RADIATION SAFETY MANUAL

CHARITY HOSPITAL NEW ORLEANS
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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 dose equivalent and dose equivalent rates of importance in routine 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. Charity Hospital New Orleans 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 a level 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

Charity Hospital New Orleans is committed to keeping exposures As Low As Reasonably Achievable (ALARA). The Radiation Safety Committee (RSC) will perform an annual review of the radiation safety program. This shall include review of operating procedures and exposure records. 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 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 Committee will record the basis for its action in the minutes of the Committee's quarterly meeting.

II. RADIATION SAFETY COMMITTEE

The control of radionuclides and radiation safety at Charity Hospital New Orleans is the responsibility of the Radiation Safety Committee. The committee is responsible for:

a. Ensuring that all individuals who work with or in the vicinity of sources of radiation have sufficient training and experience to enable them to perform their duties safely and in accordance with regulations and conditions of the license.
b. 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 committee shall:

a. Be familiar with all pertinent regulations, the terms of the license, and information submitted 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 radiation safety officer, results of inspection, 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.
i. Ensure that the radioactive material license is amended when necessary, prior to any changes in facilities, equipment, policies, procedures, and personnel.

The Radiation Safety Committee 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.

Radiation Safety Committee members are listed in Appendix A.

III. RADIATION SAFETY OFFICER

The Radiation Safety Officer will be responsible for radiological safety. It will be his responsibility for 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 Radiation Safety Committee.

It will be the responsibility of the Radiation Safety Officer to provide 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 Radiation Safety Officer 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 Radiation Safety Officer shall be notified in case of accidents and shall be responsible for the primary considerations involved in the prevention of spread of contamination. The Radiation Safety Officer shall have one or more deputies.

The RSO will investigate all overexposures, accidents, losses, misadministrations or other excursions from good radiation safety. It is the RSO's responsibility to maintain a procedure file on all matters relating to the radionuclide program from receipt to final disposition. This also includes performance checks on survey equipment as well as inservice 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 leak test.

C. Survey of sealed source storage areas.

D. Dose calibrator linearity.

E. Dose calibrator accuracy.

F. Dose calibrator geometry.

IV. GUIDELINES FOR NUCLEAR MEDICINE ACTIVITIES INVOLVING TECHNICIANS AND OTHER PARAMEDICAL PERSONNEL.

A. An authorized physician may permit technicians 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.

a. Whenever a technician 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 technicians and other paramedical personnel shall:

1. Prior to such permission, determine that such technicians 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, 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 technicians 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 and technology.

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, The Society of Nuclear Medicine and/or American Society of Clinical Pathologists will satisfy the above training requirements.

C. Personnel (Technicians and other paramedical) approved are listed in APPENDIX B.

V. ROUTINE FOR ORDERING, RECEIVING & OPENING PACKAGES CONTAINING RADIOACTIVE MATERIAL & PROCEDURE FOR DOCUMENTING USE OF MATERIAL

A. Ordering

1. The Chief Technologist, Nuclear Medicine, will place all orders for radioactive material and will ensure that the requested materials and quantities are authorized by the Radioactive Material License and that possession limits are not exceeded.

2. Ordering Diagnostic Quantities of Radionuclides

(a) A written record that identifies the nuclide, chemical form, activity level shall be maintained.

3. Ordering Therapeutic Quantities of Radionuclides

(a) A written request will be obtained from the physician who will perform the procedure.

(b) Persons ordering the materials will reference the physician's written request when placing the order. The physician's request will indicate nuclide, chemical form, activity level.

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.D.

C. Procedure for Opening Packages Containing Radioactive Material. Use the Daily Incoming/Outgoing Shipment Inspection Log, Appendix C, for recording data.

1. Put on 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 Radiation Safety Officer);

Radiation Safety Officer Office: 568-3257
Home: 626-8287
Deputy Radiation Safety Officer:
Office: 568-2377
Home: 885-3144

3. Monitor the external surfaces of the package for radioactive contamination. This includes:

(a) External Exposure Rate @ Surface.

(b) External Exposure Rate @ 3' - 0".

(c) Determination of Removable Contamination.

The monitoring shall be performed as soon as practicable after receipt, but no later than three (3) hours after the package is received if received during normal working hours or eighteen (18) hours if received after normal working hours. Such monitoring need not be performed on:

a. packages containing less than 1 millicurie (37 MBq) of beta and/or gamma emitting radioactive material or 10 microcuries (370) of alpha emitting radioactive material.

b. packages containing no more than ten (10) millicuries of radioactive material consisting solely of tritium, carbon-14, sulfur-35, or iodine-125.

c. packages containing only radioactive material as gases or in special from.

4. If removable radioactive contamination in excess of 0.001 microcuries (2,220 disintegrations per minutes) per 100 square centimeters of package surface is found on the external surfaces of the package, immediately notify, by telephone or telegraph, the final delivering carrier and the RSO.

5. Open the outer package (following manufacturer's directions, if supplied) and remove packing slip. Open inner package to verify contents and compare with requisition, packing slip and label on vial. Check integrity of final source container for breakage of seals and vials, loss of liquid and/or discoloration of packing material.

D. MEMO TO SECURITY:

TO: Director - Security

FROM: Radiation Safety Committee

SUBJECT: RECEIPT OF PACKAGES CONTAINING RADIOACTIVE MATERIAL

Any packages containing radioactive material that arrive between 1630 hrs and 0700 hrs or on Sundays 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 hospital Radiation Safety Officer. Ask the carrier to remain at the hospital until it can be determined that neither he nor the delivery vehicle is contaminated.

RADIATION SAFETY OFFICER: Meyer Heiman, M. S.

OFFICE PHONE: 568-3257

HOME PHONE: 626-8287

NUCLEAR MEDICINE PHYSICIAN: Julien Foreman, M. D.

OFFICE PHONE: 466-4140, Ext. 570

HOME PHONE: 241-7377

NUCLEAR MEDICINE TECHNOLOGIST: John Delord, M. S.

OFFICE PHONE: 568-3251

HOME PHONE: 443-4429

E. Procedures for Documenting Use of Radioactive Material

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

2. See Appendices C - I for format to be employed.

VI. INSTRUCTIONS FOR ADMINISTRATION OF RADIOPHARMACEUTICALS FOR DIAGNOSTIC AND THERAPEUTIC PROCEDURES

A. Before writing a prescription, the authorized user or the 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 prescribed dose by more than 10% shall not be administered.

D. After administering a radiopharmaceutical, a qualified person under the supervision of the authorized user will date and sign a written record in the patient's chart or other appropriate record describing the dosage administered.

VII. INSTRUCTIONS FOR BRACHYTHERAPY

A. Before prescribing a procedure, the authorized user or the 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's medical condition.

B. Before administering the radionuclide, the authorized user or the physician under the supervision of an authorized user will personally make and date a prescription.

C. Before implanting the sealed sources, a qualified person under the supervision of an authorized user 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 authorized user or the physician under the supervision of an authorized user.

E. After implanting the brachytheraphy sources, 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 percent of the prescribed dose has been administered, a qualified person under the supervision of an authorized user (e.g., a physicist, physician, dosimetrist, or technologist) will check the dose calculations.

a. Manual dose calculations will be check for:

(1) Arithmetic errors

(2) Correct transfer of data from the prescription, tables, and graphs,

(3) Correct use of nomograms (when applicable), and

(4) Correct use of all pertinent data in the calculations.

b. 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.

c. 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). Particular emphasis will be placed on verifying the correct output from one type of calculation (e.g., computer) to be used as an input in another type of calculation (e.g., manual).

VIII. 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 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 such as 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 10%. Check the patient's name and identification number and the prescribed radionuclide, chemical form and dosage before administering.

H. Wear personnel monitoring devices (film badge or 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 millicurie activities
4. When holding patients during procedures

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

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

L. Confine 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, and 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. See page 20.

P. Good Housekeeping Habits:

1. Much of the job of preventing the spread of contamination is a matter of good housekeeping.

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

   b. 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.

   c. 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 tape (plastic or adhesive) and wear rubber gloves.

   d. Food containers are not permitted in the laboratory. Refrigerators should not be used jointly for foods and radioactive materials.

IX. 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 hour a dose in excess of 100 millirem (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 hour a dose in excess of 5 mRem (0.05 mSv).

D. A sign bearing the radiation caution symbol and the words "Caution Airborne Radioactivity Area" will be posted when any room, enclosure or operating area 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," APPENDIX N, will be posted in areas utilizing radioactive materials.

X. PERSONNEL MONITORING

The Deputy Radiation Safety Officer shall: (1) issue all personnel monitoring devices and (2) maintain results of monthly and annual radiation dose summaries for all monitored individuals.

A. Film Badges

1. Any person who has a probability of being exposed to greater than 10 mR/wk should be issued a film badge.

2. Personnel who work only with pure alpha emitters or only with pure beta emitters having a maximum energy of less than 0.2 MeV will not be required to wear a film badge.

3. Film badges are to be worn on the lapel. Whenever protective lead aprons are worn, the badge should be worn on the outside of the apron at the lapel.

4. Film badges will be exchanged monthly.

B. Ring Badges

1. Any person eluting a generator and/or preparing kits will be issued a ring badge. Personnel injecting doses in the millicurie or larger range shall be issued a ring badge.

2. Ring badges will be exchanged monthly.

C. Thyroid Monitoring

Individuals involved in vented operations which utilize, at any one time, more than 1 millicurie of I-125 and/or I-131 or unvented laboratory operations involving 0.1 mCi of I-125 and/or I-131 in a noncontained form shall have bioassays performed within one week following a single operation and every 2 weeks if use of these amounts continues. Records of the bioassay shall be maintained for the inspection by the RSO and the action point listed below shall be observed.

Whenever the thyroid burden at the time of measurement exceeds 0.12 microcuries of I-125 or 0.04 microcuries of I-131, the following actions shall be taken:

1. An investigation of the operations involved, including air sampling surveys shall be carried out to determine the causes of exposure and to evaluate the potential for further exposures.

2. If the investigation indicates that further work in the area might result in exposure of a worker to concentrations that are excessive, 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 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 Chapter 4, Section 455 of the Louisiana Radiation Regulations.

If the thyroid burden at any time exceeds 0.5 microcuries of I-125 or 0.14 microcuries of I-131, the following actions shall be taken:

1. Prevent the individual from any further handling of I-125 or I-131 until the thyroid burden is below the above limits.

2. Carry out all steps described above.

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

4. Carry out repeated measurements at approximately 1-week intervals at least until the thyroid is less than 0.12 microcuries of I-125 or 0.04 microcuries of I-131.

XI. LIMITS FOR EXPOSURE TO IONIZING RADIATION

Summary of Recommendations[ab]

A.	Occupational exposures (annual)[c]		
	1. Effective dose equivalent limit (stochastic effects)	50 mSv	(5 rem)
	2. Dose equivalent limits for tissues and organs (non-stochastic 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 in years)
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[c]	1 mSv	(0.1 rem)
	2. Effective dose equivalent limit, infrequent exposure[c]	5 mSv	(0.5 rem)
	3. Remedial action recommended when:		
	a. Effective dose equivalent[d]	>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)[c]		
	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.	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)[c]		
	Effective dose equivalent per source or practice	0.01 mSv	(0.001 rem)

[a]Excluding medical exposures.
[b]See below for recommendations on Q.
[c]Sum of external and internal exposures.

[d]Including background but excluding internal exposures.

RECOMMENDED VALUES OF Q FOR VARIOUS TYPES OF RADIATION

Type of radiation	Approximate value of Q
X rays, γ rays, β particles and electrons	1
Thermal neutrons	5
Neutrons (other than thermal), protons, alpha particles and multiple-charged particles of unknown energy	20

XII. RADIATION AND CONTAMINATION AREA SURVEYS

A. All elution, preparation, and injection areas will be surveyed with a low range thin window G-M survey meter and decontaminated if necessary.

B. Laboratory areas where only small quantities of radioactive material are used (less than 200 μCi) will be surveyed weekly.

C. Laboratory areas where greater than 200 μCi are employed will be surveyed daily.

D. The daily and weekly survey will consist of:

1. A measurement of radiation levels with a survey meter sufficiently sensitive to detect 0.1 mRem/hr.

2. A series of wipe tests to measure contamination levels. The method for performing wipe tests will be sufficiently sensitive to detect 2,220 dpm per 100 cm^2 (.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 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 (point out rates that require corrective action).

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 surveyed shall be considered contaminated if the ACTION LEVELS below are exceeded.

ACTION LEVEL (Direct Survey): 0.2 mR/hr

ACTION LEVEL (Removable Contamination): 2,220 dpm (0.001 μCi)

XIII. DECONTAMINATION PROCEDURES

A. General Considerations

1. Prevent spread of contamination: The Radiation Safety Officer 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, dusting, mopping and other physical actions. To confine it, decontaminate spill from outside toward center.

2. Make a plan: Successful decontamination calls for planned action. A spur of the moment action or attempt at decontamination can cause more harm than good. The best thing to do after a spill is make a thorough plan of the steps to be taken in the decontamination procedure.

3. 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.

4. Records: Complete records should be made of each action. Copies should be sent to the Radiation Safety Officer. In most cases the Radiation Safety Officer will be involved, so a joint report can be filed.

5. 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 2 or 3 minutes and monitor. Do not wash over 3 or 4 times. Use light pressure with heavy lather. Wash for 2 minutes, three times. Rinse and monitor. Use care not to scratch or erode skin.

c. Maximum permissible levels of contamination.

1) Alpha - 150 dpm/100 cm^2.

2) Beta-Gamma - Average less than 0.3 mR/hr for each hand surface or 100 cm^2 of skin surface, using GM survey meter.

2. Wounds (cuts and breaks in skin)

a. Decontaminating agent - running tap water. Report to Physician and Radiation Safety Officer.

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 analyses will be necessary to determine amount of radionuclides in body.

4. Contaminated areas and/or objects - Radiation Safety Officer.

XIV. 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 Radiation Safety Officer.

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 Radiation Safety Officer who will assure that the necessary safeguards are taken. It is the responsibility of the laboratory personnel to request this supervision.

XV. 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., the Radiation Safety Officer - Meyer Heiman, M. S.

Office: 568-3257
Home: 626-8287

Deputy R. S. O. - Tracie D. Espenan, M. S.

Office: 568-2377
Home: 885-3144

should be immediately notified. In addition, each particular lab should have posted the location of the nearest fire alarm or phone number of the Fire Department.

B. Loss of Source:

In the event of loss of source, notify all personnel in area and contact Radiation Safety Officer. The Radiation Safety Officer shall notify the Radiation Protection Division (504) 765-0160.

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 at 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 Radiation Safety Office.

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 gloves.

4. **SURVEY**: With a GM survey meter, check the area around the spill, hands, clothing and shoes for contamination.

5. **REPORT**: Report incident to the Deputy Radiation Safety Officer.

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 up. 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 without significantly increasing your 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 Radiation Safety Officer. If the spill is on the skin, flush thoroughly and then wash with mild soap and lukewarm 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 Radiation Safety Officer immediately.

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 materials.

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 Radiation Safety Officer as soon as possible.

3. **CALL A PHYSICIAN** qualified to treat radiation injuries at once.

4. Permit no person involved in a radiation injury to return to work without approval of the Radiation Safety Officer and attendant physician.

H. Fires

1. **FOLLOW "FIRE" PROCEDURE** in Emergency Preparedness Manual.

2. **NOTIFY** the Radiation Safety Officer.

3. **GOVERN THE FIRE-FIGHTING OR OTHER EMERGENCY EQUIPMENT** observing restrictions of the Radiation Safety Officer.

4. Following the emergency, monitor the area and determine the protective devices necessary for safe decontamination.

5. Decontamination shall be supervised by the Radiation Safety Officer.

XVI. INSTRUCTIONS FOR MAINTENANCE

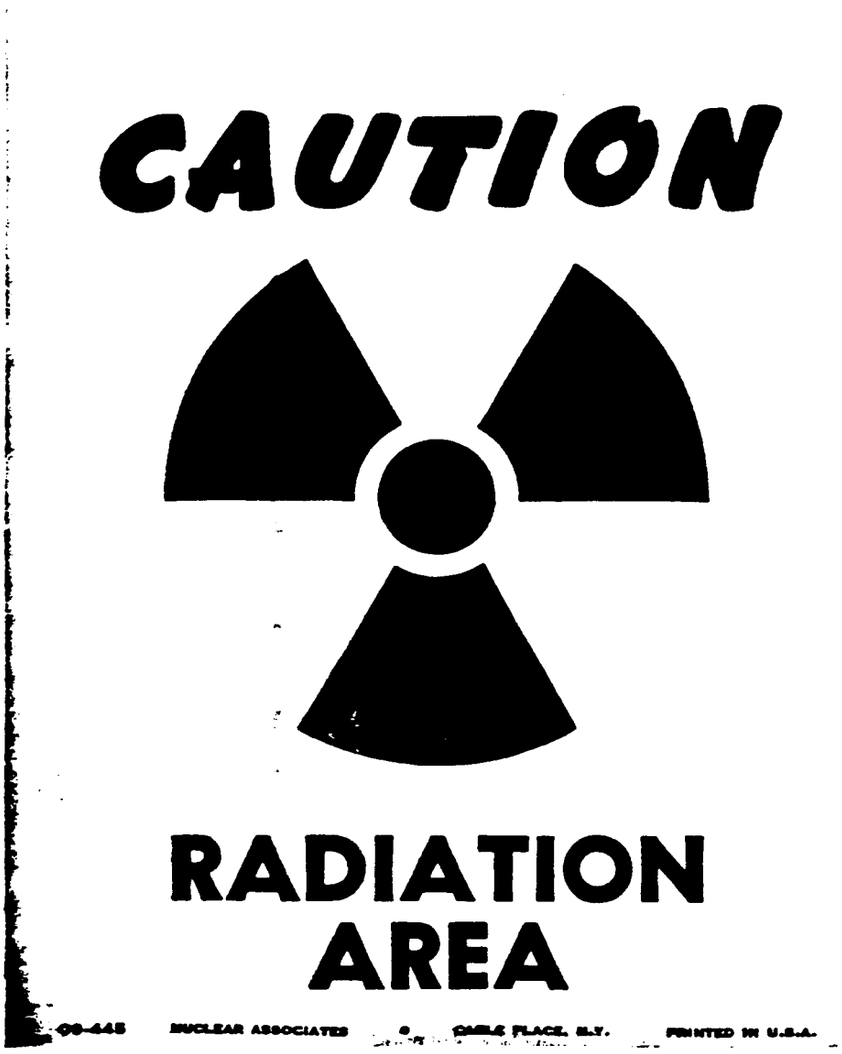
A. Maintenance personnel should enter the laboratories employing radioactive sources only for authorized and necessary purposes.

B. It is not dangerous to enter these areas when radioactive sources are properly stored; if in doubt concerning hazards present, contact the Radiation Safety Officer.

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.

DO NOT ENTER



XVII. INSTRUCTIONS FOR HOUSEKEEPING

Radiation, as we know it today, is found in many forms and amounts. It 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 feel 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 undefaced 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 it is not radioactive.

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

G. DO contact the Radiation Safety Officer if you have any questions or concerns.

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 Radiation Safety Officer 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. It is important that all stored radioactive samples be clearly labeled at all times with pertinent and accurate 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 person.

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 millirems in any one hour or will not receive a dose in excess of 100 millirems in any 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 calendar year.

4. The storage place should be chosen as to minimize risk from fire. It should be provided with a suitable means of exit.

5. The storage areas shall be well marked with a "Caution Radioactive Materials" sign, and, if necessary, entrance requirements 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 should be stored in the laboratory area.

   c. For maximum permissible concentrations in air, consult the Radiation Safety Officer.

XX. RADIONUCLIDE DISPOSAL

Records of the amounts, in microcuries (μCi), of all radionuclide disposals must be maintained. Radionuclides may be disposed of in the following manner:

A. Return to Source Supplier

1. Radionuclides received in preassayed unit dose syringes from the radiopharmacy shall be returned to the company after use. Contaminated needles are to be stored in appropriate container for decay to background levels.

B. Transfer to Commercial Disposal Agency

1. Records shall be maintained of amounts of radioactive materials transferred to commercial disposal agency licensed to receive the radioactive waste material.

C. Decay

Prior to disposal a radiation survey shall be performed and documented to verify decay of the material to background.

1. If the radionuclide is short-lived, it may be stored until activity has decayed 10 half-lives. The material may then be disposed of in normal trash providing radiation labels have been removed, obliterated or defaced.

2. If the half-life is greater than 30 days, this method becomes impractical and transfer to a commercial disposal agency licensed to receive the radioactive waste material should be considered.

3. I-125 in solid form shall be stored for decay for one-year before transfer to the regular trash.

D. Sewer disposal

1. If the radionuclide is readily soluble in water, it may be flushed down the drain providing maximum activity does not exceed the concentration specified in Table II, Column 2 of Chapter 4, Appendix A of the Radiation Regulations. Dilute the material with enough water to remove it from trap.

NOTE: Flammable liquid waste may not be disposed via sewer system.

2. Consult Radiation Safety Officer for disposal of unusual quantities.

3. Only sinks designated as radionuclide disposal sinks may be used. A "Radionuclide Record Disposal Form", APPENDIX I, must be posted near this sink and all amounts recorded in appropriate column.

E. Solid Wastes (Paper Cups, Tissues, Absorbent Pads, Syringes, etc.)

1. These items should be deposited in labeled waste containers to be removed daily and stored in decay area for decay and/or transfer to commercial disposal agency licensed to receive the radioactive waste material

F. Specific Wastes

1. BACTEC ^{14}CARBON TEST VIALS

a. Autoclave all vials to destroy any pathogens.

b. Liquids may be disposed via sanitary sewer system. On no single day will more than 1 millicurie be released in the sewer system and, over a period of one month, the activity released, when diluted by the average monthly quantity of water, will not exceed a concentration of $2X10^{-2}$ μCi/ml of C-14.

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.

2. H-3, C-14, I-125

a. 0.05 microcuries or less of the above radioactive material per gram 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.

3. 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 Radiation Safety Committee.

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

E. The radiographer shall stand behind the barrier provided for his protection during radiographic exposures.

F. Special care shall be taken to insure adequate filtration in multipurpose machines. Particular care shall be taken to insure adequate filtration in any machine equipped with a beryllium window tube.

G. Special precautions, consistent with clinical needs, should be taken to minimize exposures of the gonads of potentially procreative patients and exposure of the embryo or fetus in patients known to be or suspected of being pregnant.

XXII. SAFETY RULES: FLUOROSCOPIC

A. Protective aprons of at least 0.25 mm lead equivalent should be worn in the fluoroscopy room by each person (except the patient).

B. 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 0.25 mm lead equivalent.

C. Only persons whose presence is needed should be in the fluoroscopic room during x-ray exposure.

D. The smallest practical field sizes and shortest exposure time should be employed. The possibilities of reducing dose by techniques utilizing high tube potential and low current should be considered.

E. Fluoroscopy should not be used as a substitute for radiography, but should be reserved for the study of dynamics or special relationships or for guidance in spot film recording of critical details.

F. Medical fluoroscopy shall only be performed by a physician properly trained in fluoroscopic procedures.

G. Extraneous light that interferes with the fluoroscopic examination shall be eliminated.

H. Special precautions, consistent with clinical needs, should be taken to minimize exposure of the gonads of potentially procreative patients and exposure of the embryo or fetus in patients known to be or suspected of being pregnant.

I. In cineradiography, special care should 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.

J. 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. Inherent provisions shall be made so that the machine is not operated at source-skin distance of less than 12 inches (30 cm).

K. X-ray monitoring devices shall be worn by all persons in the x-ray room (except the patient). It must be worn outside of the protective apron on the collar.

XXIII. SAFETY RULES: MOBILE 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 by never as a substitute for adequate beam collimation and alignment.

C. Special precautions, consistent with clinical needs, should be taken to minimize exposure of the gonads of potentially procreative patients and s=exposure of the embryo or fetus in patients known to be or suspected of being pregnant.

D. 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, and he 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.

E. The operator should use the maximum source-skin distance (SSD) consistent with the conditions of the radiographic examination. Distance less than 12 inches (30 cm) shall not be used. Distances less than 15 inches (38 cm) should not be used.

F. The operator should stand as far as possible from the patient, the tube, and the useful beam. He should wear a protective apron or stand behind a suitable shield.

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

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

I. Patients in adjoining beds should be at least 6 feet away from the central ray of the primary beam. If the beds cannot be moved adjacent patients shall be furnished with lead protective aprons.

J. Before making the x-ray exposure, the technologist will announce his intention to do so. He will not make exposure if any person, other than the patient is within a 6 foot radius of the x-ray beam and is not properly shielded.

XXIV. SAFETY RULES: MOBILE FLUOROSCOPIC

A. Special care should be taken to limit patient exposure.

Image intensifiers may significantly reduce both observation time and exposure rate when properly used, but do not inherently accomplish this reduction. In equipment with automatic brightness control, the tube potential and current may rise to high values without knowledge of the operator. It is important for the operator to monitor the tube current and potential.

B. The smallest practical field size and shortest exposure time should be employed.

C. Special precautions consistent with clinical needs should be taken to minimize exposure of the gonads of potentially procreative patients and exposures of the embryo or fetus in patients known to be or suspected of being pregnant. Gonadal shielding should be used for the patient when appropriate, but never as a substitute for adequate beam collimation and alignment.

D. Extraneous light that interferes with the fluoroscopic examination should be eliminated.

E. Use the maximum source-skin distance consistent with the conditions of the examination. Distances less than 12 inches (30 cm) shall not be used.

F. Stand as far as possible from the patient, the tube and the useful beam. Wear protective apron or stand behind a suitable shield.

G. When a patient must be held in position for radiography/fluoroscopy, mechanical supporting or restraining devices should be used. If the patient must be protected with appropriate shielding devices such as protective gloves and aprons and he 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.

XXV. SAFETY RULES: PERSONS IN THE VICINITY OF MOBILE EQUIPMENT

A. If possible, vacate the room.

B. If in the room, stand as far as possible from the patient, the x-ray tube and the useful beam. Minimum recommended distance: six (6) feet.

C. If summoned to hold a patient, wear a protective apron and gloves. Position yourself so that no part of your body will be struck by the useful beam.

D. Follow all instructions given by the X-Ray Technologist.

E. Pregnant females in the special areas shall be issued a personnel monitoring device.

XXVI. SAFETY RULES: THE PREGNANT TECHNOLOGIST

A. No work should be assigned that requires the technologist in the room with the radiation source for the first trimester of pregnancy.

B. For the last two thirds of pregnancy all work shall be performed with protection of a 0.5 mm lead equivalent wrap around apron.

C. An additional monitoring device should be worn at waist level under the protective apron in order to determine fetal exposure.

D. The regular (film badge) personnel monitoring device should be worn at the lapel outside of the apron.

E. The maximum permissible dose equivalent to the fetus from occupational exposure of the expectant mother should not exceed 0.5 Rems during the entire gestation period.

XXVII. ACKNOWLEDGEMENT OF POLICY FOR THE OCCUPATIONALLY EXPOSED PREGNANT FEMALE

To The Radiation Safety Officer

Name: _____
Please Print Last First

Department: _____ Position _____

Social Security No.: _____

In signing this form, it is acknowledged that:

The National Council on Radiation Protection and Measurement Report 53, "Review of NCRP Radiation Dose Limit for Embryo and Fetus in Occupationally Exposed Women" (1977) and 54, "Medical Radiation Exposure of Pregnant and Potentially Pregnant Women" (1977) were presented to me both in oral and in written form.

2) In the event of pregnancy, the NCRP requires the limiting of radiation exposure of 5 mSv (0.5 rem) during the nine (9) month gestation period. The dose equivalent limit in a moth is 0.5 mSv (0.05 rem).

3) The Hospital Radiation Safety Officer provided a question and answer period following the above discussion, during which my questions, if any, were satisfactory answered.

4) I have read the policy "Radiation Safety Practices for the Occupationally Exposed Pregnant Female" and will comply with the procedural recommendations contained in the policy.

Signed: _____ Date: _____

XXVIII. RADIATION SAFETY PRACTICES FOR THE OCCUPATIONALLY EXPOSED PREGNANT FEMALE

The maximum permissible dose equivalent to the fetus from occupational exposure of the expectant mother should not exceed 0.5 Rems during the entire gestation period. Special care regarding exposure practices shall be carefully observed in the first trimester of pregnancy.

THE ITEMS CHECKED BELOW SHALL BE OBSERVED:

_____ 1. DISTANCE PROTECTION SHALL BE PRACTICED AT ALL TIMES.

_____ 2. AT NO TIME SHALL ANY PART OF THE BODY BE SO POSITIONED THAT PERMITS EXPOSURE FROM THE PRIMARY BEAM FROM X-RAY SOURCES OR UNSHIELDED RADIONUCLIDE SOURCES.

_____ 3. HOLDING PATIENTS FOR IMMOBILIZATION SHALL BE PROHIBITED.

_____ 4. MOBILE X-RAY WORK SHOULD BE PERFORMED WITH PROTECTION OF A 0.5 MM LEAD EQUIVALENT WRAP-AROUND APRON.

_____ 5. THE PERSONAL MONITORING DEVICE (FILM BADGE) SHALL BE WORN AT THE LAPEL OUTSIDE OF THE PROTECTIVE APRON.

_____ 6. AN ADDITIONAL MONITORING DEVICE, FILM BADGE OR DIRECT READING POCKET DOSIMETER SHALL BE WORN AT WAIST LEVEL UNDER THE PROTECTIVE APRON (WHEN APRON IS WORN) TO DETERMINE EXPOSURE DIRECTLY TO THE FETUS.

_____ 7. WATERPROOF 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 OR ^{125}I SHALL NOT BE USED.

_____ 13. EXTRA CARE SHALL BE OBSERVED TO AVOID SPILLAGE OR VAPORIZATION AND CONTAMINATION OF THE SKIN.

XXIX. DIAGNOSTIC RADIOLOGY AND THE PREGNANT PATIENT

The possibility of pregnancy must be taken into account by the attending physician when he is deciding on examinations that involve the lower abdomen and pelvis of women of reproductive capacity. The ten-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 Fetal Hazard

High Dose	Lumbar Spine Pelvis and Abdomen Hip and Femur Urography Pyelography Urethrocystography Barium Enema
Moderate Dose	Stomach Upper Gastrointestinal Tract Cholecystography Cholangiography Chest, Fluoroscopy
Low Dose	Skull Cervical Spine Dorsal Spine Extremities Chest, Radiography Dental

XXX. NUCLEAR MEDICINE AND THE PREGNANT PATIENT

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 medical 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 and 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, then the examination generally should be performed regardless of the patient's pregnancy state, but with attention 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 should notify the physician in charge.

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 and should be prepared to consult with the attending physician on possible alternatives. These alternatives include:

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

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

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

4. Cancelling the nonemergency examination once aware that the patient is or may be pregnant.

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

6. Ascertaining the advisability of using other clinical modalities to diagnose the patient's condition.

XXXI. QUALITY CONTROL PROCEDURES

A. Calibration of Survey Meters

1. All survey meters used routinely must be calibrated annually.

2. The calibration will be performed by the Radiological Physicist.

3. Upon completion of the calibration, a record will be posted on the meter indicating date of calibration.

B. Calibration of Dose Calibrator

1. Required Test Frequency:
   a. Accuracy of response at installation and quarterly thereafter.

   b. Instrument linearity at installation and quarterly thereafter.

   c. Inspection of the instrument on a quarterly basis to ascertain that the measurement chamber liner is in place and that instrument zero is properly set (see manufacturer's instructions).

   d. Geometrical variation at installation.

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

3. Daily or before each use of the instrument:

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

b. Measure and record the apparent activity of a long-lived standard radionuclide such as Cs-137 at the commonly used radionuclide settings (when the unit was first calibrated against NBS-traceable standards). Choose a source with activity in the 100 μCi to 300 μCi range.

4. Test of Instrument Linearity

The linearity of a dose calibrator should be ascertained over the entire range of activities employed. This test will utilize a vial of Tc-99m whose activity is equivalent to the highest dosage administered and 10 microcuries.

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

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

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

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

Ex: If net activity measured @ 30 hrs was 15.625 mCi, the predicted activity for 6 & 48 hrs would be 15.625 mCi X 16 = 250 mCi and 15.625 mCi X 0.125 = 1.95 mCi, respectively.

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

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

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

5. Test for Geometric Variation

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

To measure variation with volume of liquid, a 20 cc vial containing 2 mCi of Co-57 or other appropriate radionuclide in a volume of 1 ml will be used.

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

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

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

Ex. If activities of 2.04, 2.02 & 2.00 mCi are measured for 4, 8, and 10 ml volumes and 10 ml is the reference volume selected.

4 ml Volume CF = 2.00/2.04 = 0.98

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

e. The true activity of a sample is calculated as:

> True Activity = Measured Activity x Correction Factor Where CF used is for the same volume and geometrical configuration as the sample measured.

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

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

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

6. Test for Instrument Accuracy

Check the accuracy of the dose calibrator for several radionuclides such as Cs-137, Co-57, and Ba-133 using appropriate reference standards whose activity is traceable to NBS. The activity levels of the reference sources used should approximate those levels normally encountered, giving adequate attention to source configuration. The lower-energy reference standards (Tc-99m, Xe-133, I-125) must be in vials with the same thickness of glass as the actual samples to be measured for best accuracy.

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

b. Repeat step (a) for a total of 3 determinations and average results.

c. The average activity determined in step (b) should agree with the certified activity of the reference source within plus or minus 5% after decay corrections.

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

e. Keep a log of these calibration checks.

f. Calibration checks that do not agree within plus or minus 5% indicate that the instrument should be repaired or adjusted. If this is not possible, a calibration factor should be calculated for use during routine assays of radionuclides.

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

C. QUALITY CONTROL, SCINTILLATION CAMERA

1. TOTAL SYSTEM UNIFORMITY (DAILY)

(a) Materials

(1) Flood phantom; fill with water and add 1 to 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 μCi; 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-loaded 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 1 million uncorrected counts if a camera with a standard field of view is used; collect 2 million uncorrected counts for a camera with a large field of view.

(c) Data Treatment

Visually inspect film for nonuniformities.

2. SYSTEM SPATIAL RESOLUTION (WEEKLY)

(a) Materials

(1) Flood phantom; fill with water and add 1 to 5 mCi of ^{99m}Tc; count rate should be less than 20,000 cps, ^{57}Co flood source, or ^{99m}Tc point source of 100 to 200 μCi; 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 1 million counts if a camera with a standard field of view is used; collect 2 million 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)?

3. SYSTEM SENSITIVITY (ANNUALLY)

(a) Materials

(1) Approximately 100 to 200 μCi ^{99m}Tc point source, count rate should be 10,000 cps.

(2) Low-energy parallel-hole collimator only, since diverging or converging collimators are too sensitive to the source-detection distance.

(b) Procedure

(1) Place collimator on detector and raise to 5 UFOV (Useful Field of View) diameters. Draw line on detector column for reproducibility.

(2) Place point source on floor.

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

(4) Collect 3 1-minute counts.

(c) Data Treatment

(1) Determine mean counts per minute.

(2) Remove source and count background.

(3) Express sensitivity as net counts per minute per microcurie.

D. QUALITY CONTROL OF IN-HOUSE PREPARED RADIOPHARMACEUTICALS MUST BE PERFORMED:

(a) ^{99}Mo - ^{99m}Tc Generators

(1) Molybdenum breakthrough shall be performed on all generator eluents before administration to patients. Permissible limits: 0.07 μCi of ^{99}Mo per mCi of ^{99m}Tc not to exceed 2.5 μCi of ^{99}Mo per dose.

(2) Aluminum breakthrough shall be performed on all generator eluents before administration to patients. Permissible limits: 10 μg of aluminum per milliliter of eluent.

(b) Chromatography

(1) Chromatography shall be employed for radiochemical impurities. Determination of percentage ^{99m}Tc tagged or labelled shall be performed on all "kit" prepared radionuclides. Permissible limits: greater than 90% ^{99m}Tc bound.

(c) Determination of Particle Size

Radiopharmaceutical	Range of Particle Size
MAA	20 - 50 μm
Microspheres	10 - 35 μm
Sulfur Colloid	0.0001 - 1 μm

E. SEALED SOURCES; LEAKAGE/CONTAMINATION

Each sealed source, other than hydrogen-3, with a half-life greater than thirty (30) days and in any form other than gas, shall be tested for leakage and/or contamination prior to initial use and, unless otherwise authorized at intervals not to exceed six (6) months, except that each source designed for the purpose of emitting alpha particles shall be tested at intervals not to exceed three (3) months. Notwithstanding the periodic leak test required, any sealed source is exempt from such leak tests when the source contains 100 microcuries or less of beta and/or gamma emitting material or 10 microcuries or less of alpha emitting material. If, at any other time, there is reason to suspect that a sealed source might have been damaged or might be leaking, it 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.

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 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 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 Radiation Safety Committee will advise Administration of those radiation therapists that are approved for use of sealed source therapy.

   b. The Radiation Safety Committee 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 6 month intervals.

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

4) At least 48 hours notification shall be provided to Nuclear Medicine, 568-2377, 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, and

   c) The time of source insertion and removal.

5) At least 48 hour notification shall also be provided to the Operating Room Supervisor, and Head Nurse for sources to be inserted in Surgery.

c. The Radiation Safety Officer 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, 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 bed or to door to the room and attaching the "Caution, Radioactive Materials" label, Appendix LL-2, 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, Appendix KK-2.

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

a. Prior to therapy, the form "Therapeutic Radionuclide Consultation Form" Appendix KK-1, is to be completed and becomes a part of the patient's chart.

b. The Radiation Safety Officer shall be responsible for:

1) Assuring that the responsible physician has completed the appropriate form in Appendix KK 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, Appendix LL-2, 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 and completing the form "Radionuclide Therapy Survey. Appendix KK-2.

3. Patients requiring emergency surgery after therapy.

a. Consultation shall be made with the Nuclear Radiologist who in turn will notify the Radiation Safety Officer.

4. Death of patient after therapy.

a. Consultation shall be made with the Nuclear Radiologist who will in turn notify the Radiation Safety Officer.

XXXIII. MANAGEMENT OF VICTIMS OF RADIOACTIVE CONTAMINATION

A. PURPOSE

To outline a plan of action for meeting the basic requirements of the Charity Hospital New Orleans' 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 entering through open wounds.

B. OBJECTIVES

1. To handle radiation casualties.
2. To treat and service radiation casualties by applying the best medical standards.
3. To accomplish the above while avoiding or minimizing radiation exposure to hospital personnel and patients.
4. To accomplish the above while continuing the usual hospital functions.
5. To integrate the specialized supplies and experienced radiation safety personnel into hospital routine.

C. NOTIFICATION OF DISASTER

1. Any person receiving information of a disaster resulting in radiation casualties should immediately relay such information or caller to the Emergency Room Physician who will be responsible to attempt to obtain the following information:
   a. Name of person calling and their phone number.
   b. Location and type of accident.
   c. Type and amount of radiation involved.
   d. Number of victims.
   e. Extent of injuries.
   f. Type of transportation available or requested.
   g. Expected arrival time.

2. Upon verification of a nuclear accident The Emergency Room Physician shall notify the Radiation Safety Officer.

RSO Office: 568-3257
Home: 626-8287

Deputy RSO Office: 568-2377
Home: 885-3144

3. The Radiation Safety Officer will notify the Radiation Protection Division (504) 765-0160, and shall contact local police authorities to verify the disaster and obtain additional information.

Time Contacted: _____

4. Upon verification of the nature and extent of the disaster, the Emergency Room Nurse in conjunction with the Emergency Room Physician will evaluate the situation and make the decision whether to implement the Radiation Disaster Plan.

5. Upon Implementation of the Radiation Disaster Plan, the Emergency Room Nurse will notify:

* Administration On Call; Time Contacted: _____
* Radiologist On Call; Time Contacted: _____
* Security; Time Contacted: _____
* Maintenance; Time Contacted: _____
* Public Relations; Time Contacted: _____

6. Security Will Set up REA see Plan, page 67.

7. Maintenance will activate waste containment system.

D. PRE-EMERGENCY PLANNING

1. The Emergency Room Nurses will evaluate the status of the patients present and work with the physicians to discharge as many as necessary. All pregnant or possibly pregnant women should be moved to other areas of the hospital.

2. Pre-hospital communications between the ambulance and Emergency Room Physician will establish the extent of trauma injuries to the patients and the decision will be made whether to direct patients to the Emergency Room Area or the Emergency Room Decontamination Area (REA) decontamination area. If the patient does not require critical care treatment and the Emergency Room Physician directs the ambulance to report to the morgue area, the Ambulance Dispatcher shall contact the Security Department to open the morgue. The Ambulance Dispatcher, regardless of the above determination, shall notify the lab that the morgue is about to be used for decontamination purposes and to clear the area. The Emergency Room Clerk shall complete "RADIATION INCIDENT REPORT FORM" (page 70).

3. The Emergency Room Nurse will:

   a. Supervise the set-up of the Radiation Emergency Area (REA - See Page 67).

   b. Assist in removal of non-essential items from REA. If unable to remove any item, it should be covered with plastic.

   c. Contact Central Supply to assure that all decontamination room supplies (pages 73-74) are in the Emergency Room area as appropriate.

   d. Assist radiation safety personnel in setting up the Monitoring/Control Station (s).

   e. Assist in roping off/closing off REA and posting "Caution, Radiation Area" signs.

   f. Cover flooring in REA rooms and route (from entrance by transporting vehicle into REA) with paper, securing cover to flooring with tape.

4. The Assistant Director of Nursing in coordination with Emergency Room Charge Nurse shall designate nurses to be assigned to REA and person to be assigned outside REA to obtain extra supplies as needed.

5. The Radiation Safety Officer shall designate person (s) to man Monitoring/Control Station(s) and shall check all radiation monitoring equipment to insure it is in working order.

6. Safety and Security Representatives will be responsible for insuring all doors are opened in the receiving route of REA, assisting with roping off REA area and insuring area is free from by-standers and nonessential equipment.

7. Public Relations/Nursing House Supervisor will be responsible for all press releases which have been reviewed for technical content and approved prior to issue by the physicians and/or Radiation Safety Officer.

E. RADIATION/DECONTAMINATION TEAM

1. Physicians

a. Emergency Room Physicians shall be in charge of medical problems.

b. The Director, Radiology/Nuclear Medicine and the Radiation/Deputy Radiation Safety Officer shall be in charge of directing decontamination procedure.

c. Pages 71-72, "RADIATION ACCIDENT PATIENT FORM" Shall be employed.

2. Emergency Room Personnel (minimum of 3)

a. One to assist physicians with patient.

b. One to be in REA to receive supplies from outside REA and record treatment.

c. One to be outside REA to obtain supplies, as needed.

3. Radiation Safety Personnel (See page 68)

a. Radiation Safety Officer/Deputy Radiation Safety Officer.

b. Director, Radiology/Nuclear Medicine for assistance in monitoring areas and personnel, responsible for analysis of radioactive content of swabs, samples, etc.

F. RECEIVING PROCEDURES

1. Persons suspected of being contaminated with radionuclides will be received at the Emergency Room or Morgue entrance (see plan, page 67).

2. Radiation/Decontamination Team (Physicians, Nurses and radiation safety personnel) meeting the transporting vehicle will be attired as follows:

   a. Double Surgical scrub suits, gowns, surgical caps, mask and shoe covers (tape outside of scrub suits over top shoe covers and remember to remove all jewelry).

   b. Surgical gloves (tape gloves to sleeves of gown).

   c. Surgical gloves (second pair) - do not tape and change as needed if torn or contaminated.

   d. Pocket dosimeters will be 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 draped with a plastic sheet.

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 not, the patient shall be wrapped in plastic and transported to the Morgue for shower decontamination.

6. The Radiation Safety Officer or Deputy shall monitor the patient and log all contaminated areas with location and exposure measurement on chart provided, page 75.

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 Radiation Safety Officer will be responsible for disposition of clothing and valuables

8. The Emergency Room Physician will proceed with required critical patient care and evaluation. Physician will order double swab samples to be collected for radiation safety personnel to monitor. These samples should include samples of 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, area and time obtained. Duplicate swab samples shall be saved for the Division of Radiological Health.

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

10. The patient shall shower and lightly scrub all contaminated areas with betadine prep without breaking the skin.

11. The Deputy Radiation Safety Officer 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. Radiation signs shall be placed on room door and on wall above patient's head.

13. The transporting vehicle and personnel will be notified by the Radiation Safety Officer to remain with vehicle until monitored and released or instructed by the Radiation Safety Officer concerning decontamination.

14. The Deputy Radiation Safety Officer shall survey the ambulance and Ambulance Department personnel prior to their release to duty. Decontamination procedures according to "Decontamination Procedures" (pages 21-22) will be performed at the direction of the Radiation Safety Officer.

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

G. MONITORING/CONTROL POINT FUNCTIONS

1. The Radiation Safety Officer shall designate Safety & Security Representative to function as control point attendants.

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 above personnel are wearing protective clothing and proper monitoring devices.

c. Maintain a record showing name of person entering, dosimeter number, time of ingress from REA (see page 67).

d. 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.

H. RADIATION EMERGENCY AREA (REA)

1. The REA will consist of the Receiving Route, Emergency Room.

2. The Monitoring/Control Points will be established in corridors, outside Emergency Room.

3. All attending personnel will wear protective clothing and a pocket dosimeter.

4. Attending personnel will remove protective clothing and place in plastic bag labeled contaminated linen and trash before leaving REA.

5. All personnel will be monitored at Central Point 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 personnel trained in use of monitoring equipment.

8. The Radiation Safety Officer or Deputy Radiation Safety Officer will dictate need for masks, respirators, as well as need to shut off air supply and vents to avoid air borne contamination by notifying the Maintenance Department.

9. Those individuals performing actual decontamination with water should wear plastic or rubber aprons.

10. Specimens and samples will be collected and obtained according to needs as ascertained by the Emergency Room Nuclear Medicine Physicians.

11. Disposal of all radioactive material will be supervised by radiation safety personnel.

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 wrapped in plastic sheet to prevent spread of contamination and taken directly to the Operating Room on an uncontaminated stretcher accompanied by the Radiation Safety Officer or Deputy Radiation Safety Officer.

2. If time permits, the patient should be surveyed to locate and mark off contaminated areas.

3. The Operating Room personnel will be notified of contaminated patient by the Assistant Director of Nursing.

4. All articles and specimens removed must be saved for radioassay.

5. 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.

6. Removal of patient following surgery and decontamination will be under supervision of Radiation Safety Officer or Deputy Radiation Safety Officer in coordination with attending physician.

K. EXIT OF DECONTAMINATION TEAM

1. Each team member goes to clean line where control point attendant is located and removes protective clothing (placing all of it in a plastic bag marked contaminated linen and trash).

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

   b. Give dosimeters to Radiation Safety Officer or Deputy.

   c. Remove all tape at trouser cuffs and sleeves.

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

   e. Remove surgical shirt.

   f. Remove head cover.

g. Pull surgical trousers off over shoe covers.

h. Remove all outer garments.

i. Provide a pathway of stretcher paper from morgue to employee locker room at rear (employee) entrance.

j. Take shower.

L. RADIATION SAFETY OFFICER/DEPUTY RESPONSIBILITIES

1. Supervise radiation protection at the hospital.

2. Designate persons to man Control Points.

3. Check all radiation monitoring equipment to insure they are in working order.

4. Monitor patient and decontamination team during care of patient.

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

6. Monitor route from transport vehicle to REA and decontamination of above, if necessary.

7. Analyze all specimens for radiation content.

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

9. Assist in the decontamination of patient when treatment of injury permits, as determined by attending physician.

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.

12. Inspect decontamination supply stored in Radiation Disaster cart located in Central Supply to assure appropriate stocking levels and freshness of dated articles.

M. EMERGENCY ROOM PHYSICIAN RESPONSIBILITIES

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

N. SAFETY & SECURITY REPRESENTATIVE RESPONSIBILITIES

1. Restricts access to only authorized personnel.

2. Assures that all persons working in REA are wearing protective clothing and personal monitoring devices.

3. Maintains a record indicating name of person, dosimeter number, dosimeter reading and time of ingress and egress from REA.

4. Allows no one or object to leave unless free of contamination.

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

6. Assists with roping off REA area and insuring area remains free of unauthorized persons.

O. PUBLIC RELATIONS RESPONSIBILITIES

1. Provide all press releases after consulting with physicians, Nursing House Supervisor and/or Radiation Safety Officer.

P. MAINTENANCE RESPONSIBILITIES

1. Notify Radiation Safety Officer for sampling of contaminated waste as required.

Q. HOUSEKEEPING DEPARTMENT RESPONSIBILITIES

1. Supervising housekeeping personnel shall be available to obtain additional supplies, when requested.

2. Cleans REA under direction of Radiation Safety Officer or Deputy Radiation Safety Officer.

R. 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. Supervise the set up of the REA.

3. Work with the Assistant Director of Nursing to arrange for three nursing personnel to assist.

S. NURSE WORKING WITHIN REA RESPONSIBILITIES

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

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

T. CIRCULATING NURSE WITHIN REA RESPONSIBILITIES

1. Requests and receives supplies from outside the REA.

2. Records information regarding care for patient's chart.

3. Labels properly any samples obtained.

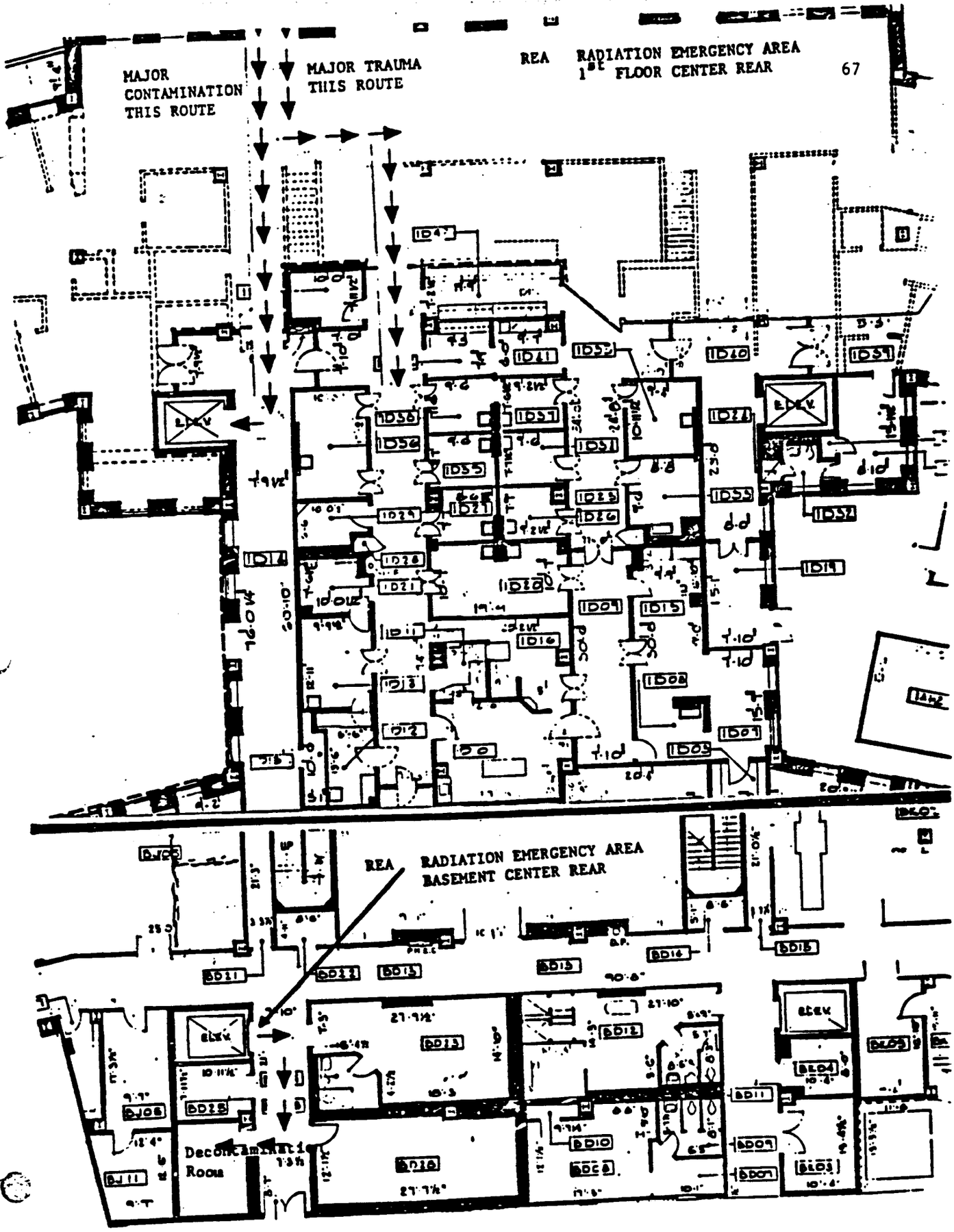
U. EMERGENCY DEPARTMENT PERSONNEL OUTSIDE REA RESPONSIBILITIES

1. Obtain any supplies or equipment needed.

2. Supply medications as needed.

V. FINAL SURVEY REA

1. The Radiation Safety Officer and Deputy shall perform a radiation survey of the REA to confirm all areas, furniture, instruments and supplies are safe and contamination free.


MAJOR CONTAMINATION THIS ROUTE
MAJOR TRAUMA THIS ROUTE
REA RADIATION EMERGENCY AREA 1st FLOOR CENTER REAR
REA RADIATION EMERGENCY AREA BASEMENT CENTER REAR
Decontamination Room

RADIATION DISASTER PLAN CRITICAL PERSONNEL

1. Medical Director of Radiology/Nuclear Medicine:

Name: Julian Foreman, M. D.
Work: 466-4140, Ext. 570
Home: 241-7377

2. Radiation Safety Officer:

Name: Meyer Heiman, M. S.
Work: 568-3257
Home: 626-8287

3. Medical Director, Emergency Room:

Name: Albert Lauro, M. D.
Work: 568-2914
Home: 837-3958

4. Deputy Radiation Safety Officer

Name: Tracie D. Espenan, M. S.
Work: 568-2377
Home: 885-3144

5. Security

Name: John Quinn
Work: 568-3277
Home: 646-1795

6. Safety Officer

Name: Joe Nelson
Work: 568-3277
Home: 244-6101

REA CONTROL SHEET

	ENTERING REA			LEAVING REA			
PERSONNEL INFORMATION: NAME, SOCIAL SECURITY NUMBER AND BIRTH DATE	DOSIMETER NUMBER	DOSIMETER READING mR	TIME A.M. P.M.	DOSIMETER READING mR	TIME A.M. P.M.	SURFACE MONITORING mR/hR	COMMENTS

INSTRUMENT USED IN SURFACE MONITORING: _____ Model # _____ Serial #_____

CALIBRATED: _____

RADIATION INCIDENT REPORT FORM

(To be used by Emergency Room Clerk 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:

Name _____ Date _____
Title _____ Affiliation _____
Address _____ Telephone _____

B. Patients to be admitted: Total number _____

Name (if available)	Injury but no radiation or	Radiation Exposure	Internal Contam-ination	External Contam-ination
1.				
2.				
3.				
4.				
5.				

C. Will patients be: surveyed for contamination? _____

Decontaminated _____

D. Nature 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

Full name: _____ Social Security Number: _____

Birth Date: _____ Age: _____ Sex: _____ Race _____

Current local address: _____

Current permanent address: _____

Name and address of employer: _____

Father's name: _____ Mother's name _____

Women only: Date of last menstrual period: _____ No. of pregnancies or miscarriages: ____

Could you be pregnant now? Definitely yes ___
Definitely no ___ Not sure ___

If you are pregnant, estimated date of delivery: _____

Any problems with the pregnancy: _____

PAST HISTORY:
Any known treatment with x-rays or isotopes? _____

If so, reason for treatment: _____

Month/year of treatment: _____

Place where treatment was given: _____

Have you ever had any cancer or other malignancy? _____

If yes, type: _____

Date of diagnosis: _____

FAMILY HISTORY:
How many children do you have? _____ Are they all healthy? _____
If not, nature of disease or defect: _____

Indicate which, if any, of the following malignancies are present in one or more members of your family: Leukemia Breast Thyroid Lung Stomach Intestines Bone

CURRENT MEDICATIONS: _____

ALLERGIES: _____

Details of Radiation Accident:
Location where accident occurred: _____

Time and date of exposure: _____

Type of radiation source: _____

Location of accident victim: _____

Distance from source: _____

Duration of exposure: _____

Shielding, including buildings, clothing, etc. _____

Dosimetry: Estimated radiation doses (whole body and organ specific ____

_____

Name, title, and address of individuals who estimated doses:
_____

_____

Method of dose estimate: Historical Dosimeters Other
Immediate post-accident medical assessment: Time ____ Date ____ Location

Symptoms: _____

Physical findings: _____

Laboratory data, including pregnancy test in all women who might be pregnant:
_____

Disposition of patient: _____

NAME/ADDRESS OF FAMILY PHYSICIAN: _____

NAME/TITLE OF PERSON COMPLETING THE FORM: _____

DATE/TIME OF COMPLETION _____

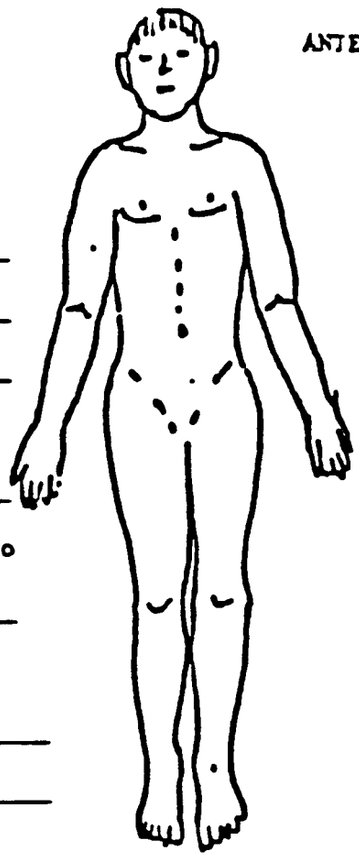
DECONTAMINATION SUPPLIES

(To be stored in Radiation Disaster Cart in Central Supply)

I.	Surgical Scrub Suits Gowns Caps Shoe Covers	Available in Operating Room
II.	Patient Gowns Sheets Towels Blankets Laundry Bags	Available in Emergency Room
III.	Labeled containers for fecal and urine specimens	Available in Emergency Room
	Specimen bottles Emesis basins Bedpans Large basins Sterile suture sets Sterile irrigation sets Sterile applications 4 x 4 sponges Mild soap Hand Brushes (soft) Tape Tubes for blood samples (purple and red top)	
IV.	Roll of paper	Radiation Emergency Kit kept in Emergency Emergency Room Medication Room
	Masking Tape Rope Kit Swabs Paper bags Plastic bags-various size Rubber bands Disposal gloves (large, medium) Rolls radioactive tape Caution, radioactive signs Caution tags Note books Clip board Felt pens (black and red) Forms - REA Control Sheet , Radiation Accident Exposure Log Roll of plastic	

V.	Decontamination Detergent Plastic Lab Aprons	Located in Nuclear Medicine
VI.	Survey Meters, Pocket Dosimeters	Located in Nuclear Medicine

...TION ACCIDENT EXPOSURE LOG



_____ Location _____

_____ Location _____

_____ mR/hr

_____

_____ Yes, _____ No

_____

_____

_____

_____

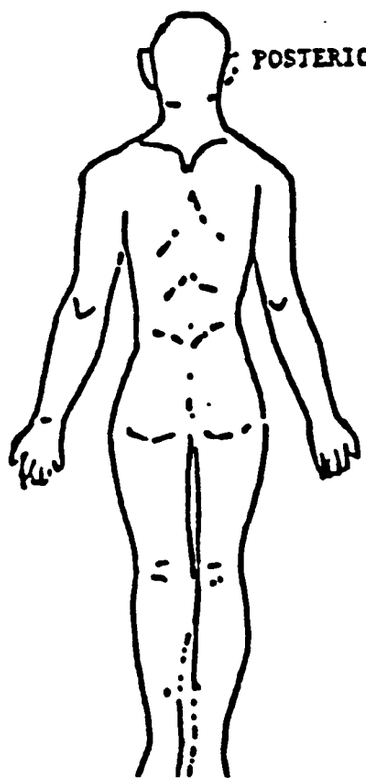
_____

...eas with arrow and note exposure in

...on chart in RED.

...nation readings in BLACK below
...readings

...PROCEDURES:



_____

...ompleting Form

XXXIV. GENERAL REFERENCES

A. National Council On Radiation Protection and Measurements' Reports:

No. 8, Control and Removal of Radioactive Contamination in Laboratories (1951)

No. 22, Maximum Permissible Body Burdens and Maximum Permissible Concentrations of Radionuclides in Air and in Water for Occupational Exposure (1959) [Includes Addendum 1 issued in August 1963]

No. 23, Measurement of Neutron Flux and Spectra for Physical and Biological Applications (1960)

No. 25, Measurement of Absorbed Dose of Neutrons and Mixtures of Neutrons and Gamma Rays (1961)

No. 27, Stopping Powers for Use with Cavity Chambers (1961)

No. 30, Safe Handling of Radioactive Materials (1964)

No. 32, Radiation Protection in Educational Institutions (1966)

No. 35, Dental X-Ray Protection (1970)

No. 36, Radiation Protection in Veterinary Medicine (1970)

No. 37, Precautions in the Management of Patients Who Have Received Therapeutic Amounts of Radionuclides (1970)

No. 38, Protection Against Neutron Radiation (1971)

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

No. 41, Specification of Gamma-Ray Brachytherapy Sources (1974)

No. 42, Radiological Factors Affecting Decision-Making in a Nuclear Attack (1974)

No. 44, Krypton-85 in the Atmosphere-Accumulation, Biological Significance, and Control Technology (1975)

No. 46, Alpha-Emitting Particles in Lungs (1975)

No. 47, Tritium Measurement Techniques (1976)

No. 48, Radiation Protection for Medical and Allied Health Personnel (1976)

No. 49, Structural Shielding Design and Evaluation for Medical Use of X-Rays and Gamma-Rays of Energies Up to 10 MeV (1976)

No. 50, Environmental Radiation Measurements (1976)

No. 51, Radiation Protection Design Guidelines for 0.1-100 MeV Particle Accelerator Facilities (1977)

No. 52, Cesium-137 From the Environment to Man: Metabolism and Dose (1977)

No. 53, Review of NCRP Radiation Dose Limit for Embryo and Fetus in Occupationally Exposed Women (1977)

No. 54, Medical Radiation Exposure of Pregnant and Potentially Pregnant Women (1977)

No. 55, Protection of the Thyroid Gland in the Event of Releases of Radioiodine (1977)

No. 57, Instrumentation and Monitoring Methods for Radiation Protection (1978)

No. 58, A Handbook of Radioactivity Measurements Procedures (1978)

No. 59, Operational Radiation Safety Program (1978)

No. 60, Physical, Chemical, and Biological Properties of Radiocerium Relevant to Radiation Protection Guidelines (1978)

No. 61, Radiation Safety Training Criteria for Industrial Radiography (1978)

No. 62, Tritium in the Environment (1979)

No. 63, Tritium and Other Radionuclide Labeled Organic Compounds Incorporated in Genetic Material (1979)

No. 64, Influence of Dose and Its Distribution in Time on Dose-Response Relationships for Low-LET Radiations (1980)

No. 65, Management of Person Accidentally Contaminated with Radionuclides (1980)

No. 66, Mammography (1980)

No. 67, Radiofrequency Electromagnetic Fields - Properties, Quantities and Units, Biophysical Interaction, and Measurements (1981)

No. 68, Radiation Protection in Pediatric Radiology (1981)

No. 69, Dosimetry of X-Ray and Gamma-Ray Beams for Radiation Therapy in the Energy Range 10 keV to 50 MeV (1981)

No. 70, Nuclear Medicine-Factors Influencing the Choice and Use of Radionuclides in Diagnosis and Therapy (1982)

No. 71, Operational Radiation Safety - Training (1983)

No. 72, Radiation Protection and Measurement for Low Voltage Neutron Generators (1983)

No. 73, Protection in Nuclear Medicine and Ultrasound Diagnostic Procedures in Children (1983)

No. 74, Biological Effects of Ultrasound: Mechanisms and Clinical Implications (1983)

No. 75, Iodine-129: Evaluation of Releases from Nuclear Power Generation (1983)

No. 76, Radiological Assessment: Predicting the Transport, Bioaccumulation, and Uptake by Man of Radionuclides Released to the Environment (1984)

No. 77, Exposures from the Uranium Series with Emphasis on Radon and its Daughters (1984)

No. 78, Evaluation of Occupational and Environmental Exposures to Radon and Radon Daughters in the United States (1984)

No. 79, Neutron Contamination from Medical Electron Accelerators (1984)

No. 80, Induction of Thyroid Cancer by Ionizing Radiation (1985)

No. 81, Carbon-14 in the Environment (1985)

No. 82, SI Units in Radiation Protection and Measurements (1985)

No. 83, The Experimental Basis for Absorbed Dose-Calculations in Medical uses of Radionuclides (1985)

No. 84, General Concepts for the Dosimetry of Internally Deposited Radionuclides (1985)

No. 85, Mammography, A User's Guide

No. 86, Biological Effects and Exposure Criteria for Radiofrequency Electromagnetic Fields (1986)

No. 87, Use of Bioassay Procedures for Assessment of Internal Radionuclide Deposition (1987)

No. 88, Radiation Alarms and Access-Control Systems (1987)

No. 89, Genetic Effects of Internally Deposited Radionuclides (1987)

No. 90, Neptunium: Radiation Protection Guidelines (1987)

No. 91, Recommendations on Limits for Exposure to Ionizing Radiation (1987)

No. 92, Public Radiation Exposure from Nuclear Power Generation in the United States (1987)

No. 93, Ionizing Radiation Exposure of the Population of the United States (1987)

No. 94, Exposure of the Population in the United States and Canada from Natural Background Radiation (1988)

No. 95, Exposure of the U. S. Population from Consumer Products and Miscellaneous Sources (1988)

No. 96, Comparative Carcinogenicity of Ionizing Radiation and Chemicals (1988)

No. 97, Measurement of Radon and Radon Daughter Products in Air (1989)

No. 98, Guidance on Radiation Received in Space Activities (1989)

No. 99, Quality Assurance for Diagnostic Imaging Equipment (1988)

No. 100, Exposure of the U. S. Population from Diagnostic Medical Radiation (1989)

No. 101, Exposure of the U. S. Population from Occupational Radiation (1989)

No. 102, Medical X-Ray, Electron Beam and Gamma-Ray Protection For Energies Up to 50 MeV (Equipment Design, Performance and Use) (1989)

B. Louisiana Radiation Regulations

APPENDIX A

RADIATION SAFETY COMMITTEE

Debbie Brown, R. N.

David Bush, M. D.

John Delord, M. S.

Tracie D. Espenan, M. D., Deputy RSO

Julian Foreman, M. D.

Meyer Heiman, M. S., RSO

Arthur LaPorte, H. A. O.

George R. Meckstorth, Ph. D., Chairman

Arvin E. Robinson, M. D.

Monroe Samuels, M. D.

Jose Torres, M. D.

APPENDIX B

TECHNOLOGISTS APPROVED FOR RADIONUCLIDE INJECTIONS
NUCLEAR MEDICINE

Rene Anderson, C. N. M. T.
John Delord, Jr., M. S., N. M. T.
Judith A. Fischer, C. N. N. T.
Karen R. Gustave, C. N. M. T.
Gary C. Nunez, C. N. M. T.

PATHOLOGY

H. Peter Lehmann, Ph. D.
Carla DeCorte, M. T. (ASCP)
Colette Dede, M. T. (ASCP)
Frances Dunn, M. T. (ASCP)
Novelle Seaberry, M. T. (ASCP)
Gladys Summers, M. T. (ASCP)
Estrelita Simpson, M. T. (ASCP)
Audrey White, M. T. (ASCP)

PATHOLOGY PHYSICIANS APPROVED FOR RADIONUCLIDE INJECTIONS

Gerry Liuzza, M. D.
Monroe S. Samuels, M. D.

PATHOLOGY RESIDENT PHYSICIANS APPROVED FOR RADIONUCLIDE INJECTIONS

Kenneth Algino, M. D.
Pamela Babycos, M. D.
Evelyn Barroso, M. D.
Patty Boustany, M. D.
Larry Caldwell, M. D.
Joel Carney, M. D.
Charles Collins, M. D.
Tom Enelow, M. D.
Ken Fallon, M. D.
Alison Galvan, M. D.
Frank Groves, M. D.
Deanna Justice, M. D.
Juanito Lim, M. D.
Giovanni Lorusso, M. D.
Andrew Martin, M. D.
Tim Peterson, M. D.
Eric Reimund, M. D.
Karen Ross, M. D.
Sarah Webb, M. D.
Russell Wong, M. D.

DIAGNOSTIC RADIOLOGY PHYSICIANS APPROVED FOR RADIONUCLIDE INJECTIONS

Jane Clayton, M. D.
Ted Collins, M. D.
Julian Foreman, M. D.
Theodore Gross, M. D.
Michael Hanemann, M. D.
Erich Lang, M. D.
Ernest Milner, M. D.
Rosa Maria Paolini, M. D.
Hugh Robertson, M. D.
Edward Ross, M. D.
Barry Sieff, M. D.
George Willis, M. D.

DIAGNOSTIC RADIOLOGY RESIDENT PHYSICIANS APPROVED FOR RADIONUCLIDE INJECTIONS

Vernon W. Barrow, III, M. D.
Carol Becker, M. D.
Kerry Berthold, M. D.
Gregory F. Dobard, M. D.
Christopher D. Dooley, M. D.
Kathleen Etzel, M. D.
Leia Ann Frickey, M. D.
Richard Friedman, M. D.
Sara George, M. D.
Robert F. Hayden, M. D.
Glenn Mason, M. D.
Joseph McDowell, M. D.
Richard Miers, M. D.
H. Lee Mitchell, M. D.
Steven Pflug, M. D.
Valerie Robertson, M. D.
Daniel Rovira, M. D.
Virginia Savastano, M. D.
Norman Scarborough, M. D.
Carl Scherer, M. D.
Janet Wilkinson, M. D.
Elizabeth Winters, M. D.
Joan Wojak, M. D.

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 μCi

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

			INCOMING					OUTGOING				
DATE	PRODUCT	SUPPLIER	EXTERNAL SURVEY mR/hR		WIPE TEST (dpm)			WIPE TEST (dpm)		mR/hR SURFACE	CORRECTIVE ACTIONS	TECH
			SURFACE	3 FEET	BKG	OUT-SIDE	IN-SIDE	BKG	OUTSIDE			

APPENDIX D

RADIOPHARMACY RECEIPT & DISTRIBUTION

DATE RECEIVED	SHIPMENT NUMBER	RADIO-PHARMACEUTICAL	ASSAY-DOSE CALIBRATOR mCi @ TIME	PATIENT NAME	PROCEDURE	DATE RETURNED RADIO-PHARMACY

APPENDIX E

RADIONUCLIDE LOG & DISTRIBUTION RECORD

(Use a Separate Sheet for Each Shipment)

Radionuclide _____
Chemical Form _____
Original Volume _____
Assay mCi/ml _____
Total Activity in mCi _____ on ___

Whole Vial Assay in Dose Calibrator _____ on ____

DATE	PATIENT NAME	NUMBER	ACTIVITY ADMINISTERED IN mCi	VOLUME IN mL	PROCEDURE PERFORMED	DOSE CALIBRATOR ASSAY	TECH

Vial Transferred to Decay/Storage Area on _____

Disposal _____ to _____

Surface Exposure Rate @ Disposal - _____ mR/hr
Background - _____ mR/hr
Instrument Used

APPENDIX F

^{99m}Tc Assay
^{99}Mo Assay
^{99m}Tc Distribution Record

Date: _____

Assay Data By: _____

^{99m}Tc Assay

^{99m}Tc Total Activity (Whole Vial) = _____ mCi;
^{99m}Tc Assay = _____ mCi/ml @ _____ a.m./p.m.

^{99}Mo ASSAY

^{99}Mo Total Activity (Whole Vial) = _____ ûCi.
^{99}Mo Assay = _____ ûCi/ml.

DISTRIBUTION: Date Patient Number	ACTIVITY ADMINISTERED IN MCi	VOLUME IN ML	PROCEDURE PERFORMED	DOSE CALIBRATOR ASSAY	TECHNOLOGIST Performing Procedure

Vial Transferred to Decay/Storage Area on _____
Disposal _____ to _____
Surface Exposure Rate @ Disposal = _____ mR/hr
Background - _____ mR/hr
Instrument Used _____

APPENDIX G

DOSE CALIBRATOR CALIBRATION RECORD

Reference Standard Month _____ Year _____

	^{57}Co	^{133}Ba	^{137}Cs
Activity: on			
Date:			
Serial No.:			

	Calculated Reference Std. Activity			Measured Reference Std. Activity						
Day	^{57}Co	^{133}Ba	^{137}Cs	^{57}Co		^{133}Ba	^{137}Cs	$^{137}Cs/Tc$	$^{137}Cs/Tl$	Tech
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
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31										

APPENDIX H

INSTRUMENT MAINTENANCE & REPAIR RECORD

Instrument Make:_____ Model No.:_____ Serial No.:_____

Date	Reason For Request of Service or Malfunction	Service Requested on	By (Tech)	To (Source of Service)	Service Completed on	By (Source of Service)	Service Report Indicating Repair Performed	Amount	Purchase Req. Number

APPENDIX I

RADIONUCLIDE RECORD DISPOSAL FORM

Records of the amounts, in microcuries, of all radionuclide disposals must be maintained.
Disposal limit: 10 microcuries (uCi) per day, all radionuclides.

Location_____ Personnel in Charge_____

Month / Day	Iso. Dis. Sig.	Iso. Dis. Sig.	Iso. Dis. Sig.	Iso. Dis. Sig.	Iso. Dis. Sig.	Iso. Dis. Sig.
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
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19						
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						
30						
31						

Iso. = Radionuclide Dis. = Amount Disposed Sig. = Signature of Responsible Individual

APPENDIX J

REPORT OF RADIOACTIVITY OF CADAVER

The physician in charge of the case shall fill out the following and attach to the patient's chart and death certificate, if necessary, with the aid of the Radiation Safety Officer.

Hospital: _____

Name of Deceased: _____

Hospital Number: _____ Date & 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

APPENDIX K

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 Remaining 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 procedures are employed.

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

_____
_____
_____
_____
_____
_____
_____

_____
Radiation Safety Officer

_____
Date

APPENDIX L

AUTOPSY OR SURGERY PRECAUTIONS

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

A. General

1. Surgical or heavier rubber 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 studies.

B. Special Precautions for ^{131}I

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

2. Tissue specimens held 3 months can be considered inactive.

APPENDIX M

PROBABLE RADIOACTIVE CONTENT OF BODY AT VARIOUS TIMES AFTER VARIOUS DOSES

A guide for consideration before autopsy or surgery. Values below the heavy lines are permissible for discharge of patient from hospital without precautions. For these levels, wearing surgical rubber gloves is the only mandatory precaution. For values above the lines, consultation with the Radiation Safety Officer is indicated.

Radionuclide	Activity Administered mCi	Days Elapsed Since Administration													
		1	2	5	10	15	20	40	60	100	150	200	250	300	350
		mCi remaining in injected cavity or tissue—no elimination													
Gold-198 or Yttrium-90	100	77	60	28	8	2									
	75	58	45	22	6	1									
	50	38	30	15	4	1									
	25	19	15	8	2	1									
		mCi remaining in cavity or tissue—no elimination													
Phosphorus-32	40	38	36	32	24	20	16	8	4						
	20	19	18	16	12	10	8	4	2						
	10	10	9	8	6	5	4	2	1						
		mCi remaining in implant													
Chromium-51	100	98	95	88	78	69	61	37	23	8	2				
	75	74	72	66	59	53	45	27	18	6	2				
	50	49	48	44	39	35	30	18	12	4	1				
	25	25	24	22	20	18	15	9	6	2	1				
		mCi remaining in implant													
Iodine-125	100	99	98	94	91	84	80	63	50	31	18	10			
	75	75	73	70	67	63	60	48	37	24	14	7			
	50	50	49	47	45	42	40	32	25	16	9	5			
	25	25	24	23	22	21	20	16	12	8	5	2			
		mCi remaining in functioning thyroid tissue or metastasis assuming 50% uptake and 6 day effective half-life													
Iodine-131	100	45	39	29	16	9	5	2							
	75	34	30	22	12	6	4	1							
	50	22	20	15	8	4	2	1							
	25	11	10	8	4	2	1	1							
		mCi remaining in implant													
Radon	80	80	42	24	10	6	2								
	40	32	28	16	8	4	1								
	20	16	14	8	4	2									
	10	8	7	4	2	1									
		mCi remaining in implant													
Iridium-192[a]	80	80	80	58	55	52	50	46	34	25	16	9	6	4	2
	40	40	40	38	36	25	34	28	23	16	10	6	4	3	2
	20	20	20	19	18	17	16	14	12	8	5	3	2	2	1
	10	10	10	9	9	9	8	7	6	5	3	2	1		
		mCi remaining in implant													
Tantalum-182[a]	40	40	40	38	37	36	35	31	28	22	16	12	9	7	5
	20	20	20	19	18	18	17	16	14	11	8	6	4	3	2
	10	10	10	9	9	9	8	8	7	5	4	3	2	2	1

[a] With these long-lived nuclides, consultation with the Radiation Protection Supervisor is indicated for at least a year after any implant.

DRC 3 (R 6/80)

5M

LOUISIANA DEPARTMENT OF NATURAL RESOURCES
Office of Environmental Affairs

NUCLEAR ENERGY DIVISION

NOTICE TO EMPLOYEES

STANDARDS FOR PROTECTION AGAINST RADIATION; NOTICES, INSTRUCTIONS AND REPORTS TO WORKERS; INSPECTIONS

In the Louisiana Radiation Regulations, the Environmental Control Commission 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 Nuclear Energy Division.

YOUR EMPLOYER'S RESPONSIBILITY

Your employer is required to—

1. Apply these regulations and the conditions of his license or registration certificate to work involving sources of radiation.
2. Post, or otherwise make available to you, a copy of the 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.
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 the 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 Division inspections; and
7. Related matters.

REPORTS ON YOUR RADIATION EXPOSURE HISTORY

1. The 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 Sections D.101, D.103 and D.104 of the regulations. These sections specify 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 Nuclear Energy Division. 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 Nuclear Energy Division. The request must set forth the specific grounds for the notice and must be signed by the worker or the representative of the workers. During inspections, Division 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:

NUCLEAR ENERGY DIVISION
P. O. Box 14690
Baton Rouge, Louisiana 70898

24-HOUR
TELEPHONE
504 925-4518

Posting Requirements

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 Nuclear Energy Division, pursuant to parts B or C of the 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.

APPENDIX O

SEALED SOURCE INVENTORY

Location: Date:

Nuclide	Source Identification	Activity on	Accountability: Present and Properly Stored	Accountability: Missing

Follow-up: Missing or lost sources:

APPENDIX P

UNITS & DEFINITIONS

Absorbed Dose:

The quotient of dE by dm where dE is the mean energy imparted by ionizing radiation to the matter in a volume element and dm is the mass of the matter in that volume element, i.e., the absorbed dose, $D = dE/dm$. The special name for the unit of absorbed dose ($J\ kg^{-1}$) is the gray (Gy). The earlier unit of absorbed dose was the rad which is equal to 0.01 Gy.

Activity:

The number of nuclear transformations occurring in a given quantity of material per unit time. The special unit of activity is the becquerel (replacing the curie as adopted by the 15th General Conference of Weights and Measures).

(1 curie = $3.7 \times 10^{10} S^{-1} = 3.7 \times 10^{10} Bq$).

Agreement State:

A state which has entered into an agreement with the U. S. Nuclear Regulatory Commission to conduct licensing and inspection programs.

ALARA:

As Low As Reasonably Achievable, economic and social factors being taken into account.

Albedo Dosimeter:

A personnel dosimeter (especially a neutron detection type) which enables one to determine the absorbed dose from the component of radiation backscattered (or moderated) by the wearer of the dosimeter.

Annual Limit on Intake (ALI):

The activity of a radionuclide that, taken into the body during a year, would provide a committed effective dose equivalent to a person, represented by Reference Man, equal to the annual occupational effective dose equivalent limit ($H_{e,L}$) or, in some cases, the organ dose equivalent limit (nonstochastic effect). The ALI is normally expressed in becquerels (Bq) or curies.

Alpha Particle:

A positively charged particle emitted by certain radioactive materials. It is made up of two neutrons and two protons bound together, and hence is identical to the nucleus of a helium atom. It is the least penetrating of the three common types of radiation (alpha, beta, gamma) emitted by radioactive materials and is stopped by a sheet of paper.

Attenuation:

Decrease in exposure rate of radiation caused by passage through material.

Background Radiation:

Radiation arising from sources other than the one directly under consideration. Background radiation due to cosmic rays and natural radioactivity is always present. There may also be additional background radiation due to the presence of sources or radiation in other parts of the building and/or area.

Becquerel (Bq):

The special name for the unit of activity in the SI. 1 Bq = 1 s^{-1}.

Beta Particle:

An elementary particle emitted from a nucleus during radioactive decay, having a single electrical charge and a mass equal to 1/1837 that of a proton. A negatively charged beta particle is identical to an electron. A positively charged beta particle is called a positron.

Biological Half-Time

The time required for a biological system to eliminate, by natural processes, half the amount of a substance (e.g., radioactive material) that has entered it.

BWR:

Boiling water reactor.

Collective Dose Equivalent:

Most frequently the product of the mean dose equivalent for a population and the number of persons in the population, but, more precisely, and preferably, the sum of all individual dose equivalents in the population of concern.

CR:

The collective dose ratio. The ratio of the collective dose equivalent determined using only doses greater than 15 mSv (1.5 rem) to the collective dose equivalent determined with all measured doses.

CR-39:

A hard plastic (allyl diglycol carbonate) used as a neutron dosimeter. Following irradiation the track damaged plastic is etched chemically to enhance the track damage for microscopic examination. The tracks are counted and the neutron dose is determined from the number of tracks.

Committed Dose Equivalent (H_{50}):

The dose equivalent accumulated in the 50 years after intake of a radionuclide.

Contamination (Radioactive):

A radioactive substance dispersed in materials or places where it is undesirable, and particularly in any place where its presence can be harmful.

Contractor Personnel:

Those who are not employed by the site operator or owner but work on the site.

Controlled Area:

A defined area in which the occupational exposure of personnel to radiation or to radioactive material is under the supervision of a Radiation Safety Officer. (This implies that controlled area is one that requires control of access, occupancy and working conditions for radiation protection purposes.)

Critical Organ

That part of the body that is most susceptible to radiation damage under the specific conditions considered.

Daughter, Daughter Products:

A nuclide, stable or radioactive, formed by radioactive decay of another nuclide, which in this context is called the parent.

Decontamination:

The removal of radioactive contaminants from surfaces (e.g., skin) by cleaning and washing.

Derived Air Concentration (DAC):

The ALI of a radionuclide divided by the volume of air inhaled by Reference Man in a working year (i.e., 2.4×10^3 m^3). The unit of DAC is Bq m^{-3}.

Distribution Factor:

A factor used to express the modification of biological effect due to non-uniform distribution in the body of the radionuclides in question.

DOD:

U. S. Department of Defense.

DOE:

U. S. Department of Energy.

Dose Equivalent (H):

A quantity used for radiation protection purposes that expresses on a common scale for all radiations, the irradiation incurred by exposed persons. It is defined as the product of the absorbed dose (D) and the quality factor (Q). The name for the unit of dose equivalent (j kg^{-1}) is the sievert (Sv).

Dose Equivalent to Whole Body (H_{wb}):

See whole body dose equivalent.

Effective Dose Equivalent (H_e):

The sum over specified tissues of the product of the dose equivalent in a tissue (T) and the weighing factor for that tissue, (w_t), i.e., $H_e = \sum w_t H_t = H_{wb}$.

Effective Half-Life (Teff):

The time required for a radionuclide contained in a biological system, such as in man, to reduce its activity by half, as a combined result of radioactive decay and biological elimination.

Electron Volt (eV):

A unit of energy equal to the kinetic energy gained in a vacuum by a particle having one electronic charge when it passes through a potential difference of one volt.

EPA:

U. S. Environmental Protection Agency.

Exposure:

In this report, exposure is used in the more general sense and not as the specifically defined radiation quantity. It is not specifically limited to exposure to x-rays.

Exposure Rate:

The time rate at which an exposure or absorbed dose occurs; that is, exposure or absorbed dose per unit time. It implies a uniform or short-term average rate, unless expressly qualified (i.e., peak dose rate). In protection work, it is usually expressed in mR/hr, mRads/hr.

Film Badge:

A pack of appropriate photographic film and filters used to determine radiation exposure.

Gamma Rays:

High energy, short-wave length radiation. Gamma radiation frequently accompanies alpha and beta emissions and always accompanies fission. Gamma rays are very penetrating and are best stopped or shielded against by dense materials, such as lead or depleted uranium. Gamma rays are essentially similar to x-rays, but are usually more energetic and are nuclear in origin.

Gray (Gy):

The special name for SI unit of absorbed dose, kerma and specific energy imparted. 1 Gy = 1 J kg^{-1} = 100 rad.

In Vivo:

Pertains to within the body.

Ionizing Radiation:

Any radiation displacing electrons from atoms or molecules, thereby producing ions.

Isocenter:

The point of intersection of the center of the primary beam of a rotating beam of radiation and the axis of rotation of the beam.

Isotopes:

One of two or more atoms with the same atomic number (the same chemical element) but with different atomic weights. An equivalent statement is that the nuclei of isotopes have the same number of protons but different numbers of neutrons. Isotopes usually have very nearly the same chemical properties, but some what different physical properties.

LWR:

Light water reactor.

Maximum Permissible Body Burden:

That quantity of activity of a specific radioactive material that may be present in a worker's body continually for a working lifetime and result in the maximum permissible dose.

Mean (Average) Dose Equivalent):

The sum of the dose equivalents received by individuals divided by the number of individuals for which the sum is taken.

MDL (Minimum Detectable Level):

The threshold of detection for the device in question.

Negligible Individual Risk Level (NIRL):

A level of risk that can be dismissed. Namely, an annual risk of 10^{-7}. This risk is that associated with an annual effective dose equivalent of 0.01 mSv (0.001 rem).

Nonpentrating Radiation:

A general term used to describe external radiations of such low penetrating power that the absorbed dose from exposures to man is principally in the skin and does not reach deeper organs to any significant extent. It refers to any alpha, beta and very soft gamma or x-ray radiations.

Nonstochastic Effects:

Effects for which the severity of the effect in affected individuals varies with the dose, and for which a threshold usually exists. A nonstochastic effect of radiation exposure is defined as a somatic effect which increases in severity with increasing absorbed dose in affected individuals, owing to damage to increasing numbers of cells and tissues. Nonstochastic late effects, e.g., diseases characterized by organ atrophy and fibrosis, are basically degenerative, as contrasted with the neoplastic growth characteristic of cancer. In general, considerably larger absorbed doses are required to cause nonstochastic effects to a degree of severity which seriously impairs health, as compared with absorbed doses required for a significant increase in cancer incidence. The incidence of nonstochastic effects in a population may increase with increasing absorbed dose, owing to differences in susceptibility and other contributing causes among individuals in the population. Examples of nonstochastic effects attributable to radiation exposure are lens opacification, blood changes and a decrease in sperm production in the male.

NRC:

U. S. Nuclear Regulatory Commission.

Nuclide:

A general term applicable to all atomic forms of elements. The term is often erroneously used as a synonym for "isotope", which properly has a more limited definition. Whereas isotopes are the various forms of a single element (hence are a family of nuclides) and all have the same atomic members, nuclides comprise all the isotopic forms of all the elements.

Occupational Exposure:

In this report, exposure to people from external, penetrating, ionizing radiation fields and irradiation by internally deposited radionuclides that are directly attributable to one's occupation.

Optimization:

This has the same meaning as ALARA.

Organ Weighing Factor (w_t):

A factor that indicates the ratio of the risk of stochastic effects attributable to irradiation of a given organ of tissue (T) to the total risk when the whole body is uniformly irradiated.

Penetrating Radiation:

A general term used to describe external radiations with sufficient penetrating power that the absorbed dose from exposures to man is delivered in significant quantities to tissues and organs other than the skin. It refers to Gamma, X and neutron radiations.

Personnel Dosimeters:

Devices designed to be worn or carried by an individual for the purpose of determining the dose equivalent received (e.g., film badges, pocket chambers, pocket dosimeters, ring badges, thermoluminescent dosimeters, etc.)

Physical Half-Life:

The time required for a radioactive substance to lose 50% of its activity by decay. It is the radioactive half-life.

Quality Factor (QF):

A factor used for radiation protection purposes that accounts for differences in biological effectiveness between different radiations. It is the ratio of the slope of the curve of risk versus dose for a given radiation to that of a reference radiation in the range of dose where the curves are assumed to be linear.

Rad:

A special unit for absorbed dose, kerma, and specific energy imparted. One rad is 0.01 joules absorbed per kilogram of any material. (Also defined as 100 ergs per gram.) Being replaced by the gray. 1 rad equals 0.01 gray.

Radioactivity:

The spontaneous decay or disintegration of an unstable atomic nucleus, usually accompanied by the emission of ionizing radiation.

Reference Level:

The predetermined value of a quantity, below a limit, which triggers a specified course of action when the value, usually a dose level, is exceeded or is expected to be exceeded.

Relative Biological Effectiveness:

A factor used to compare the biological effectiveness of different types of ionizing radiation . It is the inverse ratio of the amount of absorbed radiation required to produce a given effect to a standard of reference radiation required to produce the same effect.

Rem:

The special unit for dose equivalent. Being replaced by the sievert, 1 rem = 0.01 Sv.

Roentgen (R):

The special unit of exposure. One Roentgen equals $2.58X10^{-4}$ Coulomb per kilogram of air.

Secondary Limit:

A limit, derived from a primary limit using conservative assumptions, that assures adherence to the primary limit by methods easier to implement than those required for the primary limit.

Sievert (Sv):

The special name for the SI unit dose equivalent. 1 Sv = 1 J kg^{-1} = 100 rem.

Stochastic Effects:

Effects, the probability of which, rather than their severity, is a function of radiation dose without threshold. (More generally, stochastic means random in nature.). A stochiastic effect is one in which the probability of occurrence increases with increasing absorbed dose but the severity in affected individuals does not depend on the magnitude of the absorbed dose. A stochastic effect is an all-or-none response as far as individuals are concerned. A stochastic effect might arise as a result of radiation injury of a single cell or substructure such as a gene and is assumed to have no absolute dose threshold, despite the fact that currently available observations in population samples do not exclude zero effects at low radiation levels. Cancers (solid malignant tumors and leukemia) and genetic effects are regarded as the main stochastic effects or risks to health from exposure to ionizing radiation at low absorbed doses.

Teratogenic Effects:

Effects occurring in offspring as a result of insults sustained in-utero.

Whole Body Dose Equivalent (H_{wb}):

The dose equivalent associated with uniform irradiation of the whole body. $H_{wb} = H_e$.

Working Level (WL):

That amount of potential alpha energy in a cubic meter of air that will result in the emission of 2.08×10^{-5} joules of energy.

Working Level Month (WLM):

A cumulative exposure, equivalent to exposure to one working level for a working month (170 hours), i.e., 2.08×10^{-5} $Jm^{-3} \times 170$ h = 0.0035 Jhm^{-3}.

X-Ray:

A penetrating form of electromagnetic radiation emitted either from the inner orbital electrons of an excited atom returns to their normal state when a metal target is bombarded with high-speed electrons. X-Rays are always non-nuclear in origin.

APPENDIX Q

HOSPITAL ROUTINE AND NURSING CARE FOR RADIOACTIVE PATIENTS

For all administrations of radioactive material, an appropriate entry shall be made in the patient's clinical record. This entry shall include the date of administration and the activity and identity of the radionuclide. (Identification of the administration of all radionuclides is facilitated by the use of separate colored chart sheets for radioactive materials.) The Radiation Protection Supervisor shall be informed prior to the administration of any therapeutic doses. Transient high exposure rates may exist near patients who have received large "tracer" doses of short-lived nuclides, in which case special procedures may need to be instituted; these are outside the scope of the present report.

Radionuclides Considered in this Report

The radionuclides with which this report is specifically concerned are listed in Table 1, together with pertinent constants. For all of these except cesium-137, cobalt-60 and radium, "small" therapeutic doses are listed in column 4 of Table 2.

EXPOSURE RATE AT ONE METER

Table 1 - Physical data for specified radionuclides (point sources)

Radionuclide	Physical Half-Life	Specific Gamma Ray Constant, R/mCi-h at 1 cm	Exposure Rate at 1 Meter per 100 mCi mR/100 mCi-h
Cesium-137	30 years	3.3	33
Chromium-51	27.8 days	0.15	1.5
Cobalt-60	5.26 years	13.0	130
Gold-198	2.7 days	2.3	23
Iodine-125	60 days	1.7	0.3-3.0[b]
Iodine-131	8.04 days	2.2	22
Iridium-192	74.4 days	4.8	48
Radium-226[a]	1620 years	8.25	82.5
Radon-222[a]	3.83 days	8.25	82.5
Tantalum-182	115 days	6.8	68

[a] This value is given in rads/mCi-h at 1 cm. It is a computed value for water.

[b] Attenuation of the 35 keV x ray is such that average values based on experience at Memorial Hospital in New York City with patient implants are entered here. Computation shall be based on the higher exposure rate unless it is entered here. Computation shall be based on the higher exposure rate unless it is shown to be less by direct measurement of the particular patient.

[c] In equilibrium with short-lived daughters and filtered by 0.5 mm Pt.

Patients who have received these or smaller doses may be discharged from the hospital without supervision.

For radionuclides with half-lives greater than 115 days, generally used as removable sealed sources, it is recommended that the patient be hospitalized for the

Determination of Exposure Rate at One Meter from Patient

The maximum exposure rate at a specified distance from each patient who has received a therapeutic amount of gamma-ray emitting radionuclide greater than that indicated in Column 4 of Table 2 shall be determined immediately after administration of the material, either by measurement or by calculation. Measurement is the preferable method. Such measurements should be made with a properly calibrated ionization chamber or similar type of survey instrument. This exposure rate at a distance of 1 meter from the approximate center of the implant of from the organ with the greatest radioactivity shall be entered on the patient's chart. When redistribution or significant excretion of the radionuclide may be anticipated, the exposure rate should be remeasured and recorded 24-96 hours after administration. Discharge of patient or release of body shall be in accordance with the provisions in the following sections, and measurements shall be repeated when necessary to assure compliance.

EXPOSURE RATE AT ONE METER FROM PATIENT

Table 2 - Initial exposure rate and corresponding initial activity which result in a total integrated exposure of 0.5 R at 1 meter during complete decay

Radionuclide	Exposure Rate at 1 Meter	Initial Exposure Rate Resulting in 0.5 R to Total Decay	Corresponding Activity
	mR/mCi-h	mR/h at 1 Meter	mCi
Chromium-51	0.015	0.5	34.8
Gold-198	0.23	5.3	23
Iodine-125	0.003-0.03[a]	0.2	8-80[a]
Iodine-131	0.22	1.8	8[b]
Radon-222[c]	0.825	3.8	4.6
Also for integrated exposure of 0.5 R in one year			
Iridium-192	0.48	0.2	0.4
Tantalum-182	0.68	0.1	0.2

[a] These values cover a large range due to the variable attenuation of the 35 keV x rays in the patient.

[b] For the patient receiving radioiodine therapy, thyroidal uptake and urinary excretion are maximal before 24 hours. Therefore thyroidal radioactivity at 24 hours should be used in place of the initial activity for determinations of integrated exposure rate. This will usually be approximately 1/3 of the administered activity.

[c] In equilibrium with short-lived daughters and filtered by 0.5 mm Pt.

Exposure rates at one meter for a number of radionuclides are given in Table 1. These are calculated from the specific gamma ray emission and the inverse square law, on a basis of point sources, and are accordingly somewhat higher than the measured rates would be expected to be, since no allowance is made for attenuation of the radiation, or distribution in the body of the patient.

Exposure rates will be the basis for determination of the length of time which an attendant or visitor may spend near a patient. If the measured rate is not higher than the calculated value, exposure times based on either may be used. If there is considerable discrepancy between tabulated and measured values an immediate check should be made to determine whether the error was in the exposure rate measurement or in the amount of the radionuclide administered, or both.

The distance to be used in the exposure rate determination is that from the approximate center of the radioactivity in the patient's body to the point of measurement. The distance from the approximate center of the radioactivity in the patient to the approximate center of the attendant's body, excluding extremities, is to be used to assess compliance with exposure rate restrictions. The critical organs of the attendant and not the extremities are of concern.

No biological elimination is usually assumed, but if it is measured it may be accounted for in the calculation.

Records of these calculated or measured rates shall be maintained according to a suitable system of regular patient recordkeeping.

"Radioactivity Precautions" Tag

A "Radioactivity Precautions: tag shall be attached to the chart of each patient who receives a therapeutic amount of a gamma-ray emitting radionuclide in excess of those listed in column 4 of Table 2. Other similar tags should be attached to the patient and to his bed. The tag attached to the patient's chart shall:

(1) Specify the radionuclide administered and the activity in millicuries, at the time of administration.

(2) Specify the exposure rate at 1 meter, the time the determination was made, and by whom.

(3) Specify the date on which precautions shall cease to be required and on which tag may be removed. This is the situation when the maximum integrated exposure to any other individual from that time to complete decay is not likely to exceed 0.5 R in one year.

For the short-lived radionuclides likely to be encountered, the exposure rate and corresponding initial activities which will result in an integrated exposure of 0.5 R at 1 meter during complete decay are given in Table 2. Ten times the tabulated quantities would result in total integrated exposures of 5 R at 1 meter. For exposure 8 hours daily, 7 days a week, initial exposure rate and activity to produce a total exposure of 0.5 R at 1 meter would be 3 times the tabulated quantities, and for 5 R, 30 times the tabulated quantities.

Since the exposure rate at 0.5 meter from a point source is 4 times that at 1 meter, for this shorter distance all values of exposure rates in Tables 1 and 2 should be multiplied by 4. It is, however, highly improbable that much time will be spent in such close proximity. Correspondingly, at 2 meters the exposure rate is 1/4 that at 1 meter. It is impractical to provide tables covering all contingencies; accordingly some generalizations based on the above tables may be used. For the individual case, the pertinent figures should be provided by the Radiation Protection Supervisor.

General Considerations for Nursing Care

The length of time that attendants may spend in caring for patients should be limited by the exposure they may receive. Accordingly, as soon as the radionuclide has been administered and the exposure rate determined, the responsible person (Radiation Protection Supervisor or radiotherapist) shall attach the radioactivity labels and issue any special nursing instructions and limitations on visitors.

In Table 3 are given approximate times for exposure of 100 mR from 100 mCi of several radionuclides at two specified distances. These values have been calculated from the data of table 1, and are accordingly conservative. If the administered activity was more or less than 100 mCi, the times should be modified proportionately.

Decisions as to whether or not attendants caring for radioactive patients are to be classified as radiation workers are to be made by the Radiation Protection Supervisor. To minimize exposure of hospital personnel, it is recommended that radioactive patients not be concentrated in one area, but dispersed. However, in some large centers, where there are many such patients, dispersal may be undesirable and it may be preferable to concentrate them in designated rooms or ward under care of specially trained personnel. This is a matter of institutional policy. Pregnant nurses should not be responsible for the routine care of patients with appreciable radioactive burdens, especially those patients receiving therapy for gynecological cancer.

Table 3 - Approximate times for exposure of 100 milliroentgens from 100 mCi of various radionuclides, at specified distances

Radionuclide	Approximate Time for 100 mR per 100 mCi	
	At 2 Feet (0.61	At 6 Feet (1.83 m)
	hours	hours
Cesium-137	1	10
Chromium-51	25	230
Cobalt-60	1/3	3
Gold-198	1 ½	15
Iodine-125[a]	12	115
Iodine-131	1 ½	15
Iridium-192	3/4	7
Radium or Radon[b]	½	5
Tantalum-182	½	5

[a] These values are based on the maximum values quoted in Table 1. Exposure rates below these maximum values will increase the amount of time necessary to accumulate 100 mR.

[b] Either of these in equilibrium with short-lived daughters and filtered by 0.5 mm Pt.

Unless a patient requires extensive, one attendant can usually perform all the routine duties in the time allowed. When there is a possibility that an attendant may receive in excess of 25 percent of the 3 rems permitted in a 3-month period or fraction thereof, personnel monitoring shall be established.

A special duty nurse should not be assigned to care for more than one radioactive patient per month unless an exception is approved by the Radiation Protection Supervisor.

Precautions with Various Types of Therapeutic Procedures

Therapeutic procedures to be considered here can be divided into two classes: (1) treatment with encapsulated sources, permanent or removable, which are mechanically inserted; (2) treatment with solutions, colloidal suspensions or microspheres.

For patients being treated with encapsulated sources, the only radiation risks to attendants relate to exposure to radiation emitted by the radioactive material while in the patient or during movement of the source at the time of insertion and removal. Exposure may be controlled by limiting the duration of attendance, as outlined in the following sections.

In treatment with solutions, colloidal suspensions or microspheres, exposure times are also important because of the possibility of accidental contamination of attendants by contact with the patients or their excreta or vomitus. In dealing with these patients it is necessary to practice the "good housekeeping" habits recommended for all individuals working with radioactive materials (4). Rubber or plastic gloves shall be worn wherever contamination is possible. The gloves should be washed thoroughly while still on the hands. After removal of the gloves, the hands should immediately be washed thoroughly, particular attention being given to the fingernails. If contamination is suspected, the hands shall be monitored to make sure that no contamination remains. Eating or smoking when there is a possibility of hand contamination shall be prohibited.

Small disposable tissues that may be slightly contaminated may be flushed down the toilet. They should not go into the regular wastebasket. For larger amounts of material, including contaminated linen, a suitable waterproof, pedal-operated waste can or disposable plastic bag should be provided. These shall be turned over to the Radiation Protection Supervisor for disposal.

Special precautions regarding the use of individual radioactive nuclides will be considered in pertinent sections below.

3.51 Removable Sources Used Internally. With sealed sources, there is no danger of radioactive contamination except by damage to, or loss of, a source. No special precautions need be taken with regard to food utensils, bedding, or excreta, except to be sure that no source is lost via these routes by accidental premature removal. The problem to be considered is the amount of time the attendant should be allowed to spend in various activities connected with patient care; this depends on the radiation exposure rates at various positions. Determination of exposure rates has been discussed.

During interstitial and intracavitary radiotherapy, surgical bandages and dressings should be changed only by physician in charge or another individual designated by him and trained in techniques applicable to such cases. For gynecological patients perineal care is not ordinarily given during the treatment, but the perineal pad may be changed when necessary. In this case care must be taken to ensure that radioactive sources or source containers are not disturbed or loosened.

If a source should get free, it shall immediately be picked up with forceps and placed in a container which is to be left in the patient's room until the arrival of the physician or the Radiation Protection Supervisor, both of whom shall be notified at once.

Patients who are disoriented (due to the influence of medication or for other reasons) and are not fully aware of the nature of their treatment, may have to be restrained in order to prevent loss or malposition of a source.

As an example of the radiation protection problem in intracavitary therapy, consider a patient with 80 mg of radium in an intrauterine applicator, which is to remain in place 40 hours. The nurse caring for such patients should be classified and instructed as a radiation worker, with maximum permissible dose equivalent 100 mRem can be anticipated in about half an hour. Accordingly, during the two-day treatment period, the nurse should spend less than a quarter hour each day within two feet of this patient. Making the bed and performing the associated tasks, during which the attendant might be close to the patient, should not take more than 10 minutes. A bed bath may be omitted during these two days. At greater distances from the patient, longer times are permitted; e. g. at 6 feet the permissible time during the two days is a total of 5 hours. (these five hours are not in addition to the half hour at 2 feet).

Permanent Implants. Sources in this class which represent potential radiation hazards are radon, chromium-51, iodine-125, gold-198, tantalum-182, and iridium-192. The radon and gold decay rapidly, so that permissible time increases from day to day. A satisfactory approximation for these two nuclides is to double the permissible time after three days and again at the end of the first week.

For example, consider a patient with 40 mCi or radon implanted in a neck node. He may be able to care for himself, but food trays and medicine should be brought to him. During the first 3 days, at a distance of 2 feet, a dose of about 100 mRem may be received in about an hour. However, it is probable that an attendant need spend no more than 5 minutes a day at this short distance. At a distance of 6 feet, a dose of 100 mRem would be accumulated in about 10 hours. After 3 days, times to accumulate 100 mRem at any particular distance are doubled.

Permanent implants of beta-emitters, such as yttrium-90, do not normally present significant hazards.

Solutions, Colloidal Suspensions, and Microspheres. Radionuclides presently of importance in this category include phosphorus-32, yttrium-90, iodine-131 and gold-198. Yttrium and phosphorous are pure beta-emitters and do not give rise to significant external irradiation. (The bremsstrahlung is measurable, but the dose from it is insignificant). Phosphorus-32 and gold-198 in colloidal suspension may be injected directly into localized malignant growths and these colloids are also frequently used in body cavities. Iodine-131 is generally administered in iodide solution in treatment of thyroid disease. Half the iodine may be excreted within the first day or two. The gold is not eliminated, but its half life is short (2.7 days). Accordingly, the approximate rules mentioned in connection with gold and radon in sealed sources may be used here, namely, double all tabulated times after 3 days, and double them again at the end of the first week. However, if iodine is administered in chemical forms other than the iodide, the first doubling should be after one week and the second after two weeks. Certain special precautions may need to be observed with iodine-131. The patient who has received a therapeutic administration of iodine-131 may contaminate his food dishes and utensils with salivary excretion. Hence he should have his own

tableware, kept separate for a few days, or use disposable articles. Also his case, a large amount of the radionuclide is excreted in the urine. He should be permitted to use the regular toilet facilities, but whenever it is desirable to collect the urine for assay, special containers should be provided. Such a patient is usually ambulatory and should be instructed to collect his own urine. If the attendant must perform this duty, he should wear rubber gloves. The gloves should be washed thoroughly while still on the hands. Then the gloves should be removed and the hands washed thoroughly. A separate bedpan or urinal should be kept for the patient until he is discharged. Then the bedpan or urinal should be scrubbed thoroughly with soap and water and monitored for contamination before being returned to stock. If the patient treated with radioactive iodine vomits or is incontinent within the first 48 hours after administration of the radionuclide, or if he perspires excessively, there may be contamination of the bed linen or even of the floor. In any such emergency, or if the urine is spilled during collection, the Radiation Protection Supervisor shall be summoned immediately to supervise the decontamination. However, certain precautionary procedures should be instituted at once.

No special precautions regarding vomitus, urine, or sputum are necessary for patients treated with colloidal radioactive gold or phosphorus. The only hazard is leakage from the puncture wound made during the injection of the colloidal material. Surgical dressings and bandages should be changed only as directed by the physician in charge. Bandages or dressings which become stained should be monitored for contamination. (The gold colloid will stain linen pink, red or purple). If any time the dressing becomes damp, stained, or bloody, the physician in charge of the case and the Radiation Protection Supervisor shall be notified immediately. If there is no drainage from the wound after the first few days, dressings may be handled in the usual manner.

Procedures for Minimizing Radiation Hazard Associated with Accidental Contamination

If there is any suspicion that accidental contamination has resulted from the patient's excreta or vomitus, from spillage, from rupture of sealed sources, or from other causes, the Radiation Protection Supervisor shall be notified immediately, While awaiting his arrival, immediate steps should be taken to prevent the spread of the contamination. An area containing the entire region of potential contamination should be marked off. No person should be permitted to walk through this area. Any person who enters this area should not leave it without being monitored. Precautions shall be taken to prevent the spread of contamination to other areas.

If there is an appreciable amount of liquid, paper towels should be dropped upon it and left until the Radiation Safety Supervisor arrives. If there is contamination of the patient or of other persons, clothing should be removed and stored within the marked area. Contaminated skin should be scrubbed, using a washroom in this area, or wash basins brought to the area for this purpose. Contamination shall not be removed from the area or further cleanup attempted before arrival of the Radiation Protection supervisor. However, the following actions should be carried out as rapidly as possible, even before the arrival of the Radiation Protection Supervisor:

1. If the radioactive contamination arises from a pure beta-emitter, such as P-32, the immediate concern is only to prevent spread of contamination. If possible, the region of the spill should be covered with a plastic bed sheet and then with the equivalent of 1/2 inch of soft absorbent material such as 2 thick blankets.

This will protect personnel within the region from radiation exposure and should be left in place until the arrival of the Radiation Protection Supervisor.

2. If the contamination arises from a mixed beta-gamma emitter of medium energy such as I-131, protection against the beta radiation may be effected as described above. If personnel remain at least 6 feet from the covered spill, further immediate protection against the gamma radiation is not required.

3. If the contamination is due to breakage of a radium needle, it is possible that radioactive particles will become airborne. In this case the room should be evacuated, the door and all windows and ventilators should be closed if possible, and a region immediately outside the room marked off as a radiation hazard area. All persons evacuated from the room shall remain within this designated area until monitored by the Radiation Protection Supervisor.

Protection of Other Patients and Visitors From Radiation

The maximum permissible dose equivalent for persons not occupationally exposed is 500 mrem per year, and planning shall be based on the objective that this level will not be exceeded for other patients or for visitors exposed to radiation from a patient containing radioactive material.

As far as visitors are concerned, there is little likelihood of their exceeding this dose, even if they make repeated visits, if they remain about 6 feet or more from the patient, except for a brief period to shake hands, deliver mail, etc. Pregnant women and children should not, in general, be allowed to visit patients having an appreciable radioactive burden. Exceptions can be made in case of urgency, but the visits should be brief, and a distance of six feet or more should be maintained.

A patient not receiving radiation treatment but in a room or ward with a radioactive patient presents a different problem. If both are confined to bed, exposure is practically continuous. Even if one or both are ambulatory, there will be long periods of simultaneous bed occupancy at night and during rest hours. It is recommended that, if possible, non-radioactive patients, should receive a dose equivalent of no more than 100 mrem from another patient during any one hospital admission. This may be somewhat increased under conditions of emergency, but should not exceed 200 mrem. This may necessitate a private room assignment for the radioactive patient, but this by itself does not guarantee dose limitations, if walls are thin and beds are near walls which may have other beds just beyond.

For example, a patient has a gynecological applicator containing 60 mg of radium, which is to be kept in place for 50 hours. At a distance of 6 feet from a point source of this activity the exposure rate would be 12.5 mR/h. Absorption of radiation in the bodies of the radioactive patient and his neighbor would reduce the rate in the neighbor's critical organs somewhat, but a dose equivalent of 100 mrem would probably be accumulated in about 12 hours. With a 12-foot separation this time would be increased to 48 hours, which is satisfactory. It is evident that extra separation should be provided for patients of this type.

If one or both patients are ambulatory, it may be difficult to make an estimate of dose accumulation. In all such cases, the Radiation Protection supervisor shall make a study of the situation, and establish appropriate procedures. In the hospital where a number of such cases are treated, routines can be set up, possibly involving special rooms or wards. The irradiation of one radium patient by another such patient is of no significance, but putting several of these patients together may pose problems for attendants. In institutions having only a few cases, individual consideration of each exposure shall be made. Here the 100 mrem limit may be relaxed somewhat, since there is less probability of a second episode for the non-radiation patient. But in any such case, the dose shall not exceed 0.5 rem and should not exceed 200 mrem. The receipt of such a dose should be shown in the patient's clinical record.

RELEASE FROM HOSPITAL OF PATIENTS CONTAINING RADIOACTIVE MATERIAL

The Nuclear Regulatory Commission has usually required that patients receiving radioactive materials be hospitalized until their content of radioactivity is less than 30 mCi. Since the exposure rates and half lives of various radionuclides differ greatly, a more meaningful basis for release from the hospital is the possible exposure to other individuals with whom the patients are likely to associate.

There may be some relatively rare and unusual situations where it would be necessary, or highly desirable, to send a patient home in spite of his carrying a burden that could result in a dose to other persons in excess of 0.5 mrem. Such cases may be permitted, as exceptions, provided in general that

(1) No person under the age of 45 years shall be permitted to receive a dose in excess of 0.5 rem in a year.

(2) No person over the age of 45 years shall be permitted to receive a dose in excess of 5 rems in a year.

(3) The circumstances leading to the decision to make an exception, the evaluation of the exposure conditions, and the means of controlling individual exposures shall be documented.

(4) The local health authorities shall be notified of the action.

The division at the age of 45 is suggested by that made in NCRP Report No. 17 [1] which permits weekly doses twice as high for the individual over 45 as for those under that age. A higher permissible dose as an exception for the older group is recommended here for the probably small number of exceptional patients to be sent home. The alternative would be to declare someone in the household a radiation worker, and to institute the necessary system of supervision and monitoring.

Table 2 presents data for total integrated exposure from specific therapeutic doses of several radionuclides. Based on this information, further tables for permissible exposure times for the two levels assigned to persons under and over 45 years of age have been developed (see Table 4 and Section 4.1).

It is recognized that as far as people in the household are concerned, exposures taken from these tables will be approximate, since it is certain that specified distances will not be maintained for specified periods. The object here is to present reasonable limits. Longer distances and shorter times will lead to smaller exposures and need cause no concern. But shorter distances and longer times lead to higher exposures and are to be avoided.

On the basis of Table 4, it is seen that in some cases a 30 millicurie limit for discharge of the patient from the hospital is unnecessarily restrictive, especially when treatment has been with short-lived radionuclides. On the other hand, adequate protection for other individuals is not necessarily assured by a 30-millicurie limit when long-lived nuclides are used. The following recommendations have been formulated to correlate discharge from hospitals with possible exposure to persons in patients' homes.

Table 4 - Radioactivity levels for discharge of radioactive patients from hospital

Radionuclide	No Restrictions		All Persons in Households Over 45 Year of Age. Restriction as in Section 4.1.2(d)[a]		Some Members of Household Under 45 Years of Age. Restriction as in Section 4.1.2(d)[b]	
	Exposure Rate at 1 Meter	Activity at Discharge	Exposure Rate at 1 Meter	Activity at Discharge	Exposure Rate at 1 Meter	Activity at Discharge
	mR/h	mCi	mR/h	mCi	mR/h	mCi
Cr-51	0.5	35	5	350	1.5	100
Au-198	5.3	23	53	230	16	70
I-125	0.2	8-80[c]	2	20-800[c]	0.6	25-250[c]
I-131	1.8	8	18	80	11	50
Rn-222	3.8	4.6	38	46	15	18
Ir-192	0.2	0.4	2	4	0.6	1.2
Ta-182	0.1	0.2	1	2	0.3	0.6

[a] These levels are in general higher than any likely to be encountered.

[b] These values are rather arbitrarily selected on a basis of the probability of the situation. They represent complete integrated doses of between 1.5 and 2.5 R.

[c] These values cover a large range, due to the variable attenuation of the 35 keV x rays in the patient.

Discharge of Radioactive Patients from the Hospital

Patients Containing Radioactive Nuclides with Half-Lives Greater than 125 Days. It is recommended that for therapeutic procedures involving the use of gamma-ray emitting nuclides with half-lives greater than 125 days, the patients shall be hospitalized for the duration of the treatment. Radium-226, cobalt-60, and cesium-137 are nuclides in this category; these sources shall be removed before discharge of the patient. Exposures to other patients can be calculated as discussed in section 3.5 and the provisions of that Section shall be observed. Such a situation has been analyzed in Section 3.7

4.1.2 Patients containing Radioactive Nuclides with Half-Lives Less than 125 Days. (a) It is recommended that in the case of iodine-125, iodine-131, chromium-51, and radon, patients may be released without restrictions when their radioactive content does not exceed the amount listed in Table 2. The physician, with the concurrence of the Radiation Protection Supervisor, shall be permitted to increase these values slightly for the short-lived nuclides. However, it is suggested that rather than making any substantial increase he should make use of one of the restrictive procedures discussed in Section 4.1.2(d).

(b) It is recommended that hospitalization be required for at least 48 hours following the intraperitoneal or intrapleural administration of colloidal gold-198. Accidental loss of colloidal gold occurs usually via the insertion site and a period of at least 48 hours permits observation of the progress of healing of the puncture wound. After this period release can be in accordance with Section 4.1.2.(a).

(c) Patients treated with long-lived tantalum-182 or iridium-192 need special consideration (see 4.1.2(e)(below).

(d) Following hospitalization, as recommended in (a) and (b) above, discharge of all patients who have received therapeutic amounts of any radioactive nuclide shall be governed by the following provisions.

(1) A patient shall not be discharged from the hospital if the maximum integrated exposure, at a distance of one meter from the patient, for continuous exposure, exceeds 5R in one year.

The initial exposure rates at one meter, or the activities which will result in an integrated exposure (for continuous exposure) of approximately 5R in one year, can be obtained from the last two columns of Table 2, by multiplying the values there given by a factor of 10.

(2) If the initial exposure rate at one meter, or the activity remaining in the patient, indicates by the above application of values in the last two columns of Table 2, that the integrated exposure will not exceed 5R in one year, provision for release from the hospital shall be made for one of two different situations, as follows:

(i) In the event that all persons in the household of the radioactive patient, and hence all those persons with whom the patient will have appreciable contact, are over the age of 45 years:

---- The patient should be instructed to remain at distance greater than 3 feet from other people, except for brief periods for necessary procedures.

---- Babies and young people (of ages less than 45 years) should not visit the patient, but if they do, the visits should be brief, and a distance of at least 9 feet from the patient should be maintained.

(ii) In the event that a person under the age of 45 years lives in the household of the patient:

---- Stricter precautions shall be observed than when all contacts are with persons over 45 years of age.

---- Children and persons under 45 years of age shall not be allowed in the same room, nor at a distance of less than 9 feet, for more than a few minutes a day. Observance of these conditions will insure that persons under 45 years of age will not be exposed to more than 0.5R per years from the radioactive individual.

---- Other restrictions may be specified by the physician.

All restrictions may be removed when the activity reaches that listed in Table 2. The Radiation Protection Supervisor shall determine this time, and give the necessary instructions. The instructions should be printed or typewritten.

These conditions for release are summarized in Table 4.

(e) Permanent implants with the relatively long-lived iridium-192 and tantalum-182 constitute more serious problems than arise with the shorter-lived nuclides, It is difficult to maintain precautions for a year or more. Accordingly, permanent implants with these nuclides should be limited. A patient with such an implant should be discharged only when it is reasonably certain that precautions will be observed. The precautions shall be given in detail by the physician or the Radiation Protection Supervisor to the responsible persons in the household.

For doses of these long-lived nuclides such as might be encountered, and also for larger doses of short-lived nuclides, for households containing young people (under 45 years of age), more detailed data may be useful to the physician and the Radiation Protection Supervisor. Accordingly, Table 5 has been developed for this purpose.

Three categories of contact with the patient are used in Table 5: "no contact" "1/2 hour per day at 1 meter (3 feet) plus 2 hours per day at 2 meters", and "4 hours per day at 1 meter". These obviously do not meet all practical situations; they serve, rather, as practical guides.

(i) There should be "no contact" with the patient after discharge from the hospital for the period specified in column IV, Table 5. By "no contact" is meant that the distance between the patient and an individual under 45 years of age should be greater than 2 meters (6 feet). In practice it should be considerably greater most of the time.

(ii) For the period listed in column V, Table 5, the individual under 45 years of age may spend half an hour a day at 1 meter, and 2 more hours per day at 2 meter. For the remainder of the time he should be farther away.

(iii) At the expiration of the period listed in column V, Table 5, restrictions can be considerably relaxed, but the conditions listed in column VI should be observed -- not more than 4 hours a day at 1 meter.

(iv) Holding of infants by the patient should not be allowed until the period listed in column VI has passed, and then only for a brief period each day.

(v) Brief periods of closer contact, such as shaking hands, may be permitted.

(vi) Following the period in column VI, Table 5, definite restrictions are removed, but prolonged close association with the patient should be limited.

For somewhat smaller initial exposure rates, observation of the same times will result in a larger margin of safety, and this is probably simpler than trying to make adjustments in the table. If the initial rates are as little as half those tabulated, the times per day in each category can be doubled or distances reduced to 3/4 of those tabulated.

Table 5 - Approximate times for permissible exposures (for persons under 45 years of age) at indicated distances from patients with indicated exposure rates at 1 meter, or indicated radionuclide content, at time of hospital discharge

[These rates at the time of discharge from the hospital are arbitrarily selected on the basis of probability of the situation.]

			Category of Contact with the Patient		
Radioactive Nuclide	Exposure Rate at 1 Meter at Time of Discharge from Hospital	Approximate Activity at Time of Discharge	"No Contact" (Greater than 2 Meters Distance)	½ Hour/Day at 1 Meter Plus 2 Hours/Day at 2 Meters	4 Hours/Day at 1 Meter
I	II	III	IV	V	VI
	mR/h	mCi	weeks following discharge	weeks following discharge	weeks following discharge
Chromium-51	1.5	100	(see column V)	1st, 2nd & 3rd	4th, 5th & 6th
Gold-198	16	70	1st	2nd & 3rd	no restrictions
Iodine-125	0.6	75	1st thru 4th[a]	5th thru 10th[a]	11th thru 18th[a]
Iodine-131	11	50	1st	2nd, 3rd & 4th	5th thru 8th
Radon	15	18	1st	2nd & 3rd	4th, 5th & 6th
Iridium-192	8.0	15	1st thru 24th	25th thru 35th	36th thru 45th[b]
Tantalum-18	25.0	17	1st thru 27th	28th thru 44th	45th thru 60th[b]

[a] For the very unpenetrating radiation from this nuclide, a fluoroscopic type leaded rubber apron should provide good protection. On the advice of the Radiation Protection Supervisor, such a garment may be used to permit spending more time near the patient.

[b] It is recognized that these conditions are extremely difficult to maintain. Accordingly, use of permanent implants of these nuclides should be limited. The activities given are much greater than ten times the values of Table 2. They represent however clinically possible situations.

For initial exposure rates exceeding those tabulated by more than 15 percent, corresponding reductions should be made in the permissible times. Thus for a patient with 30 mCi of radon (25 mR/h at onset), the time at one meter in the second week should be reduced to 40 minutes per day. The appropriate instructions should be given to the responsible family member at the time of discharge. This may well be in the form of a typewritten memorandum embodying the times for the two specified "contacts".

When such a patient is sent home, it will be noted on his chart. A specific statement concerning instructions given the family is desirable.

Table 6 - Approximate activity which will produce an exposure rate of 0.25 R/h at 25 cm[a]

Radionuclide	Approximate Activity mCi
Gold-198	70
Iodine-131	70
Iridium-192	30
Radon-222[b]	20
Tantalum-182	20

[a] Values for Cr-51 and I-125 are not given in this table because the amounts required to produce this exposure rate are not ordinarily used in clinical practice.

[b] In equilibrium with short-lived daughters and filtered by 0.5 mm Pt.

Return of Patient to Work

The patient with a permanent implant may feel well enough to return to work after a short period. In such case there would be a possibility of his irradiating his fellow workers, or in the case of a teacher, of irradiating his students. Accordingly, any such case should be studied by the Radiation Protection Supervisor before permission to work is granted. The same rules should be followed as for individuals under 45 years of age at home. Workers who are always at least 2 meters from the others would be governed by the provisions of column IV of Table 5, but those who may be closer will need to wait longer. Particularly when school children might be exposed, the patient with iridium-192 or tantalum-182 should not return to work for the first year without the advice of the Radiation Protection Supervisor. Exposure to "innocent bystanders" in travel to and from work by public transport must be considered and conditions set by the Radiation Protection Supervisor.

Death of Radioactive Patient at Home

It must be impressed upon the responsible family member that if the patient dies at home or in another hospital, the radiation therapist shall be informed immediately. (A statement to this effect should be included in the instruction sheet). The embalmer is not to be considered a radiation worker, and hence his maximum exposure should not exceed 0.5R/yr. If the patient received iodine-131, gold-198, or radon, embalming can be safely performed provided the body is not opened.

APPENDIX AA

OPERATING ROOM CARE

BRACHYTHERAPHY SOURCES

Method of Implantation:

Temporary:

Usually an intracavitary (vaginal) implantation of Radium-226 or Cesium-137. Implantation may be delayed if an after-loading technique is employed. This involves insertion of an applicator before the radioactive sources are inserted.

Permanent:

An interstitial implantation that may be superficial, intraabdominal or intrathoracic. 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 O. R.:

The physician will handle the radioactive sources. The circulating nurse will open containers so that physician can remove radioactive sources. The container is to be closed immediately.

Pocket dosimeters are available in Nuclear Medicine Ext._____, to monitor the O. R. Nurses and/or Technologists assisting in the implantation of radioactive material. Pocket dosimeters shall be worn at the lapel for the full duration of application of radioactive material. When case is complete, dosimeters should be returned to Nuclear Radiology for recording of exposure on form entitled "EXPOSURE RECORD, POCKET DOSIMETERS".

Sterilization:

Temporary implant, intracavitary Radium-226, Cesium-137, (Afterloading Technique): No sterilization required. Applicators will be contained in sterile packaging.

Temporary implant, intracavitary Radium-226, Cesium-137, (Afterloading Technique not employed): Radioactive sources should be soaked a minimum of 10 minutes in 70% ethanol. This is a disinfection procedure; sources shall not be steam sterilized.

Temporary implant, interstitial Radium-226, Cesium-137: Radioactive sources should be soaked a minimum of 10 hours in 2% glutaraldehyde. Date of activation of glutaraldehyde shall be indicated and solution not used 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 Iodine-125, Iridium-192: Sources may be steam sterilized (121 degree C); follow physician's instructions.

Permanent implant, interstitial Radon-222; Radioactive sources should be soaked a minimum of 10 hours in 2% solution glutaraldehyde. Date of activation of glutaraldehyde shall be indicated and solution not used 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.

PATIENT CHART COPY

APPENDIX BB

BRACHYTHERAPY SEALED SOURCES

Patient: _____ Room:_____

Hospital Number: _____ Physician: _____

Radionuclide: _____ Number of Sources: _____ Activity _____

Source Insertion: _____/_____ Source Removal: _____/_____
Date Time Date Time

Exposure Rate @ 1 meter _____ mR/hr _____/_____ By: _____
Date Time

CHECKED ITEMS SHALL BE OBSERVED

_____ 1. Private room with toilet mandatory.

_____ 2. Patient may not have visitors.

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

_____ 4. No visitors under 18 years of age.

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

_____ 6. Wear rubber gloves.

_____ 7. Housekeeping may not enter the room.

_____ 8. Dietary may not enter the room.

_____ 9. Nurses or other attendants shall not remain in the immediate proximity, 61 cm (2 feet), of the patient for more than a total of:

15 minutes per day for RADIUM-226
15 minutes per day for RADON-222
25 minutes per day for IRIDIUM-192
25 minutes per day for CESIUM-137
4 hours per day for IODINE-125.

_____ 10. Pregnant nurses and attendants shall NOT be responsible for the routine care of this patient.

_____ 11. No special precautions need to be taken with regard to food utensils, bedding or excreta except to be sure that no source is lost via these routes by accidental removal. Exception - those patients with established isolation precautions.

_____ 12. 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.

_____ 13. Bed bath should be omitted while sources are in place.

_____ 14. Patient shall remain in bed unless orders to the contrary are written.

_____ 15. For gynecological patients, perineal care is not ordinarily given during the treatment, but the perineal pad may be changed when necessary.

_____ 16. No sources (needles or tubes) are to be removed by anyone other than the physician named above.

_____ 17. 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 Radiation Safety Officer, both of whom shall be notified at once.

Immediately contact Doctor: _____

Phone # _____

Radiation Safety Officer, # _____

_____ 18. In the event of death or emergency surgery, immediately notify Doctor _____, Phone # _____ and Radiation Safety Officer, # _____. Do not remove body from the room.

_____ 19. Check patient's chart and bed for proper identification as a radioactive patient.

Patient's chart: "Caution, Radioactive Material, Temporary Implant" label

or

"Caution, Radioactive Material, Permanent Implant or Internal Dose" label.

_____ 20. No patient is to be released from the hospital until all radioactive material is removed or decayed to safe levels.

_____ 21. At the conclusion of treatment, contact the Nuclear Medicine Department, Ext. _____, and request a survey of the patient and room or any other area occupied by the patient to ensure that all sources have been removed from the patient and room. At this time all radiation signs will be removed and pocket dosimeters assigned to nurses collected.

_____ 22. Other instructions.

PATIENT CHART COPY

APPENDIX CC

NURSING CARE
PATIENTS RECEIVING IODINE-131 THERAPY,
ACTIVITY ADMINISTERED GREATER THAN 10 MILLICURIES

Patient: _____ Room:_____
Radionuclide: _____ Activity: _____ Physician: _____
Source Administration: _____/_____
Exposure Rate @ 1 meter _____ mR/hr _____/_____ By: _____
Date Time

Equipment Needed:
Waste Basket, Plastic Liner
Linen Bag
Rubber Gloves
Paper Towels
Disposal Eating Utensils

CHECKED ITEMS SHALL BE OBSERVED

_____ 1. Private room with toilet mandatory.

_____ 2. Patient may not have visitors.

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

_____ 4. No visitors under 18 years of age.

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

_____ 6. Wear rubber gloves when handling urinals, bed pans, emesis basins or other containers having any material obtained from the body of the patient. Wash gloves before removing and then wash hands. The gloves must be left in the patient's room in the designated waste container. These gloves need not be sterile or surgical in type.

_____ 7. Housekeeping may not enter the room.

_____ 8. Dietary may not enter the room.

_____ 9. Nurses or other attendants shall not remain in the immediate proximity, 61 cm (2 feet), of the patient for more than a total of _____

_____ 10. Pregnant nurses and attendants shall NOT be responsible for the routine care of this patient.

_____ 11. Disposable items including disposable plates, cups and eating utensils shall be used by this patient whenever possible. These items should be placed in the designated waste container. Contact the Nuclear Medicine Department, 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 a member of the Nuclear Medicine Department, Ext. _____.

_____ 13. All nondisposable items should be placed in a plastic bag and left in the patient's room to be checked by a member of the Nuclear Medicine Department, Ext. _____.

_____ 14. 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.

_____ 15. 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 during collection, call the Nuclear Medicine Department, Ext. ____. Handle all contaminated material with disposable gloves and avoid spreading contamination.

_____ 16. All vomitus must be kept in the patient's room for disposal by the Nuclear Medicine Department. Feces need not be routinely saved unless ordered. The same toilet should be used by the patient at all times and it should be flushed three times after use.

_____ 17. Nurses or attendants suspecting that their skin or clothing, including shoes, is contaminated shall notify the Nuclear Medicine Department, Ext. _____, immediately. 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.

_____ 18. In the event of death or emergency surgery, immediately notify Doctor _____, Phone # _____ and Radiation Safety Officer, # _____. Do not remove the body from the room.

_____ 19. Check patient's chart and bed for proper identification as a radioactive patient.

Patient's chart: "Caution, Radioactive Material, Permanent Implant or Internal Dose" label

_____ 20. No patient is to be released from the hospital until all radioactive material is removed or decayed to safe levels.

_____ 21. At the conclusion of treatment, contact the Nuclear Medicine Department, Ext. _____, and request a survey of the patient and room or 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 pocket dosimeters assigned to nurses collected.

_____ 22. Other instructions.

PATIENT CHART COPY

APPENDIX DD

NURSING CARE
PATIENTS RECEIVING IODINE-131 HYPERTHYROID THERAPY

Patient: _____ Room:_____

Radionuclide: _____ Activity: _____ Physician: _____

Source Administration: _____/_____

Exposure Rate @ 1 meter _____ mR/hr _____/_____ By: _____
Date Time

Equipment Needed:

Waste Basket, Plastic Liner
Linen Bag
Rubber Gloves
Paper Towels
Disposal Eating Utensils

CHECKED ITEMS SHALL BE OBSERVED

_____ 1. Private room with toilet mandatory.

_____ 2. Patient may not have visitors.

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

_____ 4. No visitors under 18 years of age.

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

_____ 6. Wear rubber gloves when handling urinals, bed pans, emesis basins or other containers having any material obtained from the body of the patient. Wash gloves before removing and then wash hands. The gloves must be left in the patient's room in the designated waste container. These gloves need not be sterile or surgical in type.

_____ 7. Pregnant nurses and attendants shall NOT be responsible for the routine care of this patient.

_____ 8. Disposable items including disposable plates, cups and eating utensils shall be used by this patient whenever possible. These items should be placed in the designated waste container. Contact the Nuclear Medicine Department, EXT. _____, for proper disposal of the contents of the designated waste container.

_____ 9. 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 a member of the Nuclear Medicine Department, Ext. _____.

_____ 10. All nondisposable items should be placed in a plastic bag and left in the patient's room to be checked by a member of the Nuclear Medicine Department, Ext. _____.

_____ 11. 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.

_____ 12. 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 during collection, call the Nuclear Medicine Department, Ext. ____. Handle all contaminated material with disposable gloves and avoid spreading contamination.

_____ 13. All vomitus must be kept in the patient's room for disposal by the Nuclear Medicine Department. Feces need not be routinely saved unless ordered. The same toilet should be used by the patient at all times and it should be flushed three times after use.

_____ 14. Nurses or attendants suspecting that their skin or clothing, including shoes, is contaminated shall notify the Nuclear Medicine Department, Ext. _____, immediately. 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.

_____ 15. In the event of death or emergency surgery, immediately notify Doctor _____, Phone # _____ and Radiation Safety Officer, # _____. Do not remove the body from the room.

_____ 16. Check patient's chart and bed for proper identification as a radioactive patient.

Patient's chart: "Caution, Radioactive Material, Permanent Implant or Internal Dose" label

_____ 17. No patient is to be released from the hospital until all radioactive material is removed or decayed to safe levels.

_____ 18. At the conclusion of treatment, contact the Nuclear Medicine Department, Ext. _____, and request a survey of the patient and room or 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 pocket dosimeters assigned to nurses collected.

_____ 19. Other instructions.

APPENDIX EE

HOME INSTRUCTION, IODINE-131 THERAPY

Patient, _____, shall observe the following instructions for _____ days.

1. Sleep alone, If employed, take _____ days off.

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

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

4. Bed linens and underclothing should be washed separately after the other washing has been done. 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 Nuclear Medicine Department, _____, if you have questions.

_____, M. D.

PATIENT CHART COPY

APPENDIX FF

NURSING CARE
PATIENTS RECEIVING PHOSPHORUS-32 (SODIUM PHOSPHATE THERAPY)

Patient: _____ Room:_____

Radionuclide: _____ Activity: _____ Physician: _____

Source Administration: _____/_____

Equipment Needed:

Waste Basket, Plastic Liner
Linen Bag
Rubber Gloves
Paper Towels
Disposal Eating Utensils

CHECKED ITEMS SHALL BE OBSERVED

_____ 1. Private room with toilet mandatory.

_____ 2. Patient may not have visitors.

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

_____ 4. No visitors under 18 years of age.

_____ 5. Wear rubber gloves when handling urinals, bed pans, emesis basins or other containers having any material obtained from the body of the patient. Wash gloves before removing and then wash hands. The gloves must be left in the patient's room in the designated waste container. These gloves need not be sterile or surgical in type.

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

_____ 7. Disposable items including disposable plates, cups and eating utensils shall be used by this patient whenever possible. These items should be placed in the designated waste container. Contact the Nuclear Medicine Department, EXT. _____, for proper disposal of the contents of the designated waste container.

_____ 8. 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 a member of the Nuclear Medicine Department, Ext. _____.

_____ 9. All nondisposable items should be placed in a plastic bag and left in the patient's room to be checked by a member of the Nuclear Medicine Department, Ext. _____.

_____ 10. 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.

_____ 11. 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 during collection, call the Nuclear Medicine Department, Ext. _____ . Handle all contaminated material with disposable gloves and avoid spreading contamination.

_____ 12. All vomitus must be kept in the patient's room for disposal by the Nuclear Medicine Department. Feces need not be routinely saved unless ordered. The same toilet should be used by the patient at all times and it should be flushed three times after use.

_____ 13. Nurses or attendants suspecting that their skin or clothing, including shoes, is contaminated shall notify the Nuclear Medicine Department, Ext. _____, immediately. 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.

_____ 14. In the event of death or emergency surgery, immediately notify Doctor _____, Phone # _____ and Radiation Safety Officer, # _____. Do not remove the body from the room.

_____ 15. Check patient's chart and bed for proper identification as a radioactive patient.

Patient's chart: "Caution, Radioactive Material, Permanent Implant or Internal Dose" label

_____ 16. No patient is to be released from the hospital until all radioactive material is removed or decayed to safe levels.

_____ 17. At the conclusion of treatment, contact the Nuclear Medicine Department, Ext. _____, and request a survey of the patient and room or 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 pocket dosimeters assigned to nurses collected.

_____ 18. Other instructions.

APPENDIX GG

HOME INSTRUCTION
PHOSPHORUS-32 (SODIUM PHOSPHATE) THERAPY

Patient, _____, shall observe the following instructions for _____ days.

1. Whenever possible use separate toilet facilities, that is a toilet not used by other members of the family.

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

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

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

5. Contact Nuclear Medicine Department, _____, if you have any questions.

_____, M. D.

PATIENT CHART COPY

APPENDIX HH

NURSING CARE
PATIENTS RECEIVING PHOSPHORUS-32 (CHROMIC PHOSPHATE)
OR GOLD-198 (COLLOIDAL) THERAPY

Patient: _____ Room: _____
Radionuclide: _____ Activity: _____ Physician: _____
Source Administration: _____/_____
Date Time

Equipment Needed:

Waste Basket, Plastic Liner
Linen Bag
Rubber Gloves
Paper Towels

CHECKED ITEMS SHALL BE OBSERVED:

_____ 1. Private room with toilet is mandatory.

_____ 2. Patient may not move visitors.

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

_____ 4. No visitors under 18 years of age.

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

_____ 6. Housekeeping may not enter the room.

_____ 7. Dietary not enter the room.

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

_____ 9. Pregnant nurses and attendants shall NOT be responsible for the routine care of this patient.

_____ 10. 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 a member of the Nuclear Medicine Department, Ext. _____.

_____ 11. All nondisposable items should be placed in a plastic bag and left in the patient's room to be checked by a member of the Nuclear Medicine Department, Ext. _____.

_____ 12. Surgical bandages and dressings over the operative site should be inspected visually several times each day. If there is evidence of drainage, notify physician at once. Do not change dressings. In the event of drainage, all linen must be handled only when wearing rubber gloves.

_____ 13. Nurses or attendants suspecting that their skin or clothing, including shoes, is contaminated shall notify the Nuclear Medicine Department, Ext. _____, immediately. This person shall remain in the patient's room and not walk around the hospital. If hands become contaminated, wash immediately with soap and water.

_____ 14. In the event of death or emergency surgery, immediately notify Doctor _____, Phone # _____ and the Radiation Safety Officer, Phone # _____. Do not remove the body from the room.

_____ 15. Check patient's chart and bed for proper identification as a radioactive patient.

Patient's chart: "Caution, Radioactive Material, Permanent Implant or Internal Dose" Label.

_____ 16. No patient is to be released from the hospital until all radioactive material is removed or decayed to safe levels.

_____ 17. At the conclusion of treatment, contact the Nuclear Medicine Department, Ext. _____, and request a survey of the patient and room or 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 pocket dosimeters assigned to nurses collected.

_____ 18. Other instructions.

APPENDIX II

HOME INSTRUCTION
PHOSPHORUS-32 (CHROMIC PHOSPHATE) OR GOLD-198 (COLLOIDAL) THERAPY

Patient, _____, observe the following instructions for _____ days.

_____ 1. Notify your doctor immediately if there is any drainage from the operative site.

_____ 2. Avoid intimate contact with family members, particularly children.

_____ 3. Contact Nuclear Medicine Department, _____, if you have any questions.

_____, M. D.

APPENDIX JJ

INSTRUCTIONS FOR FAMILY OF RELEASED PATIENT

Name of Patient _____
For further information contact _____ Tel. No. _____
Please show this form to every physician consulted concerning the patient until (Date) _____.
Name of Patient _____ was treated on _____ with _____ millicuries of _____in the form of _____. NO SPECIAL RADIATION SAFETY PRECAUTIONS ARE NECESSARY 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:

a) _____ to _____.
(Date) (Date)

Permissible distance _____ feet or more for _____ hrs/wk. At other times remain farther than 6 feet.

NOTE: During the above times brief periods of closer contact (i. e., while shaking hands or kissing the patient) are permissible.

SPECIAL PRECAUTIONS:

a) Spouse or other persons 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 KK-1

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:

Radioisotope	Chemical Form	Amount	Method of Administration	Date Treatment is To Be Given

Current medications: _____

For female patients: 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: _____, M. D.

ASSISTANTS: _____

DATE	TIME	ISOTOPE	TREATMENT DOSE	TECHNIQUE

REMARKS:

APPENDIX KK-2

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 Number: _____ Age: _____ Sex ____

Therapist: _____

Permanent Implant or Internal Dose: _____ Temporary Implant:_____

Source Administration: _____/_____ Source Removal: _____

Radionuclide: _____Treatment Dose: _____ Technique: _____

Instrument Used: _____ Model: _____ Serial: _____

RADIATION SURVEY OF PATIENT & SURROUNDING AFTER ADMINISTRATION

Date: _____

Location	mR/hr
Max. @ Surface of Patient	
Max. @ 1 meter from Patient	
Patient's Bedside, Left	
Patient's Bedside, Right	
Patient's Bedside, Foot	
Entrance Door	

RADIATION SURVEY OF PATIENT & SURROUNDING AT CONCLUSION OF TREATMENT:

Date: _____

Location	mR/hr
Max. @ Surface of Patient	
Max. @ 1 meter from Patient	
Patient's Bedside, Left	
Patient's Bedside, Right	
Patient's Bedside, Foot	
Entrance Door	

APPENDIX KK-3

^{90}STRONTIUM OPHTHALMIC APPLICATOR THERAPY RECORD

Patient Name: _____ Date: _____

Hospital No.: _____ Room No. _____ Age: _____ Sex: _____

Therapist: _____ M. D.

DATE	TIME SOURCE REMOVED FROM NUCLEAR RADIOLOGY LAB.	TREATMENT TIME	TREATMENT DOSE	TECHNIQUE	TIME SOURCE RETURNED TO NUCLEAR RADIOLOGY LAB.

Patient Name: _____ Date: _____

Hospital No.: _____ Room No. _____ Age: _____ Sex: _____

Therapist: _____ M. D.

DATE	TIME SOURCE REMOVED FROM NUCLEAR RADIOLOGY LAB.	TREATMENT TIME	TREATMENT DOSE	TECHNIQUE	TIME SOURCE RETURNED TO NUCLEAR RADIOLOGY LAB.

APPENDIX LL-1

RADIOACTIVITY PRECAUTION TAG

.....HOSPITAL

Patient's Name..... Unit Number .....

CAUTION

PATIENT CONTAINS RADIOACTIVE MATERIAL

DO NOT REMOVE THIS LABEL UNTIL

1) Radioactive material is removed from patient, or
2) Removal is authorized by Radiation Protection Supervisor (Ext. .....).

VISITORS MUST CHECK WITH NURSING STATION BEFORE GOING TO PATIENT.

Date ..... Signature .....
RADIATION PROTECTION SUPERVISOR

ATOMIC PRODUCTS CORP. Shirley, New York 11967

This should be a tag placed on the door of the patient's room.

APPENDIX LL-2

LABEL FOR PATIENT'S CHART; TEMPORARY IMPLANT

_____HOSPITAL

PATIENT'S NAME_____ UNIT NUMBER_____

CAUTION

RADIOACTIVE MATERIAL

TEMPORARY IMPLANT

Radionuclide_____ mCi_____

Inserted_____
(DATE)

Initial Exposure Rate at 1 Meter_____ mR/h

(SIGNATURE)_____

To Be Removed_____
(DATE)

INSTRUCTIONS:

Patient must remain in hospital until implant is removed. When implant is removed, "Radioactivity Precautions Tags" may also be removed.

For further information call Radiation Protection Office (Ext_____).

In case of emergency, the telephone operator has a call list for use when the Radiation Protection Office is not open.

Date_____ Signature_____
RADIATION PROTECTION SUPERVISOR

09-486 Nuclear Associates, Carle Place, N.Y Printed in U.S.A.

To be attached to cover of patient's chart

APPENDIX LL-3

LABEL FOR PATIENT'S CHART
PERMANENT IMPLANT OR INTERNAL DOSE

..... **HOSPITAL**

Patient's Name ..... **Unit Number** .....

CAUTION

RADIOACTIVE MATERIAL

PERMANENT IMPLANT OR INTERNAL DOSE

Radionuclide ..... **mCi** .....

Administered .....
(DATE)

Initial Exposure Rate at 1 Meter ..... **mR/h**

(SIGNATURE) .....

INSTRUCTIONS:

Patient must remain in hospital until .....
(DATE)

"Radioactivity Precautions" tag may be removed .....
(DATE)

The Radiation Protection Office (Ext .....) must be notified before discharge or removal of patient. For further information call Radiation Protection Office. In case of an emergency, the telephone operator has a call list for use when the Radiation Protection Office is not open.

Date ..... **Signature** .....

RADIATION PROTECTION OFFICE

ATOMIC PRODUCTS CORP. Sibley, New York 14057

To be attached to cover of patient's chart