FORM NRC-313M
(8-78)
10 CFR 35

U.S. NUCLEAR REGULATORY COMMISSION

APPLICATION FOR MATERIALS LICENSE – MEDICAL

Approved:
GAO R0557

INSTRUCTIONS - *Complete Items 1 through 26 if this is an initial application or an application for renewal of a license. Use supplemental sheets where necessary. Item 26 must be completed on all applications and signed. Retain one copy. Submit original and one copy of entire application to: Director, Office of Nuclear Materials Safety and Safeguards, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555. Upon approval of this application, the applicant will receive a Materials License. An NRC Materials License is issued in accordance with the general requirements contained in Title 10, Code of Federal Regulations, Part 30, and the Licensee is subject to Title 10, Code of Federal Regulations, Parts 19, 20 and 35 and the license fee provision of Title 10, Code of Federal Regulations, Part 170. The license fee category should be stated in Item 26 and the appropriate fee enclosed.*

1.a. NAME AND MAILING ADDRESS OF APPLICANT *(institution, firm, clinic, physician, etc.)* INCLUDE ZIP CODE

Humana Hospital-Hoffman Estates
1555 North Barrington Road
Hoffman Estates, Illinois 60194

TELEPHONE NO.: AREA CODE (312) 490 6923

1.b. STREET ADDRESS(ES) AT WHICH RADIOACTIVE MATERIAL WILL BE USED *(If different from 1.a.)* INCLUDE ZIP CODE

Same as 1.a.

2. PERSON TO CONTACT REGARDING THIS APPLICATION

Jim Mikowski or Stan Buhr
Standard Nuclear Consultants, Ltd.
TELEPHONE NO.: AREA CODE (312) 344-5786

3. THIS IS AN APPLICATION FOR: *(Check appropriate item)*

a. ☐ NEW LICENSE
b. ☐ AMENDMENT TO LICENSE NO. _____
c. ☒ RENEWAL OF LICENSE NO. 12-18742-01

4. INDIVIDUAL USERS *(Name individuals who will use or directly supervise use of radioactive material. Complete Supplements A and B for each individual.)*

Timothy Tully, M.D.
Daniel E. Horan, M.D.
Donald Waxler, M.D.
Margaret Schorsch Boyle, M.D.

5. RADIATION SAFETY OFFICER (RSO) *(Name of person designated as radiation safety officer. If other than individual user, complete resume of training and experience as in Supplement A.)*

Timothy Tully, M.D.

6.a. RADIOACTIVE MATERIAL FOR MEDICAL USE

RADIOACTIVE MATERIAL LISTED IN:	ITEMS DESIRED "X"	MAXIMUM POSSESSION LIMITS (In millicuries)
10 CFR 31.11 FOR IN VITRO STUDIES	X	3.0
10 CFR 35.100, SCHEDULE A, GROUP I	X	AS NEEDED
10 CFR 35.100, SCHEDULE A, GROUP II	X	AS NEEDED
10 CFR 35.100, SCHEDULE A, GROUP III	X	4.0 Curies
10 CFR 35.100, SCHEDULE A, GROUP IV	X	AS NEEDED
10 CFR 35.100, SCHEDULE A, GROUP V	X	AS NEEDED
10 CFR 35.100, SCHEDULE A, GROUP VI		

ADDITIONAL ITEMS:	MARK ITEMS DESIRED "X"	MAXIMUM POSSESSION LIMITS (In millicuries)
IODINE-131 AS IODIDE FOR TREATMENT OF HYPERTHYROIDISM		
PHOSPHORUS-32 AS SOLUBLE PHOSPHATE FOR TREATMENT OF POLYCYTHEMIA VERA, LEUKEMIA AND BONE METASTASES		
PHOSPHORUS-32 AS COLLOIDAL CHROMIC PHOSPHATE FOR INTRACAVITARY TREATMENT OF MALIGNANT EFFUSIONS.		
GOLD-198 AS COLLOID FOR INTRACAVITARY TREATMENT OF MALIGNANT EFFUSIONS.		
IODINE-131 AS IODIDE FOR TREATMENT OF THYROID CARCINOMA		
XENON-133 AS GAS OR GAS IN SALINE FOR BLOOD FLOW STUDIES AND PULMONARY FUNCTION STUDIES.	X	200 mCi

6.b. RADIOACTIVE MATERIAL FOR USES NOT LISTED IN ITEM 6.a. *(Sealed sources up to 3 mCi used for calibration and reference standards are authorized under Section 35.14(d), 10 CFR Part 35, and NEED NOT BE LISTED.)*

ELEMENT AND MASS NUMBER	CHEMICAL AND/OR PHYSICAL FORM	MAXIMUM NUMBER OF MILLICURIES OF EACH FORM	DESCRIBE PURPOSE OF USE

Applicant 2-20-19 Ltr
Check No. 4517 $150
Amount
Type
Date Check Rec'd 2/19/85
Received By

8506030678 850510
REG3 LIC30
12-18742-01 PDR

39-14116

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INFORMATION REQUIRED FOR ITEMS 7 THROUGH 23

For Items 7 through 23, check the appropriate box(es) and submit a detailed description of all the requested information. Begin each item on a separate sheet. Identify the item number and the date of the application in the lower right corner of each page. If you indicate that an appendix to the medical licensing guide will be followed, do not submit the pages, but specify the revision number and date of the referenced guide: Regulatory Guide 10.8 , Rev. 1 Date: October 1980

(Some portions of the Guide have been revised slightly as shown in the attachments to more closely describe our program).

7. MEDICAL ISOTOPES COMMITTEE	
	Names and Specialties Attached; and
X	Duties as in Appendix B; or *(Check One)*
	Equivalent Duties Attached
8. TRAINING AND EXPERIENCE	
	Supplements A & B Attached for Each Individual User; and
	Supplement A Attached for RSO.
9. INSTRUMENTATION *(Check One)*	
X	Appendix C Form Attached; or
	List by Name and Model Number
10. CALIBRATION OF INSTRUMENTS	
X	Appendix D Procedures Followed for Survey Instruments; or *(Check One)*
	Equivalent Procedures Attached; and
X	Appendix D Procedures Followed for Dose Calibrator; or *(Check One)*
	Equivalent Procedures Attached
11. FACILITIES AND EQUIPMENT	
X	Description and Diagram Attached
12. PERSONNEL TRAINING PROGRAM	
X	Description of Training Attached
13. PROCEDURES FOR ORDERING AND RECEIVING RADIOACTIVE MATERIAL	
X	Detailed Information Attached
14. PROCEDURES FOR SAFELY OPENING PACKAGES CONTAINING RADIOACTIVE MATERIALS *(Check One)*	
X	Appendix F Procedures Followed; or
	Equivalent Procedures Attached

15. GENERAL RULES FOR THE SAFE USE OF RADIOACTIVE MATERIAL *(Check One)*	
X	Appendix G Rules Followed; or
	Equivalent Rules Attached
16. EMERGENCY PROCEDURES *(Check One)*	
X	Appendix H Procedures Followed; or
	Equivalent Procedures Attached
17. AREA SURVEY PROCEDURES *(Check One)*	
X	Appendix I Procedures Followed; or
	Equivalent Procedures Attached
18. WASTE DISPOSAL *(Check One)*	
X	Appendix J Form Attached; or
	Equivalent Information Attached
19. THERAPEUTIC USE OF RADIOPHARMACEUTICALS *(Check One)*	
X	Appendix K Procedures Followed; or
	Equivalent Procedures Attached
20. THERAPEUTIC USE OF SEALED SOURCES	
	Detailed Information Attached; and
	Appendix L Procedures Followed; or *(Check One)*
	Equivalent Procedures Attached
21. PROCEDURES AND PRECAUTIONS FOR USE OF RADIOACTIVE GASES (e.g., Xenon – 133)	
X	Detailed Information Attached
22. PROCEDURES AND PRECAUTIONS FOR USE OF RADIOACTIVE MATERIAL IN ANIMALS	
	Detailed Information Attached
23. PROCEDURES AND PRECAUTIONS FOR USE OF RADIOACTIVE MATERIAL SPECIFIED IN ITEM 6.b	
	Detailed Information Attached

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24. PERSONNEL MONITORING DEVICES

	TYPE (Check appropriate box)		SUPPLIER	EXCHANGE FREQUENCY
a. WHOLE BODY	X	FILM	R. S. Landauer, Jr. & Co.	Monthly
		TLD		
		OTHER (Specify)		
b. FINGER		FILM		
	X	TLD	R. S. Landauer Jr. & Co.	Monthly
		OTHER (Specify)		
c. WRIST		FILM		
		TLD		
		OTHER (Specify)		

d. OTHER (Specify)

This institution is also committed to the ALARA program set forth in the attached Appendix O.

25. FOR PRIVATE PRACTICE APPLICANTS ONLY

a. HOSPITAL AGREEING TO ACCEPT PATIENTS CONTAINING RADIOACTIVE MATERIAL

NAME OF HOSPITAL

MAILING ADDRESS

CITY | STATE | ZIP CODE

b. ATTACH A COPY OF THE AGREEMENT LETTER SIGNED BY THE HOSPITAL ADMINISTRATOR.

c. WHEN REQUESTING THERAPY PROCEDURES, ATTACH A COPY OF RADIATION SAFETY PRECAUTIONS TO BE TAKEN AND LIST AVAILABLE RADIATION DETECTION INSTRUMENTS.

26. CERTIFICATE

(This item must be completed by applicant)

The applicant and any official executing this certificate on behalf of the applicant named in Item 1a certify that this application is prepared in conformity with Title 10, Code of Federal Regulations, Parts 30 and 35, and that all information contained herein, including any supplements attached hereto, is true and correct to the best of our knowledge and belief.

a. LICENSE FEE REQUIRED
(See Section 170.31, 10 CFR 170)

(1) LICENSE FEE CATEGORY: 7C

(2) LICENSE FEE ENCLOSED: $ 580.00

b. APPLICANT OR CERTIFYING OFFICIAL *(Signature)* Barry Schneider

(1) NAME *(Type or Print)* Barry Schneider

(2) TITLE Executive Director

c. DATE

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Item 4: Authorized Users of Radioactive Materials

Name of User	Authorization
Timothy E. Tully, M.D.	All
Daniel E. Horan, M.D.	Diagnosis
Donald Waxler, M.D.	Groups I, II, III xenon-133 and iodine-131 for therapy
Margaret Schorsch Boyle, M.D.*	All

* See attached NRC-313 Supplements A and B documenting Dr. Boyle's clinical and didactic training in nuclear medicine.

Please reference the current NRC radioactive materials license application for documentation of the above-named users' experience in the handling of radioactive materials.

Duties of the Radiation Safety Officer and/or Delegate

a. General surveillance over all activities involving the use of radioactive materials, including routine monitoring and special surveys of all areas where radioactive material is stored.

b. Determining compliance with rules and regulations and license conditions.

c. Furnishing consulting services on all aspects of radiation safety to personnel at all levels of responsibility.

d. Receiving, delivering, and surveying all shipments of radioactive material arriving at the facility.

e. Distributing and processing personnel monitoring devices when needed. Determining the need for and evaluation of bioassays, keeping personnel exposure and bioassay records and notifying individuals of exposures approaching maximum permissable dose and recommending appropriate remedial action.

f. Conducting training programs and otherwise instructing personnel in the proper procedures for handling radioactive materials prior to use, at periodic intervals and as required by changes in procedures, equipment, regulation or license condition.

g. Supervising and coordinating the radioactive waste management program, including keeping waste storage and disposal records.

h. Storing all radioactive materials.

i. Performing leak tests on sealed sources when needed.

j. Maintaining an inventory of all radionuclides and limiting the quantity to the amounts authorized by the license.

The membership of this committee will consist of at least three (3) members and will include:

1. the radiation safety officer;

2. the hospital administrator or other administrative official directly responsible to the hospital administrator in the hospital's internal chain of command;

3. a physician specialist* from each department where radioactive materials are used; and

4. a representative of the hospital's nursing staff.

*Some departments, such as the nuclear pharmacy, may not be under the supervision of a physician. In these cases, the supervisory paramedical professional will be a member of the committee.

The names and specialties of the committee members will be documented at the hospital, will be updated as necessary, and will be available for inspection.

APPENDIX B

MEDICAL ISOTOPES COMMITTEE*

Responsibility

The committee is responsible for :

1. Ensuring that all individuals who work with or in the vicinity of radioactive material have sufficient training and experience to enable them to perform their duties safely and in accordance with NRC regulations and the conditions of the license.

2. Ensuring that all use of radioactive material is conducted in a safe manner and in accordance with NRC regulations and the conditions of the license.

Duties

The committee shall:

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

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

3. 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 as required by §19.12 of 10 CFR Part 19.

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

5. 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.

6. Review the entire radiation safety program at least annually to determine that all activities are being conducted safely and in accordance with NRC regulations and the conditions of the license. The review shall include an examination of all records, reports from the radiation safety officer, results of NRC inspection, written safety procedures, and the adequacy of the institution's management control system.

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

8. Maintain written records of all committee meetings, actions, recommendations, and decisions.

9. Ensure that the byproduct material license is amended, when necessary, prior to any changes in facilities, equipment, policies, procedures, and personnel, as specified in the license.

Meeting Frequency

The medical isotopes committee shall meet as often as necessary to conduct its business but not less than once in each calendar quarter.

*A rule is expected in 1981 that would change the name, composition, and functions of this committee.

FORM NRC-313M-SUPPLEMENT B
(8-78)

U. S. NUCLEAR REGULATORY COMMISSION

PRECEPTOR STATEMENT

Supplement B must be completed by the applicant physician's preceptor. If more than one preceptor is necessary to document experience, obtain a separate statement from each.

1. APPLICANT PHYSICIAN'S NAME AND ADDRESS

FULL NAME

Margaret Schorsch Boyle

STREET ADDRESS

1111 S. Hamlin

CITY | STATE | ZIP CODE

Park Ridge | Il | 60068

KEY TO COLUMN C

PERSONAL PARTICIPATION SHOULD CONSIST OF:

1-Supervised examination of patients to determine the suitability for radioisotope diagnosis and/or treatment and recommendation for prescribed dosage.

2-Collaboration in dose calibration and actual administration of dose to the patient including calculation of the radiation dose, related measurements and plotting of data.

3-Adequate period of training to enable physician to manage radioactive patients and follow patients through diagnosis and/or course of treatment.

2. CLINICAL TRAINING AND EXPERIENCE OF ABOVE NAMED PHYSICIAN

ISOTOPE A	CONDITIONS DIAGNOSED OR TREATED B	NUMBER OF CASES INVOLVING PERSONAL PARTICIPATION C	COMMENTS *(Additional information or comments may be submitted in duplicate on separate sheets.)* D
I-131 or I-125	DIAGNOSIS OF THYROID FUNCTION	3005	
	DETERMINATION OF BLOOD AND BLOOD PLASMA VOLUME		
	LIVER FUNCTION STUDIES		
	FAT ABSORPTION STUDIES		
	KIDNEY FUNCTION STUDIES		
	IN VITRO STUDIES	2149	
OTHER			
I-125	DETECTION OF THROMBOSIS 99mTc	13	
I-131	THYROID IMAGING	87	
P-32	EYE TUMOR LOCALIZATION		
Se-75	PANCREAS IMAGING		
Yb-169	CISTERNOGRAPHY	5	
Xe-133	BLOOD FLOW STUDIES AND PULMONARY FUNCTION STUDIES	736	
OTHER			
Tc-99m	BRAIN IMAGING	99	
	CARDIAC IMAGING	211	
	THYROID IMAGING	193	
	SALIVARY GLAND IMAGING		
	BLOOD POOL IMAGING	2	
	PLACENTA LOCALIZATION		
	LIVER AND SPLEEN IMAGING	485	
	LUNG IMAGING	167	
	BONE IMAGING	710	
OTHER			

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PRECEPTOR STATEMENT *(Continued)*

2. CLINICAL TRAINING AND EXPERIENCE OF ABOVE NAMED PHYSICIAN *(Continued)*

ISOTOPE A	CONDITIONS DIAGNOSED OR TREATED B	NUMBER OF CASES INVOLVING PERSONAL PARTICIPATION C	COMMENTS *(Additional information or comments may be submitted in duplicate on separate sheets.)* D
P-32 *(Soluble)*	TREATMENT OF POLYCYTHEMIA VERA, LEUKEMIA, AND BONE METASTASES		No experience only authorize for I-131 Hyper, Cardiac & Thy Carcinoma
P-32 *(Colloidal)*	INTRACAVITARY TREATMENT		
I-131	TREATMENT OF THYROID CARCINOMA	8	
	TREATMENT OF HYPERTHYROIDISM	25 ✓	
Au-198	INTRACAVITARY TREATMENT		
Co-60 or Cs-137	INTERSTITIAL TREATMENT		
	INTRACAVITARY TREATMENT		
I-125 or Ir-192	INTERSTITIAL TREATMENT		
Co-60 or Cs-137	TELETHERAPY TREATMENT		
Sr-90	TREATMENT OF EYE DISEASE		
	RADIOPHARMACEUTICAL PREPARATION		
Mo-99/ Tc-99m	GENERATOR	5 ✓	
Sn-110/ In-113m	GENERATOR		
Tc-99m	REAGENT KITS	5 ✓	
Other			

3. DATES AND TOTAL NUMBER OF HOURS RECEIVED IN CLINICAL RADIOISOTOPE TRAINING

Dr. Margaret Schorsch was in Nuclear Medicine at Michael Reese Hospital and Medical Center from January 1983 through May 1983 for clinical training. She has received approximately 670 hours of nuclear medicine time and approximately 140 hours of lecture time.

4. THE TRAINING AND EXPERIENCE INDICATED ABOVE WAS OBTAINED UNDER THE SUPERVISION OF:

a. NAME OF SUPERVISOR
Steven Pinsky, M.D.

b. NAME OF INSTITUTION
Michael Reese Hosp. & Medical Ctr.

c. MAILING ADDRESS
31st Street at Lake Shore Drive

d. CITY
Chicago, IL 60616

5. MATERIALS LICENSE NUMBER(S)
12-00074-04

6. PRECEPTOR'S SIGNATURE
Steven Pinsky

7. PRECEPTOR'S NAME *(Please type or print)*
Steven Pinsky, M.D.

8. DATE
October 5, 1984

FORM NRC-313M-SUPPLEMENT B
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FORM NRC-313M-SUPPLEMENT A (8-78) — U.S. NUCLEAR REGULATORY COMMISSION

TRAINING AND EXPERIENCE
AUTHORIZED USER OR RADIATION SAFETY OFFICER

1. NAME OF AUTHORIZED USER OR RADIATION SAFETY OFFICER	2. STATE OR TERRITORY IN WHICH LICENSED TO PRACTICE MEDICINE
Margaret Schorsch Boyle	Illinois

3. CERTIFICATION

SPECIALTY BOARD A	CATEGORY B	MONTH AND YEAR CERTIFIED C
RADIOLOGY		

4. TRAINING RECEIVED IN BASIC RADIOISOTOPE HANDLING TECHNIQUES

FIELD OF TRAINING A	LOCATION AND DATE(S) OF TRAINING B	TYPE AND LENGTH OF TRAINING: LECTURE/ LABORATORY COURSES (Hours) C	TYPE AND LENGTH OF TRAINING: SUPERVISED LABORATORY EXPERIENCE (Hours) D
a. RADIATION PHYSICS AND INSTRUMENTATION	Michael Reese Hospital & Medical Center Division of Nuclear Medicine Chicago, IL 60616 January 1983 - May 1983	75	100
b. RADIATION PROTECTION		50	30
c. MATHEMATICS PERTAINING TO THE USE AND MEASUREMENT OF RADIOACTIVITY		25	30
d. RADIATION BIOLOGY		25	10
e. RADIOPHARMACEUTICAL CHEMISTRY		25	30

5. EXPERIENCE WITH RADIATION. *(Actual use of Radioisotopes or Equivalent Experience)*

ISOTOPE	MAXIMUM AMOUNT	WHERE EXPERIENCE WAS GAINED	DURATION OF EXPERIENCE	TYPE OF USE
99mTc	2,000 MIlci	Michael Reese Hosp. &	20 weeks	Diagnosis
131-I	200 Milci	Medical Center	"	Therapy & Diagnosis
51 Cr	0.2 "	31st St. Lake Shore Dr.	"	Diagnosis
59 Fe	.05 "	Chicago, IL 60616		Diagnosis
57 Co	10 "			Standards-Vitamin B-12

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5. EXPERIENCE WITH RADIATION (Continued)

ISOTOPE	MAXIMUM AMOUNT	WHERE EXPERIENCE WAS GAINED	DURATION OF EXPERIENCE	TYPE OF USE
133-Xe	5,000 Milci	Michael Reese Hospital	20 Weeks	Diagnosis
111-In	10 "	& Medical Center		Diagnosis
169-Yb	10 "	Div. Nucl. Med		Diagnosis
125-I	0.1 "	31st & Lake Shore Dr.		Lab, In-Vitro & RISA
67-Ga	30 "			Diagnosis
137-Cs	10 "			Standard
201-Tl	50 "			Diagnosis
75-Se	10 "			Diagnosis
123-I	30 "			Diagnosis

Item 9: INSTRUMENTATION

1. Survey Meters

   a. Manufacturer's name: Picker

      Manufacturer's model: G.M. Meter-Model 800

      Number of instruments available: One

      minimum range: 0 mr/hr to 0.2 mr/hr

      maximum range: 0 mr/hr to 2000 mr/hr

   b. Manufacturer's name: Victoreen

      Manufacturer's model: 740 F

      Number of instruments available: One

      minimum range: 0 mr/hr to 25 mr/hr

      maximum range: 0 mr/hr to 25000 mr/hr

2. Dose Calibrator:

   Manufacturer: Picker

   Model: Isotope Calibrator

   Number available: One

3. Instruments Used for Diagnostic Procedures:

Type of Istrument	Manufacturer Name	Model
Gamma Camera (One)	Picker	Dyna Camera 4/15
Gamma Camera (One)	Picker	Dyna Camera 4/61
Uptake Probe (One)	Picker	Spectroscaler 4P

Calibration of Survey Instruments

Check appropriate items:

__X__ Survey instruments will be calibrated at least annually and following repair.

__X__ Calibration will be performed at two points on each scale used for radiation protection purposes up to 1 R/hr.

The two points will be approximately 1/3 and 2/3 of full scale. A survey instrument may be considered properly calibrated when the instrument readings are +/- 10% of the calculated values for each point checked. Readings within +/- 20% are considered acceptable if a chart, graph or response factor is prepared and affixed to the instrument, and used to interpret readings to within +/- 10%. Also, when higher scales are not checked or calibrated, an appropriate precautionary note will be posted on the instrument.

Survey instruments will be calibrated:

__X__ By the manufacturer, or

__X__ The calibration procedures in Section 1 of Appendix D (attached) will be used, or

__X__ By a consultant or outside firm:

Standard Nuclear Consultants, Ltd.
1340 Balmoral Avenue
Westchester, Illinois 60153

Procedures and sources:

__X__ Have been approved by the NRC (license no 12-20362-01) and IDNS (license no. IL-00565-01), and are on file with the respective agencies.

or

__X__ By other firm or individual whose procedures and sources have been approved by the NRC.

Section 2

METHODS FOR CALIBRATION OF DOSE CALIBRATOR*

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

A. Test for the following:

1. Instrument constancy (daily)
2. Instrument accuracy (at installation and annually thereafter)
3. Instrument linearity (at installation and quarterly thereafter)
4. Geometrical variation (at installation)

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

C. Test for Instrument Constancy

Instrument constancy means that there is reproducibility, within a stated acceptable degree of precision, in measuring a constant activity over time. Assay at least one relatively long-lived reference source such as Cs-137, Co-57,** or Ra-226** using a reproducible geometry before each day's use of the instrument. Preferably, at least two reference sources (for example, 3-5 mCi of Co-57 and 100-200 μCi of Cs-137 or 1-2 mg Ra-226 (with appropriate decay corrections) will be alternated each day of use to test the instrument's performance over a range of photon energies and source activities.

1. Assay each reference source using the appropriate instrument setting (i.e., Cs-137 setting for Cs-137).
2. Measure background level at same instrument setting, or check that automatic background subtraction is operating properly when blanks are inserted in the calibrator.
3. Calculate net activity of each source subtracting out background level.
4. For each source, plot net activity versus the day of the year on semilog graph paper.
5. Log the background levels.
6. Indicate the predicted activity of each source based on decay calculations and the ±5 percent limits on the graph.
7. Repeat the procedure used for the Cs-137 source for all the commonly used radionuclide settings.
8. Variations greater than ±5 percent from the predicted activity indicate the need for instrument repair or adjustment.
9. Investigate higher than normal background levels to determine their origin and to eliminate them if possible by decontamination, relocation, etc.

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

E. Test of Instrument Linearity

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

1. Assay the Tc-99m vial in the dose calibrator, and subtract background level to obtain net activity in millicuries.
2. Repeat step 1 at time intervals of 6, 24, 30, and 48 hours after the initial assay.
3. Using the 30-hour activity measurement as a starting point, calculate the predicted activities at 0, 6, 24, and 48 hours using the following table:

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*See ANSI N42.13-1978, "Calibration and Usage of Dose Calibrator Ionization Chambers for the Assay of Radionuclides" (American National Standards Institute, Inc., 1430 Broadway, New York, N.Y. 10018).

**Co-57 and Ra-226 are not subject to NRC licensing; the respective State agency should be consulted to determine its requirements for possessing this material.

Assay Time (hr)*	*Correction Factor*
0	31.633
6	15.853
24	1.995
30	1.
48	0.126

Example: If the net activity measured at 30 hours was 15.625 mCi, the calculated activities for 6 and 48 hours would be 15.625 mCi x 15.853 = 247.7 mCi and 15.625 mCi x 0.126 = 1.97 mCi, respectively.

** 4. On log-log coordinate paper, plot the measured net activity (for each time interval) versus the calculated activity (for the same time interval).

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

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

F. Test for Geometrical Variation

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

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

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

2. Increase the volume of liquid in the vial in steps to 2, 4, 8, 10, 20, and 25 ml by adding the appropriate amount of water or saline. After each addition, gently shake vial to mix contents and assay as in step 1. (Follow good radiation safety practices to avoid contamination and to minimize radiation exposure.)

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

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

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

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

5. The true activity of a sample is calculated as follows:

True Activity = Measured Activity x Correction Factor

where the correction factor used is for the same volume and geometrical configuration as the sample measured.

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

7. It should be noted that differences of 200 percent in dose calibrator readings between glass and plastic syringes have been observed for lower-energy radionuclides such as I-125, which should be assayed in a dose calibrator only if the reliability of such an assay can be established. Glass tubes and syringes may also vary enough in thickness to cause significant errors in assaying I-125. Hence, adequate correction factors must be established.

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

G. Test for Instrument Accuracy

Check the accuracy of the dose calibrator for several radionuclides, including Cs-137, Co-57, and Ba-133, using appropriate reference standards whose activities have been calibrated by comparisons with standard sources that have been assayed by NBS and documented.

* Assay times should be measured in whole hours and correction factors should be used to the third decimal place as indicated. The more recent half-life of $T_{1/2}$ = 6.02 hours has been used in calculating these correction factors.

** Alternately the % error at each point can be determined by the following equation: Calculated activity - Measured activity / Calculated activity % error.

The activity levels of the reference sources used should approximate those levels normally encountered in clinical use (e.g., Co-57, 3-5 millicuries) giving adequate attention to source configuration. Identify in your application the three sources that you will use. State nuclide, activity, and calibration accuracy. The lower-energy reference standards (Tc-99m, Xe-133, I-125) must be in vials with the same thickness of glass as the actual samples to be measured for best accuracy.

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

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

3. The average activity determined in step 2 should agree with the certified activity of the reference source within ±5 percent after decay corrections.

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

5. Keep a log of these calibration checks.

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

7. At the same time the instrument is being initially calibrated at the licensee's facility with the reference 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 reference standards. Keep a log of these initial and subsequent readings.

CALIBRATION OF DOSE CALIBRATOR

A. Sources Used for Linearity Test

(Check as appropriate)

X First elution from new Mo-99/Tc-99m generator

X Other* (specify) ** If generators are not in use, a source of Tc-99m with activity equivalent to the maximum activity assayed to clinical situations will be used

B. Sources Used for Instrument Accuracy and Constancy Tests ***

Radionuclide	Suggested Activity (mCi)	Activity (mCi)	Accuracy
Co-57	3-5	One millicurie or more	within ±5%
Ba-133	0.1-0.5	100 microcuries or more	within ±5%
Cs-137	0.1-0.2	100 microcuries or more	within ±5%
Ra-226	1-2	N/A	N/A
N/A		N/A	N/A

C. X The procedures described in Section 2 of Appendix D will be used for calibration of the dose calibrator

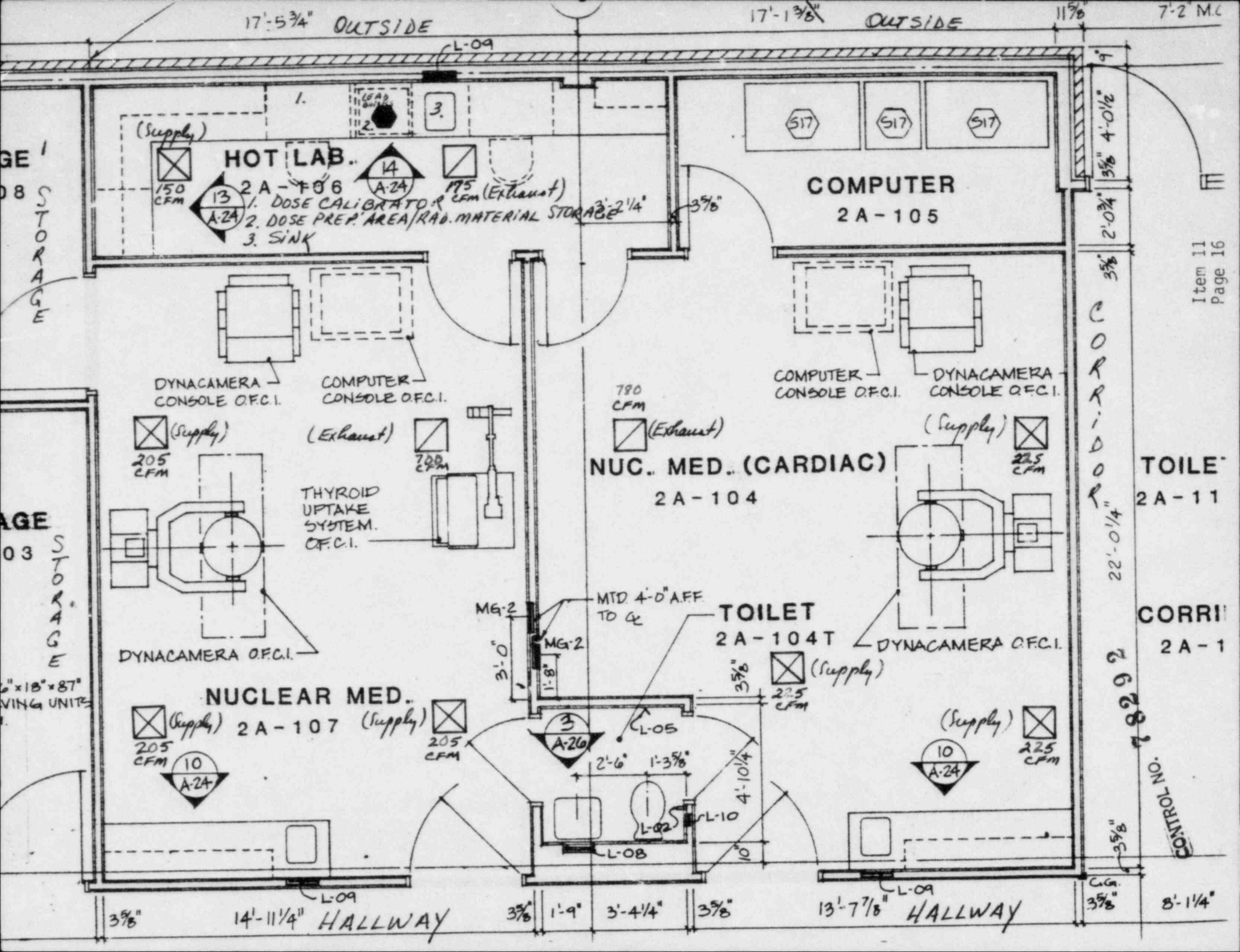
or

_____ Equivalent procedures are attached.

*For licensees who are not authorized for Mo-99/Tc-99m generators, activity must be equivalent to the highest activity used.

** We also request authorization to use an alternate method of performing dose calibrator linearity checks using a "Lineator" device (Atomic Products Corp., Center Moriches, NY) or a "Calicheck" system (Calcorp). We confirm the manufacturer's product literature will be followed with respect to use, calculations, and replacement of damaged parts.

*** For constancy tests, we will use a Cs-137 source of 100 µCi or more to check the Cs-137 setting as well as the other commonly used radionuclide settings. The shorter half-lives of Ba-133 and Co-57 make frequent decay corrections necessary and we therefore do not feel they are practical for this use.


17'-5 3/4" OUTSIDE
17'-1 3/8" OUTSIDE
11 5/8"
7'-2" M.C
L-09
HOT LAB.
2A-106
1. DOSE CALIBRATOR
2. DOSE PREP. AREA/RAD. MATERIAL STORAGE
3. SINK
(Supply)
150 CFM
195 CFM (Exhaust)
13 A-24
14 A-24
COMPUTER
2A-105
S17
S17
S17
3'-2 1/4"
3 5/8"
9"
4'-0 1/2"
3 5/8"
2'-0 3/4"
3 5/8"
DYNACAMERA CONSOLE O.F.C.I.
COMPUTER CONSOLE O.F.C.I.
COMPUTER CONSOLE O.F.C.I.
DYNACAMERA CONSOLE O.F.C.I.
780 CFM
(Exhaust)
NUC. MED. (CARDIAC)
2A-104
(Supply)
225 CFM
(Supply)
205 CFM
(Exhaust)
700 CFM
THYROID UPTAKE SYSTEM. O.F.C.I.
DYNACAMERA O.F.C.I.
DYNACAMERA O.F.C.I.
MG-2
MTD 4'-0" A.F.F. TO ℄
MG-2
3'-0"
1'-8"
TOILET
2A-104T
(Supply)
225 CFM
3 5/8"
NUCLEAR MED.
2A-107
(Supply)
205 CFM
10 A-24
(Supply)
205 CFM
3 A-26
L-05
(Supply)
225 CFM
10 A-24
2'-6"
1'-3 5/8"
4'-10 1/4"
L-10
L-02
L-08
10"
L-09
L-09
3 5/8"
14'-11 1/4" HALLWAY
3 5/8"
1'-9"
3'-4 1/4"
3 5/8"
13'-7 7/8" HALLWAY
C.G.
3 5/8"
8'-1 1/4"
CORRIDOR
22'-0 1/4"
TOILE
2A-11
CORRI
2A-1
CONTROL NO. 4826 02
Item 11
Page 16
STORAGE
STORAGE

Personnel Training

Individuals who work in or frequent restricted areas will be instructed in the items specified in 10 CFR Part 19.12 at the time of initial employment and at least annually thereafter.

These instructions will include:

a. All terms of the license pertinent to radiation safety.

b. Areas where radioactive materials are used or stored.

c. Potential hazards associated with radioactive materials.

d. Radiological safety procedures appropriate to their respective duties.

e. Pertinent NRC regulations.

f. Rules and regulations of the license.

g. Obligation to report unsafe conditions to the radiation safety officer.

h. Appropriate response to emergencies or unsafe conditions.

i. Right to be informed of their radiation exposure and bioassay results.

j. Locations where the licensee has posted or made available copies of pertinent regulations, copies of the license and license conditions (including applications and applicable correspondence), as required by 10 CFR Part 19.

Individuals whose duties may require them to work in the vicinity of licensed material will be informed about radiation hazards and appropriate precautions at the time of initial employment and at least annually thereafter. This information will be provided initially at the employee's orientation and annually at inservice training sessions.

Item 13: Radiation Protection Program

Procedures for Ordering and Accepting Delivery of Radioactive Materials

1. The Supervisory Nuclear Medicine Technologist or delegate will place all orders for radioactive materials and will ensure that the requested materials and quantities are authorized by the license and that possession limits are not exceeded.

2. A system for ordering and receiving radioactive materials is established. The system will consist minimally of the following:

   a. Ordering of routinely used materials:

      (1) Written records that identify the radionuclide, compound activity levels, and supplier, etc. will be used.

      (2) The written records will be referenced when opening or storing the radioactive shipment.

   b. Ordering of specially used materials, (e.g., therapeutic uses)

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

      (2) Persons ordering the materials will reference the physician's written request when placing the order. The physician's request will include radionuclide, compound, activity level, etc.

      (3) The physician's written request will be referenced when receiving, opening, or storing the radioactive material.

   * It is essential that written records be maintained for all ordering of and receipt procedures. In the case of special orders, the physician's written request and appropriate shipping/receipt records will be referenced and the dose assayed prior to its administration.

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

4. During off-duty hours, Packages containing radioactive materials will be received through the Emergency Room. Hospital Security will be notified to escort the carrier to the Nuclear Medicine Hot Lab where the shipment will be secured in accordance with the procedures outlined in the sample memorandum on the following page.

Item 13: Procedures for Ordering and Accepting Delivery of Radioactive Material-Continued

SAMPLE MEMORANDUM

To: Emergency Room and Security Personnel

FROM: Radiation Safety Officer

Re: Receipt of Packages Containing Radioactive Materials

Any packages containing radioactive materials that arrive between 4:30 p.m. and 7:00 a.m. shall be signed for by the night supervisor in the Emergency Room. The Security Officer on duty will be notified to escort the carrier with the package to the hot lab in the Nuclear Medicine Department. Unlock the door, place the package on the counter top, and relock the door. If the package is wet or appears damaged immediately contact the RSO. Ask the carrier to remain until it can be determined that neither he nor the delivery vehicle is contaminated.

Radiation Safety Officer:_____

Office Phone:_____

Home Phone:_____

APPENDIX F

PROCEDURES FOR SAFELY OPENING PACKAGES CONTAINING RADIOACTIVE MATERIAL

1. Special requirements will be followed for packages containing quantities of radioactive material in excess of the Type A quantity limits as specified in paragraphs 20.205(a)(1) and (c)(1) of 10 CFR Part 20 (more than 20 Ci for Mo-99 and Tc-99m). They will be monitored for surface contamination and external radiation levels within 3 hours after receipt if received during working hours or within 18 hours if received after working hours, in accordance with the requirements of paragraphs 20.205(a) through (c). All shipments of liquids greater than exempt quantities will be tested for leakage. The NRC Regional Office will be notified in accordance with the regulations if removable contamination exceeds 0.01 μCi/100 cm^2 or if external radiation levels exceed 200 mR/hr at the package surface or 10 mR/hr at 3 feet (or 1 m).

2. For all packages, the following additional procedures for opening packages will be carried out:

   a. Put on gloves to prevent hand contamination.

   b. Visually inspect package for any sign of damage (e.g., wetness, crushed). If damage is noted, stop procedure and notify Radiation Safety Officer.

   c. Measure exposure rate at 3 feet (or 1 m) from package surface and record. If >10 mR/hr, stop procedure and notify Radiation Safety Officer.

   d. Measure surface exposure rate and record. If >200 mR/hr, stop procedure and notify Radiation Safety Officer.

   e. Open the package with the following precautionary steps:

      (1) Open the outer package (following manufacturer's directions, if supplied) and remove packing slip.

      (2) Open inner package and verify that contents agree with those on packing slip. Compare requisition,* packing slip, and label on bottle.

      (3) Check integrity of final source container (i.e., inspect for breakage of seals or vials, loss of liquid, and discoloration of packaging material).

      (4) Check also that shipment does not exceed possession limits.

   f. Wipe external surface of final source container shield and remove wipe to low background area. Check wipes with a thin-end-window G-M survey meter, and take precaution against the spread of contamination as necessary.

   g. Monitor the packing material and packages for contamination before discarding.

      (1) If contaminated, treat as radioactive waste.

      (2) If not contaminated, obliterate radiation labels before discarding in regular trash.

3. Maintain records of the results of checking each package, using "Radioactive Shipment Receipt Record" (see next page) or a form containing the same information.

---

*In the case of special orders (e.g., therapy doses), also compare with physician's written request.

APPENDIX G

GENERAL RULES FOR SAFE USE OF RADIOACTIVE MATERIAL

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

2. Wear disposable gloves at all times while handling radioactive materials.

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

4. Always use syringe shields for routine preparation of patient doses and administration to patients, except in circumstances such as pediatric cases when their use would compromise the patient's well-being. In these exceptional cases, use other protective methods such as remote delivery of the dose (e.g., through use of a butterfly valve).

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

   b. Do not store food, drink, or personal effects with radioactive material.

6. a. Assay each patient dose in the dose calibrator prior to administration. Do not use any doses that differ from the prescribed dose by more than 10 percent.

   b. For therapeutic doses, also check the patient's name, the radionuclide, the chemical form, and the activity vs. the order written by the physician who will perform the procedure.

7. Wear personnel monitoring devices (film badge or TLD) at all times while in areas where radioactive materials are used or stored. These devices should be worn at chest or waist level. Personnel monitoring devices when not being worn to monitor occupational exposures should be stored in a designated low background area.

8. Wear TLD finger badges during elution of generator and preparation, assay, and injection of radiopharmaceuticals.

9. Dispose of radioactive waste only in specially designated and properly shielded receptacles.

10. Never pipette by mouth.

11. Survey generator, kit preparation, and injection areas for contamination after each procedure or at the end of the day. Decontaminate if necessary.

12. Confine radioactive solutions in covered containers plainly identified and labeled with name of compound, radionuclide, date, activity, and radiation level, if applicable.

13. Always transport radioactive material in shielded containers.

APPENDIX H

EMERGENCY PROCEDURES

Minor Spills

1. NOTIFY: Notify 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. Also insert into the plastic bag all other contaminated materials such as disposable gloves.

4. SURVEY: With a low-range, thin-window G-M survey meter, check the area around the spill, hands, and clothing for contamination.

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

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, but do not attempt to clean it 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. CLOSE THE ROOM: Leave the room and lock the door(s) to prevent entry.

5. CALL FOR HELP: Notify the Radiation Safety Officer immediately.

6. 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.

*RADIATION SAFETY OFFICER: _____
*OFFICE PHONE: _____
*HOME PHONE: _____

*ALTERNATE NAMES AND TELEPHONE NUMBERS DESIGNATED BY RADIATION SAFETY OFFICER

_____
_____
_____

*On the actual copy that is posted in the nuclear medicine department, this information will be filled in and updated as necessary.

APPENDIX I

AREA SURVEY PROCEDURES

1. All elution, preparation, and injection areas will be surveyed daily with an appropriately low-range survey meter and decontaminated if necessary.*

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

3. Waste storage areas and all other laboratory areas will be surveyed weekly.

4. The weekly and monthly surveys will consist of:

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

   ** b. A series of wipe tests to measure contamination levels. The method for performing wipe tests will be sufficiently sensitive to detect 200 dpm per 100 cm^2 for the contaminant involved. Wipes of elution and preparation areas or other "high background" areas will be removed to a low background area for measurement.

5. A permanent record will be kept of all survey results including negative results. The record will include:

   a. Location, date, and identification of equipment used, including the serial number and pertinent counting efficiencies.

   b. Name of person conducting the survey.

   c. Drawing of area surveyed, identifying relevant features such as active storage areas, active waste areas, etc.

   d. Measured exposure rates, keyed to location on the drawing (point out rates that require corrective action).

   e. Detected contamination levels, keyed to locations on drawing.

   f. 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.

6. ***Area will be cleaned if the contamination level exceeds 200 dpm/100 cm^2.

* For daily surveys where no abnormal exposures are found, only the date, the identification of the person performing the survey, and the survey results will be recorded.

** At times when a well counter is not available for assaying wipes, the following method may be performed, using a low level g.m. survey meter. We confirm the following points:

A. The detector wall thickness will be 30 mg/cm^2 or less.

B. The instrument will be capable of detecting 0.1 mr/hr or less.

C. The approximate response time of the survey meter used will be 30 seconds or less. The wipes will therefore be held at the open window of the detector for about 30 seconds to ensure any contamination present may be detected.

D. Wipes will be assayed in a low background area.

*** When a survey meter is used to assay the wipes, any readings over background radiation levels (rather than 200 dpm/100 cm^2) will be used as the action level for cleaning the area.

APPENDIX J

WASTE DISPOSAL

Note: In view of the recent problems with shallow-land burial sites used by commercial waste disposal firms, NRC is encouraging its licensees to reduce the volume of wastes sent to these facilities. Important steps in volume reduction are to segregate radioactive from nonradioactive waste, to hold short-lived radioactive waste for decay in storage, and to release certain materials in the sanitary sewer in accordance with §20.303 of 10 CFR Part 20.

1. Liquid waste will be disposed of (check as appropriate)

__X__ In the sanitary sewer system in accordance with §20.303 of 10 CFR Part 20.

__N/A__ By commercial waste disposal service (see also Item 4 below).

_____ Other (specify): _____

2. Mo-99/Tc-99m generators will be (check as appropriate)

__X__ Returned to the manufacturer for disposal.

__X__ Held for decay* until radiation levels, as measured in a low background area with a low-level survey meter and with all shielding removed, have reached background levels. All radiation labels will be removed or obliterated, and the generators will be disposed of as normal trash.**

__N/A__ Disposed of by commercial waste disposal service (see also Item 4 below).

_____ Other (specify): _____

3. Other solid waste will be (check as appropriate)

__X__ Held for decay* until radiation levels, as measured in a low background area with a low-level survey meter and with all shielding removed, have reached background levels. All radiation labels will be removed or obliterated, and the waste will be disposed of in normal trash.

__N/A__ Disposed of by commercial waste disposal service (see also Item 4 below).

_____ Other (specify): _____

4. The commercial waste disposal service used will be

_____
(Name) (City, State)

NRC/Agreement State License No. _____

*Be sure that waste storage areas were described in Item 11 and that they are surveyed periodically (Item 17).

**These generators may contain long-lived radioisotopic contaminants. Therefore, the generator columns will be segregated so that they may be monitored separately to ensure decay to background levels prior to disposal.

APPENDIX K

RADIATION SAFETY PROCEDURES FOR THERAPEUTIC USE OF RADIOPHARMACEUTICALS*

1. All patients treated with I-131 or Au-198 will be placed in a private room that has a toilet. The large surfaces in the room and toilet areas that are more likely to be contaminated will be covered with absorbent pads or protective material as appropriate to the amounts of contamination to be expected. Attention should be given to objects likely to be touched by the patient, e.g., telephones, doorknobs, and other items that would be difficult to decontaminate. Plastic bags or wrappings that are waterproof and easily disposable should be used on the smaller items.

2. The patient's room will be properly posted or attended in accordance with §§ 20.203 or 20.204 of 10 CFR Part 20.

3. Surveys of the patient room and surrounding areas will be conducted as practicable after administration of the treatment dose. Exposure rates will be measured at the patient's bedside and 3 feet (or 1 m) from the patient after administration and at the entrance to the room. The Radiation Safety Officer or his designee will then determine how long a person may remain at these positions and will post these times on the patient's chart and on his door. The results of daily surveys will be used to recalculate permitted times, which will be posted on the patient's chart and on his door.

4. The form, Nursing Instructions for Patients Treated with Phosphorus-32, Gold-198, or Iodine-131 (or a similar form containing all the requested information), will be completed immediately after administration of the treatment dose. A copy will be posted on the patient's chart.

5. Radiation levels in unrestricted areas will be maintained less than the limits specified in paragraph 20.105(b) of 10 CFR Part 20.

6. All linens will be surveyed for contamination before being removed from the patient's room and, if necessary, will be held for decay.

7. Disposable plates, cups, eating utensils, tissue, surgical dressings, and other similar waste items will be placed in a specially designated container. The material will be collected daily by the Radiation Safety Officer or his designee, checked for contamination, and disposed of as normal or radioactive waste, as appropriate.

8. Nondisposable items used for these patients will be held in plastic bags in the patient's room and will be checked for contamination by the Radiation Safety Officer or his designee. Items may be returned for normal use, held for decay, or decontaminated, as appropriate.

9. If urine and vomitus from I-131 therapy patients are collected, they will be stored for decay in the radioactive waste storage area. Such stored wastes will be retained until they have reached background levels, as measured with a low-level survey meter. They will then be released to the sanitary sewer system.

10. Before a therapy patient's room is reassigned to another patient, the room will be surveyed for contamination and decontaminated if necessary, and all radioactive waste and waste containers will be removed.

11. Nursing Instructions

    a. Nurses should spend only that amount of time near the patient required for ordinary nursing care. Special restrictions may be noted on the precaution sheet on the patient's chart. Nurses should read these restrictions before administering to the patients. Call the Nuclear Medicine Department or the Radiation Safety Officer with any questions about the care of these patients. Nursing personnel who attend the patient will wear personnel monitoring devices as advised by the Radiation Safety Office.

    b. Visitors will be limited to those 18 years of age or over unless other instructions are noted on the precaution sheet on the patient's chart.

    c. Patients must remain in bed while visitors are in the room and visitors should remain at least 3 feet (or 1 m) from the patient.

    d. Patients containing radioactive materials are to be confined to their rooms except for special medical or nursing purposes approved by the Nuclear Medicine Department.

    e. No nurse, visitor, or attendant who is pregnant should be permitted in the room of a patient who has received a therapeutic amount of radioactivity until the patient no longer presents a radiation hazard. Female visitors should be asked whether they are pregnant.

    f. Attending personnel should wear rubber or disposable plastic gloves when handling urinals,

* Be sure to submit a complete response to Item 19b in addition to referencing procedures in Appendix K.

bedpans, 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 should be left in the patient's room in the designated waste container. These gloves need not be sterile or surgical in type.

g. Disposable items should be used in the care of these patients, whenever possible. These items should be placed in the designated waste container. Contact the Radiation Safety Officer or his designee for proper disposal of the contents of the designated waste container.

h. All clothes and bed linens used by the patient should be placed in the laundry bag provided and should be left in the patient's room to be checked by the Radiation Safety Officer or his designee.

i. All nondisposable items should be placed in a plastic bag and should be left in the patient's room to be checked by the Radiation Safety Officer or his designee.

j. Surgical dressings should be changed only as directed by the physician. Au-198 leaking from a puncture wound may stain the dressings dark red or purple. Such dressings should not be discarded but should be collected in plastic bags and turned over to the Radiation Safety Officer or his designee. Handle these dressings only with tongs or tweezers. Wear disposable gloves.

k. For I-131 patients:

(1) To the degree possible with cooperative patients, urine will be collected in special containers provided by the Radiation Safety Officer or his designee. The patient should be encouraged to collect his own urine in the container. If the patient is bedridden, a separate urinal or bed pan should be provided. The urinal or bed pan should be flushed several times with hot soapy water after use.

(2) If the nurse helps to collect the excreta, disposable gloves should be worn. Afterward, hands should be washed with the gloves on and again after the gloves are removed. The gloves should be placed in the designated waste container for disposal by the Radiation Safety Officer or his designee.

(3) Disposable plates, cups, and eating utensils will be used by patients who are treated with I-131.

(4) Vomiting within 24 hours after oral administration, urinary incontinence, or excessive sweating within the first 48 hours may result in contamination of linen and floor. In any situation where the patient's room may be contaminated or if radioactive urine and/or feces is spilled during collection, call the Radiation Safety Officer or his designee, Ext. _____. Meanwhile, handle all contaminated material with disposable gloves and avoid spreading contamination.

(5) Keep all contaminated wastes and vomitus in plastic bags in the patient's room for disposal by the Radiation Safety Officer or his designee. Feces need not be routinely saved unless ordered on the chart. The same toilet should be used by the patient at all times and it should be well flushed (3 times). The Radiation Safety Officer will establish procedures for disposal of wastes (see Item 12 below).

l. If a nurse, attendant, or anyone else knows or suspects that his or her skin or clothing, including shoes, is contaminated, notify the Radiation Safety Officer or his designee immediately. This person should remain in an area adjacent to the patient's room and should not walk about the hospital. If the hands become contaminated, wash them immediately with soap and water.

m. If a therapy patient should need emergency surgery or should die, notify the Radiation Safety Officer or the Nuclear Medicine Department immediately.

n. When the patient is discharged, call the Radiation Safety Officer or his designee or the Nuclear Medicine Department and request that the room be surveyed for contamination before remaking the room.

12. Waste Disposal

When contaminated wastes are transported to the Waste Storage/Disposal area, precautions will be taken to minimize external irradiation of personnel. Stored wastes will be shielded to maintain exposure to personnel in restricted and unrestricted areas ALARA.

Date _____

NURSING INSTRUCTIONS FOR PATIENTS TREATED WITH PHOSPHORUS-32, GOLD-198, OR IODINE-131

Patient's Name: _____

Room No.: _____ Physician's Name: _____

Radioisotope Administered: _____

Date and Time of Administration: _____

Dose Received: _____ Method of Administration: _____

Exposure Rates in mR/hr

Date	3 feet from bed	10 feet from bed

(Comply with all checked items)

_____ 1. Visiting time permitted: _____

_____ 2. Visitors must remain _____ from patient.

_____ 3. Patient may not leave room.

_____ 4. Visitors under 18 are not permitted.

_____ 5. Pregnant visitors are not permitted.

_____ 6. Film or TLD badges must be worn.

_____ 7. Pocket chambers will be worn for supplementary personnel monitoring of individual tasks.

_____ 8. Tag the following objects and fill out the tag:

_____ door _____ chart

_____ bed _____ wrist

_____ 9. Disposable gloves must be worn while attending patient.

_____ 10. Patient must use disposable utensils.

_____ 11. All items must remain in room until approved for removal by the Radiation Safety Officer or his designee.

_____ 12. Smoking is not permitted.

_____ 13. Room is not to be released to Admitting Office until approved by the Radiation Safety Officer or his designee.

_____ 14. Other instructions.

In case of an emergency contact:

RSO _____

Name On-duty/Off-duty Telephone Numbers

NURSING INSTRUCTIONS
FOR PATIENTS CONTAINING LESS THAN 30 MILLICURIES
OF IODINE-131

A. OUT PATIENTS:

Patients may be treated as Out Patients and released after administration of radiotherapeutic doses less than 30 millicuries.

B. IN PATIENTS:

If a patient is admitted to the hospital, there will be no restrictions regarding nursing care, visitors, and bathroom privileges.

However, the following procedures should be followed:

1. Patients using non-disposable urinal or bedpan:

   a. Gloves should be worn when handling urinal or bedpan.
   b. Dispose of excreta in toilet, flushing three (3) times.
   c. Clean the bedpan in a routine manner.
   d. Rinse urinal, filling with hot water three (3) times.
   e. Keep the urinal and bedpan at the patient's bedside until the patient is discharged.
   f. The Radiation Safety Officer or his delegate will survey the urinal or bedpan prior to the equipment being issued to other areas.

2. Patients using disposable urinal or bedpan:

   a. The Radiation Safety Officer or his delegate will survey disposable urinal and/or bedpan before disposal to insure background exposure limits.

3. If a patient should soil self and/or bed with vomitus, feces, or urine:

   a. Notify the Radiation Safety Officer.
   b. Wear gloves to handle all soiled material.
   c. Contain all non-absorbed liquid material with absorbable disposable material.
   d. Store all soiled material in a plastic bag for monitoring by the Radiation Safety Officer prior to disposal.

RADIATION SAFETY OFFICER: _____

ON DUTY PHONE NUMBER: _____

HOME PHONE NUMBER: _____

Procedures and Precautions for Use of Radioactive Gas (Xe-133)

1. Quantities to be used:

We expect the number of patients undergoing Xe-133 lung ventilation studies to average 8 per week with an average of 15 mCi of Xe-133 per patient. A 200 mCi possession limit is requested.

2. Use and Storage:

Xe-133 will be used and stored only in the nuclear medicine area of the hospital (see sketch). The Xe-133 will be stored in the manufacturer's shielded shipping container in our hot lab. The Xe-133 will be used in the camera room and administered to the patient with a New England Nuclear "Calidose" dispensing system and Nuclear Associates Model XDS Xenon Delivery Unit/Nonex Model 36-023 Xenon Gas Trap. The system is shielded to minimize radiation exposure to personnel. Other approved shielded dispensing/trapping devices may be used as they become available from the manufacturers.

The combined measured air flow rates of the hot lab and imaging room are 1440 CFM supply and 1600 CFM exhaust to keep the area under a negative air pressure. The areas where Xenon-133 is used and stored will be kept under a 10% negative air pressure effect. The exhaust air is vented directly to the outside.

3. Procedures for Routine Use:

To minimize the escape of Xe-133 from the area, the door to the camera room will be kept closed during the handling and use of Xe-133.

Xenon-133 will be received in precalibrated unit vial doses. All doses will be assayed in the dose calibrator prior to administration.

Patients will be instructed on the details of the procedure. Those steps in which their cooperation is needed will be emphasized.

Attached are brochure copies of the Xe-133 delivery system to be used. Patients will be connected to the system either by a mouth and nose mask or by a mouthpiece with a nose clamp. The patient connection will be checked for leakage by feeling for air movement around the mask or mouthpiece as the patient exhales into the system prior to administration of Xe-133. To minimize the chances of having to discontinue the study prior to completion, the patient will first be given an opportunity to become acclimated to the system before Xe-133 is administered.

The lung ventilation procedure consists of breath holding, equilibrium and washout phases. During the washout phase, the air is drawn into the gas trap to remove the Xe-133.

Manufacturer's instructions for checking and changing the CO2 and moisture absorbers will be followed. The system will also be visually checked periodically to ensure all connectors are intact.

4. Emergency Procedures:

In the event of accidental release of Xe-133, the room will be evacuated for approximately 20 minutes depending upon the condition of the patient. A survey meter will be used upon reentry into the room to ensure the Xe-133 has cleared. With an approximate room volume of 6000 cubic feet and a combined exhaust rate of 1600 CFM, we calculate one air turnover to be approximately 4 minutes.

5. Air Concentration of Xe-133 in RESTRICTED areas:

All reasonable precautions will be taken to minimize the release of Xe-133 into the room. There will, however, be some release from the charcoal trap as well as some release during handling, from the delivery system and from patients. It is unlikely these releases would ever exceed 25% of the Xe-133 used.

We can calculate the air concentration of Xe-133 for RESTRICTED areas (camera room and hot lab), as follows:

Assumptions: 8 patients per week
15 millicuries per patient
120 millicuries per week, or
1.2x E5 uCi per week

25% loss into the room
1600 CFM exhaust
1 CFM = 6.797 x E7 ml/40 hour week

Therefore:

$$\frac{1.2 \times E5 \text{ uCi} \times 0.25}{1600 \text{ CFM} \times 6.797 \times E7 \text{ ml}/40 \text{ hour week/CFM}} = 2.0 \times E\text{-}7 \text{ uCi/ml}$$

The calculated concentration of 2.0 E-7 is well below the NRC limit of 1.0 x E-5 uCi/ml to restricted areas for Xe-133.

6. Air Concentrations of Xe-133 in UNRESTRCTED areas:

As stated in item #5 above, the release of Xe-133 into the room is not likely to exceed 25% of the activity used. We can therefore calculate the maximum air concentration of Xe-133 in unrestricted areas (point of release from the exhaust system), as follows:

A. 8 patients/week x 15 mCi/patient x 1000 uCi/mCi x 52 weeks/year x 0.25 release fraction = 1.56 x E6 uCi activity released per year

B. 1600 CFM x 1.484 x E10 ml/year/CFM = 2.374 x E13 ml per year volume

C. 1.56 x E6 uCi/2.374 x E13 ml/year = 6.57 x E-8 uCi/ml air conc.

The air concentration of 6.57 x E-8 uCi/ml averaged over one year is less than the NRC limit of 3 x E-7 uCi/ml to unrestricted areas for Xe-133.

7. Monitoring of Xe-133 Gas Trap Efficiency:

The efficiency of the Xe-133 gas trap will be monitored by measuring the activity in the rebreathing tube during the equilibrium phase, and exhaust port during the first minute of the washout phase. This measurement will be made on every tenth patient study using the low-level g.m. survey meter. The meter probe will be shieled from the patient while taking the readings. Exhaust port readings of less than 10% of the rebreathing tube indicate the trap is operating properly. If the exhaust reading would exceed 10% of the rebreathing tube reading, the charcoal filter will be replaced. The shielded saturated traps will be stored in nuclear medicine until no detectable activity remains.

APPENDIX O

MODEL PROGRAM FOR MAINTAINING OCCUPATIONAL RADIATION EXPOSURES AT MEDICAL INSTITUTIONS ALARA

Humana Hospital-Hoffman Estates, IL
(Licensee's Name)

January 17, 1985
(Date)

1. **Management Commitment**

   a. We, the management of this (medical facility, hospital, etc.), are committed to the program described in this paper for keeping exposures (individual and collective) as low as is reasonably achievable (ALARA). In accord with this commitment, we hereby describe an administrative organization for radiation safety and will develop the necessary written policy, procedures, and instructions to foster the ALARA concept within our institution. The organization will include a Radiation Safety Committee (RSC)[1] and a Radiation Safety Officer (RSO).

   b. We will perform a formal annual review of the radiation safety program, including ALARA considerations. This shall include reviews of operating procedures and past exposure records, inspections, etc., and consultations with the radiation protection staff or outside consultants.

   c. Modification to operating and maintenance procedures and to equipment and facilities will be made where they will reduce exposures unless the cost, in our judgment, is considered to be unjustified. We will be able to demonstrate, if necessary, that improvements have been sought, that modifications have been considered, and that they have been implemented where reasonable. Where modifications have been recommended but not implemented, we will be prepared to describe the reasons for not implementing them.

   d. 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. It would not be desirable, for example, to hold the highest doses to individuals to some fraction of the applicable limit if this involved exposing additional people and significantly increasing the sum of radiation doses received by all involved individuals.

2. **Radiation Safety Committee (RSC)[2]**

   a. Review of Proposed Users and Uses

      (1) The RSC will thoroughly review the qualifications of each applicant with respect to the types and quantities of materials and uses for which he has applied to ensure that the applicant will be able to take appropriate measures to maintain exposure ALARA.

      (2) When considering a new use of byproduct material, the RSC will review the efforts of the applicant to maintain exposure ALARA. The user should have systematized procedures to ensure ALARA and shall have incorporated the use of special equipment such as syringe shields, rubber gloves, etc., in his proposed use.

      (3) The RSC will ensure that the user justifies his procedures and that dose will be ALARA (individual and collective).

   b. Delegation of Authority

      (The judicious delegation of RSC authority is essential to the enforcement of an ALARA program.)

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

      (2) The RSC will support the RSO in those instances where it is necessary for the RSO to assert his/her 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.

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[1] Private practice physician licenses do not include an RSC.

[2] The RSO on private practice physician licenses will assume the responsibilities of the RSC under Section 2.

c. Review of ALARA Program

(1) The RSC will encourage all users to review current procedures and develop new procedures as appropriate to implement the ALARA concept.

(2) The RSC will perform a quarterly review of occupational radiation exposure with particular attention to instances where Investigational Levels in Table 0-1 below are exceeded. The principal purpose of this review is to assess trends in occupational exposure as an index of the ALARA program quality and to decide if action is warranted when Investigational Levels are exceeded (see Section 6).[3]

(3) The RSC will evaluate our institution's overall efforts for maintaining exposures ALARA on an annual basis. This review will include the efforts of the RSO, authorized users, and workers as well as those of management.

3. **Radiation Safety Officer (RSO)**

a. Annual and Quarterly Review

(1) Annual review of the radiation safety program. The RSO will perform an annual review of the radiation safety program for adherence to ALARA concepts. Reviews of specific procedures may be conducted on a more frequent basis.

(2) Quarterly review of occupational exposures. The RSO will review at least quarterly the external radiation exposures of authorized users and workers to determine that their exposures are ALARA in accordance with the provisions of Section 6 of this program.

(3) Quarterly review of records of radiation level surveys. The RSO will review radiation levels in unrestricted and restricted areas to determine that they were at ALARA levels during the previous quarter.

b. Education Responsibilities for ALARA Program

(1) The RSO will schedule briefings and educational sessions to inform workers of ALARA program efforts.

(2) The RSO will ensure that authorized users, workers, and ancillary personnel who may be exposed to radiation will be instructed in the ALARA philosophy and informed that management, the RSC, and the RSO are committed to implementing the ALARA concept.

c. Cooperative Efforts for Development of ALARA Procedures

Radiation workers will be given opportunities to participate in formulation of the procedures that they will be required to follow.

(1) The RSO will be in close contact with all users and workers in order to develop ALARA procedures for working with radioactive materials.

(2) The RSO will establish procedures for receiving and evaluating the suggestions of individual workers for improving health physics practices and will encourage the use of those procedures.

d. Reviewing Instances of Deviation from Good ALARA Practices

The RSO will investigate all known instances of deviation from good ALARA practices and, if possible, will determine the causes. When the cause is known, the RSO will require changes in the program to maintain exposures ALARA.

4. **Authorized Users**

a. New Procedures Involving Potential Radiation Exposures

(1) The authorized user will consult with, and receive the approval of, the RSO and/or RSC during the planning stage before using radioactive materials for a new procedure.

(2) The authorized user will evaluate all procedures before using radioactive materials to ensure that exposures will be kept ALARA. This may be enhanced through the application of trial runs.

b. Responsibility of Authorized User to Persons Under His/Her Supervision

(1) The authorized user will explain the ALARA concept and his/her commitment to maintain exposures ALARA to all persons under his/her supervision.

(2) The authorized user will ensure that persons under his/her supervision who are

[3] The NRC has emphasized that the Investigational Levels in this program are not new dose limits but, as noted in ICRP Report 26, "Recommendations of the International Commission on Radiological Protection," serve as check points above which the results are considered sufficiently important to justify further investigations.

subject to occupational radiation exposure are trained and educated in good health physics practices and in maintaining exposures ALARA.

5. **Persons Who Receive Occupational Radiation Exposure**

   a. The worker will be instructed in the ALARA concept and its relationship to working procedures and work conditions.

   b. The worker will know what recourses are available if he/she feels that ALARA is not being promoted on the job.

6. **Establishment of Investigational Levels In Order to Monitor Individual Occupational External Radiation Exposures**

This institution (or private practice) hereby establishes Investigational Levels for occupational external radiation exposure which, when exceeded, will initiate review or investigation by the RSC and/or the RSO. The Investigational Levels that we have adopted are listed in Table O-1 below. These levels apply to the exposure of individual workers.

Table O-1

	Investigational Levels (mrems per calendar quarter)	
	Level I	*Level II*
1. Whole body; head and trunk; active blood-forming organs; lens of eyes; or gonads	125	375
2. Hands and forearms; feet and ankles	1875	5625
3. Skin of whole body*	750	2250

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

The Radiation Safety Officer will review and record on Form NRC-5, "Current Occupational External Radiation Exposures," or an equivalent form (e.g., dosimeter processor's report), results of personnel monitoring not less than once in any calendar quarter as required by § 20.401 of 10 CFR Part 20. The following actions will be taken at the Investigational Levels as stated in Table O-1 :

a. Quarterly exposure of individuals to less than Investigational Level I.

   Except when deemed appropriate by the RSO, no further action will be taken in those cases where an individual's exposure is less than Table O-1 values for the Investigational Level I.

b. Personnel exposures equal to or greater than Investigational Level I, but less than Investigational Level II.

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

c. Exposure equal to or greater than Investigational Level II.

   The RSO will investigate in a timely manner the cause(s) of all personnel exposures equaling or exceeding Investigational Level II and, if warranted, will take action. A report of the investigation, actions taken, if any, and a copy of the individual's Form NRC-5 or its equivalent will be presented to the RSC at the first RSC meeting following completion of the investigation. The details of these reports will be recorded in the RSC minutes. Committee minutes will be sent to the management of this institution for review. The minutes, containing details of the investigation, will be made available to NRC inspectors for review at the time of the next inspection.

d. Reestablishment of an individual occupational worker's Investigational Level II to a level above that listed in Table O-1.

   In cases where a worker's or a group of workers' exposures need to exceed Investigational Level II, a new, higher Investigational Level II may be established on the basis that it is consistent with good ALARA practices for that individual or group. Justification for a new Investigational Level II will be documented.

   The RSC will review the justification for, and will approve, all revisions of Investigational Level II. In such cases, when the exposure equals or exceeds

the newly established Investigational Level II, those actions listed in paragraph 6.c above will be followed.

7. **Signature of Certifying Official**[4]

I hereby certify that this institution (or private practice) has implemented the ALARA Program set forth above.

Barry Schneider
Signature

Barry Schneider
Name (print or type)

Executive Director
Title

Institution (or Private Practice) Name and Address:

N/A

[4]The person who is authorized to make commitments for the administration of the institution (e.g., hospital administrator) or, in the case of a private practice, the licensed physician.

CLOSE-OUT RADIATION SURVEY OF: Humana Hospital-Hoffman Estates

FACILITY: Nuclear Medicine Department LICENSE #: NRC:12-18742-01

DATE OF SURVEY: January 31, 1985

GM SURVEY METER USED: Picker CAL. DATE: September 29, 1984

MODEL #: 800 SERIAL #: 464

OPERATIONAL CHECK: 6.0 mr/hr SOURCE USED: 189 uCi Cs-137 at 10 cm

INST. USED FOR ASSAYING WIPE SAMPLES: Well Counter CAL. DATE: 1-11-85

MODEL #: Nuclear Chicago-8725 SERIAL #: N/A

OPERATIONAL CHECK OR EFFICIENCY CHECK: %efficiency for Tc-99m = 89% (approx.)

RADIATION SURVEY ACTION LEVEL: 0.05 mr/hr

WIPE SAMPLE ACTION LEVEL: 200 dpm/100 cm2 (89 net cpm = 100 dpm)
(or 178 net cpm = 200 dpm)

SURVEY LOCATION (Refer to corresponding #s on sketch)	SURVEY RESULTS (mr/hr)	WIPE TEST RESULTS (mr/hr-net cpm:circle one)
1. Hallway	<0.05 mr/hr	1
2. Patient Injection Table	<0.05 mr/hr	3
3. Entrance Doorway	<0.05 mr/hr	0
4a. Camera Detector Head	<0.05 mr/hr	0
4b. Camera Detector Head	<0.05 mr/hr	4
5. Imaging Room Floor	<0.05 mr/hr	7
6a. Gamma Camera Console	<0.05 mr/hr	2
6b. Gamma Camera Console	<0.05 mr/hr	0
7. Entrance to Hotlab	<0.05 mr/hr	0
8. Hotlab Dose Prep Area	<0.05 mr/hr	3
9. Desk Area	<0.05 mr/hr	11
10. Sink	<0.05 mr/hr	6

USE ADDITIONAL PAGE IF NECESSARY: See next page

SURVEY PERFORMED BY: Jim Mikowski TITLE: Consultant

COMMENTS: Well Counter background = 18 cpm

Close-out Radiation Survey of Humana Hospital-Hoffman Estates-Continued

SURVEY LOCATION	SURVEY RESULTS (mr/hr)	WIPE TEST RESULTS (net cpm)
11. Dose Calibrator	<0.05 mr/hr	3
12. Dose Prep Area	<0.05 mr/hr	1
13. Dose Prep Area	<0.05 mr/hr	0
14. Miscellaneous Waste	<0.05 mr/hr	6
15. Hotlab Floor	<0.05 mr/hr	9
16. Uptake Probe (Hallway)	<0.05 mr/hr	6
17. Xenon-133 Apparatus	<0.05 mr/hr	3

Conclusion: All areas wipe tested were found to be less than 200 dpm/100cm2 at Tc-99m (Cobalt-57) setting.

Analyzed by: James J. Nikowski Date: January 31, 1985

NUCLEAR MEDICINE