with you fingers. Use something like a spoon or tweezers to place it in a jar or other container that you may close with a lid.

   Place the container with the seed or pellet in a location away from people.

   Notify your physician at once.

______________________________________ M.D.
**APPENDIX W**

"\(^{90}\text{STRONTIUM OPTHALMIC APPLICATOR THERAPY RECORD}\)"

<table>
<thead>
<tr>
<th>Patient</th>
<th>Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Hospital No.</th>
<th>Room</th>
<th>Age</th>
<th>Sex</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Therapist</th>
<th>M.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DATE</th>
<th>TIME SOURCE</th>
<th>TREATMENT TIME</th>
<th>TREATMENT DOSE</th>
<th>TECHNIQUE</th>
<th>TIME SOURCE RETURNED TO</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>REMOVED FROM NUCLEAR RADIOLOGY LABORATORY</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

|      |               |               |               |           |                         |
|      |               |               |               |           |                         |
|      |               |               |               |           |                         |
|      |               |               |               |           |                         |
|      |               |               |               |           |                         |
|      |               |               |               |           |                         |
|      |               |               |               |           |                         |
APPENDIX X

INSTRUCTIONS FOR FAMILY OF RELEASED PATIENT

Patient Name ______________________________________________________________________________________

For further information contact ________________________________ Phone No. ______________________________

Please show this form to every physician consulted concerning the patient until

(DATE) ___________________________________________________________________________________________

Patient Name_______________________________________ was treated on __________________________________

with ________________ mCi of ________________________ in the form of ___________________________________

NO SPECIAL RADIATION SAFETY PRECAUTIONS ARE REQUIRED AFTER (DATE) ______________________

UNTIL THAT DATE:

Persons under 45 years of age should not remain closer than the following distances from the patient for the time period indicated below:

________________________ to _________________________

Date Date

Permissible distance______ feet or more for ________ hours/week. At other times, remain farther than six (6) feet.

SPECIAL PRECAUTIONS:

a) Spouse or other individuals caring for patient: _____________________________________________________

b) Children or pregnant women: __________________________________________________________________

______________________________________________________________________________________________

c) Sleeping arrangements: _______________________________________________________________________

______________________________________________________________________________________________

If the patient is to be hospitalized, or if death should occur, notify the following individuals immediately:

______________________________________________________________________________________________

______________________________________________________________________________________________

______________________________________________________________________________________________

(A copy of this form should be kept with the patient's record.)
APPENDIX Y

REPORT OF RADIOACTIVITY OF CADAVER

The physician in charge of the case should fill out the following and attach to the patient’s chart and death certificate. The Radiation Safety Officer is available for assistance to the physician.

Hospital: ___________________________________________

Name of Deceased: ___________________________________

Hospital Number: ______________________ Date and Time of Death: _________________________

Diagnosis: __________________________________________________

Radioactivity Survey - Before Autopsy:

Radionuclide: __________________________ Activity (mCi): ____________________

Last Treatment Date: __________ Hour: __________ a.m.;p.m.

Survey Date: ______________________________ Hour: ______________ a.m./p.m.

Elapsed Time from Last Treatment to Survey in Days: _______________________________________

Maximum Level of Radiation @ Surface of Body (mR/hr): _________________________________

Instrument Used: _____________________________________________________________________

Model #: ____________________ Serial #: ______________________ Calibration Date: __________

Signed: _____________________________________________

Radiation Safety Officer
INSTRUCTIONS TO FUNERAL DIRECTOR FOR EMBALMING BODY CONTAINING RADIOACTIVE MATERIAL

Hospital: ____________________________________________________________

Name of Deceased: ____________________________________________________

Date of Death: ________________________________________________________

Radionuclide Used: ______ Half-life: ______ Radiation Emitted: _______

Chemical Form: _______________________________________________________

Estimated Activity at Time of Death (mCi): _______________________________

Critical Organs or Sites: _________________________________________________

This is to certify that the remains of ______________________________________

have been examined on __________________________ by ________________________

                           Date                              Radiation Safety Officer

_____ This body does not contain significant amounts of radioactive material. No special precautions are required if standard embalming practices are used.

_____ This body contains significant amounts of radioactive material. The following precautions are to be observed:

____________________________________________

Radiation Safety Officer

____________________________________________

Date
APPENDIX AA

AUTOPSY OR SURGERY PRECAUTIONS

The following are main precautions required for autopsies or surgery on bodies containing large doses of radionuclides:

A. General

1. Impermeable disposable gloves must always be worn to prevent contamination of skin and nails with material difficult to remove.

2. If the combined beta and gamma dose rate is high enough to deliver more than the permissible dose to hand or whole body, the autopsy or surgery should be performed by a team of physicians working in relay.

3. Tissue and organs removed should be handled with long handled forceps and scissors. Specimens should be refrigerated in jars or other containers, or fixed, and suitably labeled to indicate when they can safely be worked on and studied.

B. Special

1. All tissues and body fluids should be surveyed by the RSO and handled according to his recommendations. Urine and blood should be removed and stored or disposed.

2. Tissue specimens held three (3) months can be considered inactive.
APPLICATION FOR AUTHORIZATION TO USE RADIONUCLIDES/RADIATION SOURCES FOR IN VIVO HUMAN USE

1. Date: _____ New Application _____ Amendment _____ Renewal

2. Applicant Name: _____________________ Degree: ____________________
   Department: _____________________________________ Box Number: _______________________
   Telephone Number: _______________________________

3. Description of Radiation Source(s). Describe all the radiation sources that subjects will encounter:
   a. Radioactive Material:
      
      | Radionuclide | Activity Each | Compound & Method of Administration | Number of Administrations |
      |--------------|---------------|-----------------------------------|--------------------------|
      | Each         | Each Administration | Each Subject |
      | Radionuclide | Administration | Administration | Each Subject |

   Where will the material be administered and by whom?

   b. X-Ray Radiography:
      
      | Type         | Film | mAs/ | Number of | Entrance |
      | Exam         | Size | kVp  | Films/Exam | Distance | Filter | mR |

   Where will radiography occur and who will supervise?

   c. Fluoroscopy:
      
      | Anatomical Area | Beam Size | kVp | mA | Fluoroscopy Time | Entrance Exposure Rate (mR/MA-minute) |

   Where will fluoroscopy occur and who will supervise?
4. Experimental Limitations:
   a. Explain why it is necessary to use radiation rather than alternate procedures:

   b. Explain the factors that determine the minimum amount of radiation that is necessary, i.e. limits based on instrument sensitivity or physiological parameters:

5. Description of Subjects and Selection Criteria
   a. Age Distribution:

   b. Sex:

   c. Special basis for selection (disease, abnormality, occupation, etc.):

   d. Number of special selected subjects:

   e. Indicate time frame; how many subjects will be studied each year?

   f. How will the subject benefit from the study?

   g. Are potential subjects rejected if they are or might be pregnant?
      How is nonpregnancy assured?

   h. Are potential subjects rejected if they:
      1) Had volunteered for similar studies within the past year?
      2) Had significant medical exposure?
      3) Receive significant occupational exposure?
      How are these conditions assured?
6. Radiation Protection for Subjects:

Describe all methods for protecting the subject from unnecessary radiation, i.e. gonadal shielding, thyroid block against iodine, etc.:

7. Radiation Dosimetry:

Include dosimetry calculations and summary of radiation doses. References should be cited if used:

8. Summary of Risk to Subject:

Attach copy of Consent Form to be employed.

9. The Committee on Use of Human Subjects:

Pending review ___________________________

Approved ___________________________

(Date)

10. Experience Form Attached: _____Yes _____ No

Applicant's Signature: _________________________________________

(IN INK SIGNATURE AND DATE)

11. Review by Radiation Safety Committee:

By:_________________________________________________  Date:____________________

Recommendation: _____Approve       _____Disapprove

Comments:
RADIATION SAFETY COMMITTEE

EXPERIENCE FORM
FOR
IN VIVO HUMAN RADIATION USE

NAME: ______________________________________________ DATE:__________________________

DEPARTMENT: _______________________________________

Formal Courses:
Give names of formal courses taken which would assist in the understanding of radiation protection problems (e.g. nuclear or atomic physics, health physics, radionuclide technology, radiation biology, etc.). Specify when and where taken.

Practical Experience:
Summarize in 200 words or less. Indicate radionuclides and chemical forms used, amounts, when and where:

_____________________________________

Signature
Application for Use of Radioactive Material/Radiation Source

1. Date: ______ New Application ______ Amendment ______ Renewal

2. Applicant Name: ________________________________ Degree: ______
Department: ________________________________ Box Number: _____
Telephone Number: ________________________________

3. Check Category for Intended Use:
   Animal Use _____
   Class Room Use _____
   In Vitro Use _____
   In Vivo Human Use _____ (Use In Vivo Human Use Form)

4. Radiation Source(s):
   Radionuclide Physical Form Possession Use
   Chemical/ Maximum mCi Maximum mCi Use (Orders/Month)

Describe other radiation sources (i.e. x-ray unit, x-ray diffraction, etc.):

5. Describe proposed use of each item:
6. List individuals who will handle requested material (Name and Title/Position):

7. List Radiation Detection Instruments available (survey meter, beta/gamma counting systems, etc.):

<table>
<thead>
<tr>
<th>Type</th>
<th>Manufacturer</th>
<th>Model #</th>
<th>Radiation</th>
<th>Location</th>
<th>Detected</th>
<th>(Room Number)</th>
</tr>
</thead>
</table>

List radiation sources available (x-ray units, diffraction units, sealed sources, etc.):

<table>
<thead>
<tr>
<th>Type</th>
<th>Manufacturer</th>
<th>Model #</th>
<th>Location (Room Number)</th>
</tr>
</thead>
</table>

8. Describe Storage of Material (Facilities, Containers, Special Shielding):


10. Describe special laboratory radiation safety practices, including monitoring practices:

11. Describe waste disposal procedures and estimate quantities per month of liquid, solid waste. Describe type of waste anticipated (i.e. aqueous or nonaqueous, infectious, flammable, etc.):
12. Indicate rooms where radioactive materials and/or sources of radiation will be stored, used, and site for sewer disposal, if appropriate, by drawing a floor plan of the facility:

13. For In Vitro Human Use:
   a. Attach Consent Form to be employed.
   b. Committee on Use of Human Subjects:
      Pending Review: _____
      Approved: __________________________________________
                  (Date)

14. Experience Form Attached: _____Yes _____ No

15. Applicant's Signature: __________________________________________
     (In ink signature and date)

16. Review by Radiation Safety Committee:
   By: ____________________________ Date: ____________________________
   Recommendation: _____Approve _____ Disapprove
   Comments:
RADIATION SAFETY COMMITTEE

EXPERIENCE FORM
FOR
USE OF RADIOACTIVE MATERIAL/RADIATION SOURCE

NAME: ______________________________ DATE: ______________________________

DEPARTMENT: __________________________________________

Formal Courses:
Give names of formal courses taken which would assist in the understanding of radiation protection problems (e.g. nuclear or atomic physics, health physics, radionuclide technology, radiation biology, etc.). Specify when and where taken.

Practical Experience:
Summarize in 200 words or less. Indicate radionuclides and chemical forms used, amounts, when, and where:

__________________________________

Signature
APPENDIX DD

RADIATION INCIDENT PLAN

A. Purpose

To outline a plan of action for meeting the basic requirements of Tulane University's role in an external disaster situation resulting in casualties who are suspected or known to have become contaminated with transferable radioactive material, either by ingestion, deposition on skin or entrance through open wounds.

B. Objectives

1. To handle radiation casualties.
2. To treat radiation casualties using the best medical standards.
3. To avoid or minimize radiation exposure to hospital personnel and patients.
4. To continue the usual hospital functions.
5. To integrate the specialized supplies and experienced radiation safety personnel into hospital routines.

C. Notification of Disaster

1. Any person receiving information of a disaster resulting in radiation casualties should immediately relay such information to the Emergency Department Charge Nurse who will complete the Radiation Incident Report Form.

2. Upon verification of such an incident, the Emergency Department Charge Nurse shall immediately notify the Office of Environmental Health and Safety (OEHS) 988-5486 of this emergency situation and request that the Radiation Safety Officer (RSO) respond. If the incident occurs after normal work hours, holidays or weekends, the Emergency Department Charge Nurse shall contact Hospital Communications, and require them to immediately contact by pager or telephone the OEHS On Call staff member.

Designated responding staff members are listed in the following priority for contact:

a. Radiation Safety Officer (RSO)
b. Medical Physicist (Radiology)
c. Deputy Radiation Safety Officer (DRSO)
d. Hospital Safety Officer (HSO)

The above staff may request that other OEHS members assist in the emergency response activity.

3. The RSO or designee will contact the notifying agency to obtain additional information as necessary and notify the Radiation Protection Division (504) 756-0160.

4. The Emergency Department Charge Nurse or Physician in conjunction with the RSO will evaluate the situation and decide whether to implement the Radiation Incident Plan.
5. Upon Implementation of this plan, the Emergency Department will contact the telephone operators and advise them to notify the following of the emergency situation:

Administrator On Call

Nursing Supervisor (Off Shifts)

TUHSC Police

Emergency Department Medical Director

Environmental Services

Public Relations

6. The RSO or designee upon their arrival at the Emergency Department will then coordinate the activation of the Radiation Emergency Area (REA). The Emergency Department Charge Nurse will give the completed Radiation Incident Form to the first responding staff member. Prior to arrival of the RSO or designee, Emergency Department personnel will begin to establish the Radiation Emergency Area (REA) by using the appropriate signage and ropes.

D. Planning

1. The Emergency Room Nurses will evaluate the status of the patients present and work with the physicians to discharge or re-locate as many as possible. All pregnant women will be moved to other areas of TUHC.

2. Communications via the Edac radio between the ambulance and Emergency Room staff will establish the extent of trauma injuries and level of contamination. A decision will be made by the RSO, the Emergency Room Charge Nurse or the Emergency Room Physician whether to direct patients to the decontamination or to the treatment areas inside the designated Radiation Emergency Area (REA).

3. The Radiation Emergency Area (REA) will be established in the following manner:

   a. Room 1074 will be used for Decontamination and rooms 1072 and 1070 will be used for post-decontamination treatment. Drain covers will not be needed to prevent radioactive materials from entering the sewer system.

   b. The RSO or designee will establish the Control Points where a staff member will be positioned with a survey meter.

   c. The REA will be roped off and posted with signs that read, "Caution, Radiation Area." Ropes and signs will be used as provided by the RSO or designee. See REA in Appendix for rope locations.

   d. Plastic sheets should be placed on top of the stretcher mattresses.

4. The RSO shall designate person(s) to man Control Points and shall check all radiation monitoring equipment to insure it is in working order.

5. Office of Environmental Health & Safety (OEHS) and TUHSC Police representatives will be responsible for insuring all doors are opened in the receiving route of REA, assisting with providing ropes and signs in the REA area and insuring area is free from by-standers and nonessential equipment.
6. Public Relations and/or Nursing Supervisor will be responsible for all press information which has been reviewed for technical content and approved by the physician and RSO prior to release.

E. Radiation/decontamination Team

1. Physicians
   a. Emergency Department Physicians shall be in charge of medical care.
   b. The RSO or designee shall be in charge of directing decontamination procedures.
   c. The RADIATION ACCIDENT PATIENT FORM shall be employed with the assistance of the RSO or designee.

2. Emergency Room Personnel will be assigned tasks by the RSO or designee.
   a. Two RNs to assist physicians with patients.
   b. One Nursing Assistant to be in the REA to receive supplies from outside REA and record treatment.
   c. One Nursing Assistant to be outside REA to obtain supplies, as needed.

3. Radiation Safety Personnel (See RADIATION INCIDENT PLAN CRITICAL PERSONNEL)
   a. Radiation Safety Officer (RSO) and other responding OEHS personnel.

F. Receiving Procedures

1. Persons suspected of being contaminated with radionuclides will be received at the Emergency Department.

2. Radiation/Decontamination Team (Physicians, Nurses and radiation safety personnel) meeting the transporting vehicle will be attired as follows:
   a. Gowns or other disposable outer clothing to include, universal precaution - personal protective attire, i.e. gloves and goggles as needed.
   b. Pocket dosimeters worn at neck region where they can be easily removed by other persons for monitoring. They should be read at intervals during decontamination and reported to the Control Point attendant.

3. The patient will be met at transporting vehicle with a stretcher having the top surface of the mattress covered.

4. The physician will evaluate the patient to determine if there is any medical problem or associated injury requiring care prior to decontamination.

5. If immediate medical care is not needed, then the patient shall be secured in plastic wrap and transported to the decontamination shower.

6. The RSO or designee shall monitor the patient and log all contaminated areas with location and exposure measurement on Radiation Accident Exposure Log. (See RADIATION ACCIDENT EXPOSURE LOG)
7. All patient clothing shall be removed and placed in plastic bags labeled "patient's clothing". Valuables shall
be bagged and labeled with patient information. The RSO or designee will be responsible for disposition of
clothing and valuables.

8. The Emergency Room Physician will proceed with required critical patient care and evaluation. The RSO or
designee will collect swab samples of contaminated areas for radiation safety personnel to monitor. These
samples may include samples from ear canals, nostrils, scalp, fingernails, toenails, mouth and contaminated
areas of body, etc. All samples are to be placed in separate containers labeled with patient's name, body area
and time obtained.

9. Physicians shall proceed with decontamination of radioactive areas (OPEN WOUNDS FIRST PRIORITY).

10. The patient shall shower or lightly scrub all contaminated areas with betadine prep without breaking the skin.
Medical staff may assist as necessary.

11. The RSO or designee will again monitor following decontamination and log dose and, if necessary, repeat the
shower and scrub procedure.

12. After decontamination, the patient may be admitted to a regular hospital bed. If the patient has inhaled or
ingested radionuclides, he should be placed in a private room. All urine and feces shall be saved for
monitoring if there is suspected internal contamination. Radiation signs shall be placed on room door.

13. The transporting vehicle and personnel will be notified by the RSO to REMAIN WITH THE VEHICLE until
monitored and released or instructed by the RSO concerning decontamination.

14. The RSO or designee shall survey the ambulance and Emergency Medical Service (EMS) personnel prior to
their release to duty. Decontamination procedures will be performed at the direction of the RSO or designee.

15. Area entrances and hallways will be monitored by the RSO or designee after patient is located in Radiation
Emergency Area so as to prevent tracking to other hospital areas.

G. Control Point Functions

1. The RSO or designee shall assign OEHS and TUHSC Police staff members to function as Control Point
attendants. One TUHSC Police Officer with the help of Emergency Department staff will secure the REA
and then report to the Emergency Department ramp, one TUHSC Police Officer will be posted adjacent to the
Nursing Station. One OEHS person will install the ropes and signs, and then assist in other radiation safety
functions.

2. The attendants shall be responsible for:

   a. Restricting access to only personnel authorized by the attending physician, Radiation Safety Officer or
      Nursing Supervisor.

   b. Assure that no person or object is allowed to leave REA (after patient admitted) until monitoring has
      been performed and there is no detectable radionuclide contamination. Permission will be given by the
      RSO or designee.
H. Radiation Emergency Area (REA)

1. The REA will consist of the Emergency Department.

2. The Control Points will be established in corridors outside the REA.

3. Medical personnel attending the patient will wear protective clothing and a pocket dosimeter.

4. Attending personnel will remove outer protective clothing and place in plastic bag labeled radioactive before leaving REA.

5. All personnel will be monitored before leaving area.

6. No supplies, clothing, etc., will leave the area until monitored.

7. The REA will remain closed to all personnel until it has been determined to be free of radioactive contamination by the RSO or designee.

8. The RSO or designee will dictate need for masks, respirators, as well as need to shut off air supply and vents to avoid airborne contamination by notifying the Maintenance Department.

9. Staff performing decontamination with water should wear plastic or rubber aprons and gloves.

10. Specimens and samples will be collected and obtained according to needs as ascertained by the RSO.

11. Disposal of all radioactive material will be supervised by RSO or designee.

I. Procedures for Transfer of Patient

1. Following decontamination and emergency treatment, the patient may be transferred from the REA to the appropriate section of the hospital.

J. Extreme Medical Emergency Requiring Immediate Surgery

1. In the event of the above circumstances, the patient will be secured in plastic sheet to prevent spread of contamination and taken directly to the Operating Room on an uncontaminated stretcher accompanied by the RSO or designee.

2. The OR personnel will be notified of the contaminated patient by the RSO or designee.

3. The Operating Room becomes a part of the REA and no personnel or objects may be removed from the area unless monitored and found to be free of contamination.

4. Removal of patient following surgery and decontamination will be under supervision of RSO or designee in coordination with attending physician.
K. Personnel Clearance

1. Each team member goes to Control Point where the RSO or designee is located and removes protective clothing (placing all of it in a plastic bag designated for contaminated linen and trash). Contaminated material will be transported to the OEHS Hazardous Waste Room in the Medical School.

   a. Remove outer gloves first, turning them inside out as they are pulled off.

   b. Give dosimeters to Radiation Safety Officer or designee.

   c. Remove outer surgical gown, turning it inside out; avoid shaking.

   d. Remove head cover.

   e. Take shower only at the direction of the RSO.

L. Radiation Safety Officer and Designee Responsibilities

(Several OEHS staff members may be asked to assist; OEHS will be responsible for contacting them and assigning duties.)

1. Supervise radiation protection at the hospital and restrict access to authorized persons only.

2. Install ropes and signs in the REA and insure that Control Points are secure.

3. Distribute dosimeters and record name, dosimeter number and initial reading of each unit. All equipment will be checked for proper operation.


5. Monitor transport vehicle and personnel before they leave area.

6. Monitor route from transport vehicle to REA and decontaminate if necessary.

7. Collect all specimens to be analyzed for radiation content.

8. Collect dosimeters, monitor and evaluate personnel throughout the emergency.


10. Collect used protective clothing, wastes, samples and equipment for decontamination, evaluation and/or disposal.

11. Record radiation survey findings of personnel and property, evaluate and recommend follow-up as necessary to be completed following the incident.

12. Provide annual training to all staff involved with the radiation incident response.

13. Annually inspect decontamination supplies located in the Emergency Department.
M. Emergency Department Physician Responsibilities

1. Evaluate and treat the patient's critical medical problems and then proceed to decontamination.

N. TUHSC Police Responsibilities

1. The TUHSC Officer will remain outside the roped area and not allow anyone to enter the secured location without the approval of the RSO or designee.

2. Allows no person or object to leave REA without approval of the RSO or designee.

3. Makes sure that all doors are opened in the receiving route of REA and elevators are available, if needed.

4. Assists with roping off REA area.

O. Public Relations Responsibilities

1. Provide all press releases.

P. Environmental Services Responsibilities

1. Environmental Services supervising personnel shall be available to obtain additional supplies, when requested.

2. Clean REA under direction and supervisory of the RSO or the Deputy RSO.

Q. Emergency Department Charge Nurse Responsibilities

1. Work with physician to discharge as many Emergency Room patients as possible or move them out of the REA.

2. Work with the ED Staff to assist in the REA.

R. Nurse Working Within REA Responsibilities

1. Work directly with the physician in delivering care to the patient.

2. Collects specimen samples, wash contaminated areas, etc.

3. Requests and receives supplies from outside the REA.

4. Records information regarding care for patient’s chart.

S. Emergency Department Personnel Outside REA Responsibilities

1. Obtain any supplies or equipment needed. (See DECONTAMINATION SUPPLIES)

2. Supply medications as needed.

T. Final Survey REA

1. The Radiation Safety Officer and designee shall perform a radiation survey of the REA to confirm all areas, furniture, instruments and supplies are safe and contamination free.
Contact Charles Reindl at 988-5486 for a copy of the Radiation Emergency Area Plan.
RADIATION DISASTER PLAN CRITICAL PERSONNEL

(After Hours Contact Operator 988-5263)

1. Radiation Safety Officer:
   Name: Charles F. Reindl, M.S.
   Work: 988-5486

2. Medical Physicist (Radiology):
   Name: James Terry, Ph.D.
   Work: 988-5486

3. Deputy Radiation Safety Officer
   Name: Jim Balsamo Jr., M.P.H.
   Work: 988-5486

4. Hospital Safety Officer
   Name: Skip Peoples
   Work: 988-7139

5. Medical Director of Radiology/Nuclear Medicine
   Name: Harold Neitzschman
   Work: 988-7627

6. Director of Radiology/Nuclear Medicine
   Name: Sharon Hafner, R.T.
   Work: 988-6093

7. Director of Emergency Room Services
   Name: Bryan Dean, R.N.
   Work: 988-1483

8. Security
   Name: On Duty
   Work: 988-5555 or 988-5532

(After normal work hours, telephone the TUHC operator to have the above personnel contacted; the TUHC operator # is (988-5532)
# REA CONTROL SHEET

## Personnel Information:

<table>
<thead>
<tr>
<th>Name:</th>
<th>Social Security No:</th>
<th>Date of Birth:</th>
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</thead>
<tbody>
<tr>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Dosimeter Number</th>
<th>Dosimeter Reading mR</th>
<th>Time a.m./p.m.</th>
<th>Dosimeter Reading mR</th>
<th>Time a.m./p.m.</th>
<th>Surface Monitoring mR/hr.</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
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</tbody>
</table>

**Instrument Used in Surface Monitoring:**

- Model #: [ ]
- Serial #: [ ]

**Calibrated:**
### RADIATION INCIDENT REPORT FORM

(To be used to enter available data when a notification is received of the impending admission of a case involving radiation exposure or contamination.)

**A. Person making notification:**

<table>
<thead>
<tr>
<th>Name: ____________________________________________</th>
<th>Date: __________________________</th>
</tr>
</thead>
<tbody>
<tr>
<td>Title: __________________________________________</td>
<td>Affiliation: __________________</td>
</tr>
<tr>
<td>Address: ________________________________________</td>
<td>Telephone: ____________________</td>
</tr>
</tbody>
</table>

**B. Patients to be admitted:**

<table>
<thead>
<tr>
<th>Name (if available)</th>
<th>Injury but no radiation</th>
<th>Radiation Exposure</th>
<th>Internal Contamination</th>
<th>External Contamination</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
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<td>2.</td>
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<td>4.</td>
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<tr>
<td>5.</td>
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</tbody>
</table>

**C. Will patients be:**

Surveyed for contamination? □ Yes □ No
Decontaminated? □ Yes □ No

**D. Name of accident:**

Type radiation source:

Other Details:

**E. Person in charge of radiation evaluation:**

**F. Expected time of arrival (your hospital):**

Notification taken by:
# RADIATION ACCIDENT PATIENT FORM

<table>
<thead>
<tr>
<th>Field</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full Name</td>
<td></td>
</tr>
<tr>
<td>Social Security Number</td>
<td></td>
</tr>
<tr>
<td>Birth Date</td>
<td>Age: Sex: Race:</td>
</tr>
<tr>
<td>Current local address</td>
<td></td>
</tr>
<tr>
<td>Current permanent address</td>
<td></td>
</tr>
<tr>
<td>Name and address of employer</td>
<td></td>
</tr>
<tr>
<td>Father's name</td>
<td>Mother's name:</td>
</tr>
<tr>
<td>Women only:</td>
<td>Date of last menstrual period: No. of pregnancies or miscarriages:</td>
</tr>
<tr>
<td>Could you be pregnant now?</td>
<td>Definitely Yes: □ Definitely No: □ Not sure □</td>
</tr>
<tr>
<td>If you are pregnant, estimated date of delivery:</td>
<td></td>
</tr>
<tr>
<td>Any problems with the pregnancy?</td>
<td></td>
</tr>
<tr>
<td><strong>PAST HISTORY:</strong></td>
<td></td>
</tr>
<tr>
<td>Any known treatment with x-rays or isotopes?</td>
<td></td>
</tr>
<tr>
<td>If so, reason for treatment:</td>
<td></td>
</tr>
<tr>
<td>Month/year of treatment:</td>
<td></td>
</tr>
<tr>
<td>Place where treatment was given:</td>
<td></td>
</tr>
<tr>
<td>Have you ever had any cancer or other malignancy?</td>
<td></td>
</tr>
<tr>
<td>If yes, type:</td>
<td></td>
</tr>
<tr>
<td>Date of diagnosis:</td>
<td></td>
</tr>
<tr>
<td><strong>FAMILY HISTORY:</strong></td>
<td></td>
</tr>
<tr>
<td>How many children do you have?</td>
<td>Are they all healthy?</td>
</tr>
<tr>
<td>If not, nature of disease or defect?</td>
<td></td>
</tr>
<tr>
<td>Indicate which, if any, of the following malignancies are present in one or more members of your family:</td>
<td>Leukemia □ Breast □ Thyroid □ Lung □ Stomach □ Intestines □ Bone □</td>
</tr>
<tr>
<td><strong>CURRENT MEDICATIONS:</strong></td>
<td></td>
</tr>
</tbody>
</table>
**RADIATION ACCIDENT PATIENT FORM**

<table>
<thead>
<tr>
<th>ALLERGIES:</th>
</tr>
</thead>
</table>

| DETAILS OF RADIATION ACCIDENT: |
| Location where accident occurred: |

<table>
<thead>
<tr>
<th>Time and date of exposure:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Type of radiation source:</th>
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</thead>
</table>

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<thead>
<tr>
<th>Location of accident victim:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Distance from source:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Duration of exposure:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Shielding, including buildings, clothing, etc:</th>
</tr>
</thead>
</table>

| Dosimetry: |
| Estimated radiation doses (whole body and organ specific): |

<table>
<thead>
<tr>
<th>Name, title, and address of individuals who estimated doses:</th>
</tr>
</thead>
</table>

| Method of dose estimate: |
| ☐ Historical |
| ☐ Dosimeters |
| Other: |

| Immediate post-accident medical assessment: |
| Time: _________ |
| Date: _________ |

<table>
<thead>
<tr>
<th>Location:</th>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Symptoms:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Physical findings:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Laboratory data, including pregnancy test in all women who might be pregnant:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Disposition of patient:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>NAME/ADDRESS OF FAMILY PHYSICIAN:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>NAME/TITLE OF PERSON COMPLETING THE FORM:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>DATE/TITLE OF COMPLETION:</th>
</tr>
</thead>
</table>
DECONTAMINATION SUPPLIES

I. Available in Operating Room:
   Surgical Scrub Suits
   Gowns
   Caps
   Shoe Covers

II. Available in Emergency Room:
   Patient Gowns
   Sheets
   Towels
   Blankets
   Plastic Bags - to be supplied by the RSO or the designee

III. Available in Emergency Room:
   Labeled containers for fecal and urine specimens
   Specimen bottles
   Emesis basins
   Bedpans
   Large basins
   4 x 4 sponges
   Disposable gloves
   Sterile irrigation sets
   Sterile applications
   Sterile suture sets
   Mild soap
   Hand Brushes (soft)
   Tape
   Tubes for blood samples

IV. Radiation Emergency Kit kept in the Emergency Department
   Swabs
   Caution, radioactive signs
   Roll of plastic
   Forms: REA Control Sheet
       Radiation Accident Exposure Log
   Rope Kit
   (1) Roll radioactive tape
   Caution tags
   Rubber Boots/Plastic Boots
   Forms from Radiation Incident Plan
   Red ink pens

V. Survey Meters, Pocket Dosimeters (Located in Nuclear Medicine, and OEHS Lab in Room M002 of the Medical School)
<table>
<thead>
<tr>
<th>Date:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient Name:</td>
<td></td>
</tr>
<tr>
<td>Time of Contamination:</td>
<td></td>
</tr>
<tr>
<td>Location:</td>
<td></td>
</tr>
<tr>
<td>Time of Decontamination:</td>
<td></td>
</tr>
<tr>
<td>Location:</td>
<td></td>
</tr>
<tr>
<td>Estimated Total Dose: mR/hr:</td>
<td></td>
</tr>
<tr>
<td>Type of Radiation:</td>
<td></td>
</tr>
<tr>
<td>Internal Contamination:</td>
<td>□Yes □No</td>
</tr>
<tr>
<td>Location:</td>
<td></td>
</tr>
<tr>
<td>List Medical Injuries:</td>
<td></td>
</tr>
</tbody>
</table>

Instructions:

1. Label HOT areas with arrow and note exposure in mR/hr.
2. Mark HOT area on chart in RED.
3. Mark decontamination readings in BLACK below contamination readings.

NOTES OR DECONTAMINATION PROCEDURES:

X____________________________________________

Signature of Individual Completing Form
APPENDIX EE

CONDENSED RESEARCH LABORATORY RULES

A. A radioactive material license can be obtained by completing an Application for Authorization to Use Radioactive Materials/Radiation Source form pp. 86-93.

B. Radioactive material can be ordered by sending a computerized purchase requisition to the Radiation Safety Office. Ensure that the name of the licensed principal investigator is clearly indicated. If the principal investigator has not received an internal Tulane Notice of Violation of Radiation Regulations, the purchase requisition will be routed to the purchasing office.

C. Laboratories with regular use patterns should perform daily surveys of their immediate work areas with an end window or scintillation type radiation survey meter. Surveys for the presence of radioactive contamination must be performed on a weekly basis AND DOCUMENTED so that they can be inspected by regulatory authorities. Occasional use laboratories must perform and record these checks at the completion of each procedure.

D. Decontamination of work areas must be performed when contamination levels exceed twice background.

E. Accurate Radionuclide Receipt and Use Records must be maintained in order to verify that radioactive material has been used and disposed of in a safe and legal manner.

F. A Semi-Annual Radionuclide Inventory/Sewer Disposal form is required of each licensee every six months.

G. No food or drink can be stored in refrigerator/freezers that are used to store radioactive materials.

H. Incoming radioactive material packages labeled White I, Yellow II, or Yellow III must be wipe tested for radioactive contamination and the results recorded.

I. Radioactive waste is accepted in Room 1105 of the Medical School every Tuesday from 8:30 to 10:30 a.m.

J. For additional information, see:

Procedure for Opening Packages Containing Radioactive Material pp. 13-14
Laboratory Rules for Use of Radioactive Materials pp. 17-18
Restriction and Labeling of Radiation Areas p. 19
Personnel Monitoring Policy pp. 20-21
Limits for Exposure to Ionizing Radiation pp. 22-23
Decontamination Procedures p. 25
Contaminated Equipment p. 26
Storage of Radionuclides p. 34
Radionuclide Disposal pp. 35-38
Safety Rules: Fixed Radiographic/Fluoroscopic pp. 39-40
Specific Instructions for Allied Medical Workers pp. 44
Application for Authorization to Use Radioactive Materials/Radiation Source pp. 86-93
Radioactive material packages must be logged/wipe tested by the Radiation Safety Office prior to being picked up by department representatives. On most work days this is:

Charles Reindl, Radiation Safety Officer
Phone: 504/988-5486
Beep: 504/544-9109

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

No radioactive material packages will be accepted outside of normal working hours.
Radioactive material packages must be logged/wipe tested and delivered by the Radiation Safety Officer or his designee:

Charles Reindl
Phone: 504/988-5486
Beep: 504/544-9109

If the package is wet or appears to be damaged, ask the carrier to remain at Receiving until it can be determined that neither he/she nor the delivery vehicle is contaminated.

No radioactive material packages will be accepted outside of normal working hours.
Radioactive material packages must be logged/wipe tested by the Radiation Safety Office prior to being delivered to their respective departments. In order to achieve this, the outside of the box can be wiped, the wipe sealed in an envelope, and the envelope stapled to a copy of the package packing slip before being sent to the Radiation Safety Office, TW16.

If the package is wet or appears to be damaged, immediately contact the Radiation Safety Officer:

Charles Reindl
Phone: 504/988-5486
Beep: 504/544-9109

No radioactive material packages will be accepted outside of normal working hours.
Radioactive material packages labeled White I, Yellow II, or Yellow III must be monitored for radioactive contamination. In order to do this, wipe the outside of the box with a cotton tipped swab and hold the swab as close as possible to the radiation survey meter probe. Subtract background counts per minute (cpm) from Gross cpm to obtain net cpm. Record this number on the corner of the Radionuclide Receipt and Use Record or other suitable form. The cpm to \( \mu Ci \) conversion factor is on the calibration sticker on the side of the instrument. Note that swabs obtained from labeled boxes containing \(^3\)H, \(^{14}\)C, or \(^{35}\)S must be counted on a Liquid Scintillation Counter.

If net cpm exceeds twice background cpm or if the package is wet or appears to be damaged, immediately contact the Radiation Safety Officer:

Charles Reindl  
Phone: 504/988-5486  
Beep: 504/544-9109

No Radioactive material packages will be accepted outside of normal working hours.