NRC FORM 313M (9-81) 10 CFR 35	U.S. NUCLEAR REGULATORY COMMISSION APPLICATION FOR MATERIALS LICENSE – MEDICAL	Approved by OMB 3150-0041 Expires 9-30-83

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

Veterans Administration Medical Center
1030 Jefferson Avenue
Memphis, TN. 38104

TELEPHONE NO.: AREA CODE (901) 523-8990

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

SAME 1a.

2. PERSON TO CONTACT REGARDING THIS APPLICATION

Murray L. Fields, M.D.

TELEPHONE NO.: AREA CODE (901) 523 8990(ext 5093)

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

a. ☐ NEW LICENSE
b. ☐ AMENDMENT TO LICENSE NO. _____
c. ☒ RENEWAL OF LICENSE NO. 41-0019-08

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

As Stated in The License

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.)*

HASSAN M. OMAR, Ph.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		
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	^{99}Mo ^{99m}Tc - 3curies
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	X	1 curie

ADDITIONAL ITEMS:	MARK ITEMS DESIRED "X"	MAXIMUM POSSESSION LIMITS (In millicuries)
IODINE-131 AS IODIDE FOR TREATMENT OF HYPERTHYROIDISM	X	50
PHOSPHORUS-32 AS SOLUBLE PHOSPHATE FOR TREATMENT OF POLYCYTHEMIA VERA, LEUKEMIA AND BONE METASTASES	X	50
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	X	200
XENON-133 AS GAS OR GAS IN SALINE FOR BLOOD FLOW STUDIES AND PULMONARY FUNCTION STUDIES.	X	500

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
SEE SUPPLEMENTARY	SHEETS (A) and (B)		

16269

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. _____ Date: _____

7. MEDICAL ISOTOPES COMMITTEE	
X	Names and Specialties Attached; and
	Duties as in Appendix B; or _____ *(Check One)*
X	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)*	
	Appendix C Form Attached; or
X	List by Name and Model Number
10. CALIBRATION OF INSTRUMENTS	
	Appendix D Procedures Followed for Survey Instruments; or _____ *(Check One)*
X	Equivalent Procedures Attached; and
	Appendix D Procedures Followed for Dose Calibrator; or _____ *(Check One)*
X	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)*	
	Appendix F Procedures Followed; or
X	Equivalent Procedures Attached

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

24. PERSONNEL MONITORING DEVICES

TYPE (Check appropriate box)			SUPPLIER	EXCHANGE FREQUENCY
a. WHOLE BODY	X	FILM	R.S. LANDAUER, JR. AND COMPANY	MONTHLY
		TLD		
		OTHER (Specify)		
b. FINGER		FILM		
		TLD		
		OTHER (Specify)		
c. WRIST		FILM		
	X	TLD	R.S. LANDAUER, JR. AND COMPANY	MONTHLY
		OTHER (Specify)		

d. OTHER (Specify)

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:
Exempt under 10 CFR 170. 11 (a) (5)

(2) LICENSE FEE ENCLOSED: $ _____

b. APPLICANT OR CERTIFYING OFFICIAL *(Signature)*
H. M. Omar

(1) NAME *(Type of Print)*
HASSAN M. OMAR, Ph.D.

(2) TITLE
RADIATION SAFETY OFFICER

c. DATE
9-23-83

NRC FORM 313M (9-81)

PRIVACY ACT STATEMENT

Pursuant to 5 U.S.C. 552a(e)(3), enacted into law by section 3 of the Privacy Act of 1974 (Public Law 93-579), the following statement is furnished to individuals who supply information to the Nuclear Regulatory Commission on NRC Form 313M. This information is maintained in a system of records designated as NRC-3 and described at 40 Federal Register 45334 (October 1, 1975).

1. **AUTHORITY** Sections 81 and 161(b) of the Atomic Energy Act of 1954, as amended (42 U.S.C. 2111 and 2201(b)).

2. **PRINCIPAL PURPOSE(S)** The information is evaluated by the NRC staff pursuant to the criteria set forth in 10 CFR Parts 30-36 to determine whether the application meets the requirements of the Atomic Energy Act of 1954, as amended, and the Commission's regulations, for the issuance of a radioactive material license or amendment thereof.

3. **ROUTINE USES** The information may be used: (a) to provide records to State health departments for their information and use; and (b) to provide information to Federal, State, and local health officials and other persons in the event of incident or exposure, for their information, investigation, and protection of the public health and safety. The information may also be disclosed to appropriate Federal, State, and local agencies in the event that the information indicates a violation or potential violation of law and in the course of an administrative or judicial proceeding. In addition, this information may be transferred to an appropriate Federal, State, or local agency to the extent relevant and necessary for a NRC decision or to an appropriate Federal agency to the extent relevant and necessary for that agency's decision about you. A copy of the license issued will routinely be placed in the NRC's Public Document Room, 1717 H Street, N.W., Washington, D.C.

4. **WHETHER DISCLOSURE IS MANDATORY OR VOLUNTARY AND EFFECT ON INDIVIDUAL OF NOT PROVIDING INFORMATION** Disclosure of the requested information is voluntary. If the requested information is not furnished, however, the application for radioactive material license, or amendment thereof, will not be processed.

5. **SYSTEM MANAGER(S) AND ADDRESS** Director, Division of Fuel Cycle and Material Safety, Office of Nuclear Material Safety and Safeguards, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555.

SUPPLEMENT to 6.b.

SUPPLEMENTARY SHEET (A)

Byproduct, source, and/or special nuclear material	Chemical and/or physical form	Maximum amount that licensee may possess at any one time under this license
A. Any byproduct material listed in Groups I and II of Schedule A, Section 35.100 of 10 CFR 35	A. Any radio pharmaceutical listed in Groups I and II of Schedule A, Section 35.100 of 10 CFR 35	A. As necessary for uses authorized in Subitem 9.A.
B. Any byproduct material listed in Group III of Schedule A, Section 35.100 of 10 CFR 35	B. Any form listed in Group III of Schedule A, Section 35.100 of 10 CFR 35	B. 3 curies of each byproduct material authorized in Subitem 6.B.
C. Any byproduct material listed in Group IV of Schedule A, Section 35.100 of 10 CFR 35	C. Any radiopharmaceutical listed in Group IV of Schedule A, Section 35.100 of 10 CFR 35	C. As necessary for uses authorized in Subitem 9.C.
D. Any byproduct material listed in Group V of Schedule A, Section 35.100 of 10 CFR 35	D. Any radiopharmaceutical listed in Group V of Schedule A, Section 35.100 of 10 CFR 35	D. As necessary for uses authorized in Subitem 9.D.

Authorized use

A. Any diagnostic procedure listed in Groups I and II of Schedule A, Section 35.100, Title 10, Code of Federal Regulations.

B. Preparation and use of radiopharmaceuticals for any diagnostic procedure listed in Group III of Schedule A, Section 35.100 of Title 10, Code of Federal Regulations.

C. Any therapeutic procedure listed in Group IV of Schedule A, Section 35.100 of Title 10, Code of Federal Regulations.

D. Any therapeutic procedure listed in Group V of Schedule A, Section 35.100 of Title 10, Code of Federal Regulations.

SUPPLEMENT to 6.b.

SUPPLEMENTARY SHEET (A)

Byproduct, source, and/or special nuclear material	Chemical and/or physical form	Maximum amount that licensee may possess at any one time under this license
Condition		
The licensee shall comply with the provisions of Title 10, Chapter 1, Code of Federal Regulations, Part 19, "Notices, Instructions and Reports to Workers; Inspections" and Part 20, "Standards for Protection Against Radiation."		
Licensed material shall be used by, or under the supervision of Murray L. Fields, M.D. or Alys H. Lipscomb, M.D.		
F. Iodine 131	F. Any	F. ~~50~~ 100 millicuries
G. Carbon 14	G. Any	G. ~~200~~ 400 millicuries
H. Phosphorus 32	H. Any	H. ~~25~~ 100 millicuries
I. Sulfur 35	I. Any	I. 25 100 millicuries
J. Hydrogen 3	J. Any	J. ~~700~~ 900 millicuries
K. Iodine 125	K. Any	K. ~~100~~ 400 millicuries
L. Chromium 51	L. Any	L. ~~25~~ 100 millicuries
Authorized use		
F. through L. In Vitro studies and tracer research on laboratory animals.		
Condition		
M. Xenon 133	M. Gas or gas in solution that is subject of an active (i.e., not withdrawn or terminated) "New Drug Application" (NDA) approved by FDA or an active (i.e., not withdrawn, terminated or on "clinical hold") "Notice of Claimed Investigational Exemption for a New Drug" (IND) that has been accepted by FDA	M. 500 millicuries
Authorized use		
Blood flow and pulmonary function studies.		

ITEM: 6.b -2
DATE: 9-23-83

SUPPLEMENT to 6.b.

SUPPLEMENTARY SHEET (A)

Byproduct, source, and/or special nuclear material	Chemical and/or physical form	Maximum amount that licensee may possess at any one time under this license
N. Uranium (Depleted in Uranium 235)	N. Cadmium plated metal	N. 182 kilograms

Authorized Use

N. As shielding in a linear accelerator.

O. Cesium 137	O. Sealed Source Shepherd S.N. 10048 Model #28-5	O. 100 millicuries
P. Strontium 90	P. Sealed Source (Nuclear Enterprises, Ltd. Model 2503)	P. 10 millicuries

Authorized Use

O. For use in a Victoreen Model 681 device for instrument calibration.

P. For instrument calibration.

SUPPLEMENT to 6.b.

SUPPLEMENTARY SHEET (B)

Licensed material listed in Item 6 above is authorized for use by, or under the supervision of, the following individuals for the materials and uses indicated:

Murray L. Fields, M.D.	Groups I, II, III, IV, and V, Xenon 133
Alys H. Lipscomb, M.D.	Groups I, II, III, IV, and V, Xenon 133
Edwin H. Beachey, M.D.	Subitems 6.F through 6.L. for non-human use
Ray Cox, Ph.D.	Subitems 6.F through 6.L for non-human use
Hassan M. Omar, Ph.D.	Subitems 6.F through 6.L., 6.O., and 6.P. for non-human use
Camilo U. Paig, M.D.	Group VI
Narayanagoud Memula, M.D.	Group VI

The only change from our license No. 41-00119-08 is the deletion of Gary B. Stillwagon, Ph.D.

ITEM: 6.b-4

DATE: 9-23-83

ITEM: 7 RADIATION SAFETY COMMITTEE

(1) Responsibility:

The Committee is responsible for:

a. 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.

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

(2) Policy and Implementation:

a. The Chairman of the Committee shall call a meeting of the Committee whenever he deems that such a meeting is appropriate. In any case, however, no fewer than four such meetings will be held each year. The minutes of each meeting will be recorded usually by the Radiation Safety Officer and distributed to the Committee members, the Director, the Chief of Staff, and to any other interested parties.

b. The Radiation Safety Committee is the final authority in all matters pertaining to safe use of radioactive material within the facility. Briefly, the Committee shall ensure that all radioactive material is used in a safe manner, within ALARA (As Low As Reasonably Achievable) guidelines and our NRC License. In addition, the Radiation Safety Committee shall ensure that all individuals affected by our NRC License have sufficient training to function within NRC requirements.

c. The pertinent documents stating areas of responsibility delegated to the Committee and rules enforced by the Radiation Safety Committee are detailed in (1) the Medical Center ALARA Program, (2) Memorandum 115-1, (3) Memorandum 11-33, (4) NRC License 41-00119-08, and 10 CFR 35.11(b). Some of these responsibilities and rules are re-stated below.

d. The Committee shall review all applications and procedures for the use of radioactive materials within the facility. In addition, any transfer of radioactive materials to or from another institution will require the approval of the Committee. All modifications or improvements concerning any facet of the use or transfer of radioactive materials that the Committee deems appropriate in the interest of radiation safety shall be effected at the earliest possible time. The Committee may delegate authority to the Chairman and/or Radiation Safety Officer on such occasions that arise between normal meeting dates that do not warrant a special meeting of the full Committee. In cases of non-compliance, the Committee has the authority to terminate a user's authorization to use radiation sources.

ITEM: 7 (Continued)

e. The Radiation Safety Committee is the authorizing agency within this institution for each Principal Investigator. A Principal Investigator is a person who by virtue of his/her experience, training and knowledge is approved by the Committee to possess and use Radioactive material and to ensure compliance with the terms of his/her authorization even though other individuals may work under his/her supervision. All new uses of radioactive material concerning treatment or experimentation involving humans as patients or subjects require consultation with the Chairman of the Radiation Safety Committee prior to consideration for approval by the full Committee. Clinicians who wish to use radioactive materials for the treatment or diagnosis of disease must submit appropriate information before a request for amendment of the license issued by the Nuclear Regulatory Commission to the Veterans Administration Medical Center can be considered by the Committee.

f. The Chief of Nuclear Medicine will provide standard clinical procedures requiring the use of radionuclides within the general policies established by the Committee and the limitations of personnel and facilities available. The Chief of Nuclear Medicine Service will supervise all "Human Use" of radiopharmaceuticals. Radionuclides will be given to patients only by or under the direct supervision of a physician designated as a "user" on the Nuclear Regulatory Commission license.

g. The Radiation Safety Committee will conduct an audit of the Radiation Safety Program on an annual basis to ensure that the radiation absorbed dose received by the employees of this institution are maintained as low as reasonably achievable (ALARA). This audit will include (1) an examination of the radioactive waste disposal program, (2) an examination of past and present radiation exposure records for employees to determine if radiation doses have remained ALARA, (3) review of any investigations that were conducted to identify and correct causes of excessive radiation exposures, (4) review of the results of any NRC inspections that occurred during the previous year, including any corrective actions taken, (5) review of employee training sessions, (6) review of the documents listed in 2(c) above to ensure compliance with any new NRC requirements, (7) review of any reports from the Radiation Safety Officer, (8) review of current radionuclide user list and radionuclide inventory to ensure compliance with individual limits and NRC requirements, and (9) general assessment of the effectiveness of the Radiation Safety Program, including the adequacy of our management control system.

h. Dr. Hassan M. Omar will be Radiation Safety Officer.

ITEM: 7 (Continued)

(3) Membership. The Committee membership shall consist of at least one authorized user for each type of use of radioactive material permitted by our license, a representative of Nursing Service, a representative of our Radiation Safety Officer, as required by the NRC. The members will include:

M. L. Fields, M.D., Chief, Nuclear Medicine Service, Chairman
James W. Langston, M.D., Chief, Radiology Service
Charles C. Irving, Ph.D., Chief, Cancer Research Laboratory
Edwin H. Beachey, M.D., ACOS for Research and Development
Camilo U. Paig, M.D., Chief, Radiation Oncology Service
Ray Cox, Ph.D., Cancer Research Laboratory
Hassan M. Omar, Ph.D., Radiation Safety Officer
Alys H. Lipscomb, M.D., Consultaant, Nuclear Medicine Service
Marjorie J. Zachariah, R.N., Nursing Service.

VA MEDICAL CENTER
Memphis, Tennessee 38104

MEMORANDUM 11-5
January 17, 1983

SUBJ: Radiation Safety Committee

1. Purpose. To establish a Radiation Safety Committee for the Memphis VA Medical Center.

2. Policy and Implementation.

a. The Chairman of the Committee shall call a meeting of the Committee whenever he deems that such a meeting is appropriate. In any case, however, no fewer than four such meetings will be held each year. The minutes of each meeting will be recorded usually by the Radiation Safety Officer and distributed to the Committee members, the Director, the Chief of Staff, and to any other interested parties.

b. The Radiation Safety Committee is the final authority in all matters pertaining to safe use of radioactive material within the facility. Briefly, the Committee shall ensure that all radioactive material is used in a safe manner, within ALARA (As Low As Reasonably Achievable) guidelines and our NRC License. In addition, the Radiation Safety Committee shall ensure that all individuals affected by our NRC License have sufficient training to function within NRC requirements.

c. The pertinent documents stating areas of responsibility delegated to the Committee and rules enforced by the Radiation Safety Committee are detailed in (1) the Medical Center ALARA Program, (2) Memorandum 115-1, (3) Memorandum 11-33, (4) NRC License 41-00119-08, and 10 CFR 35.11(b). Some of these responsibilities and rules are re-stated below.

d. The Committee shall review all applications and procedures for the use of radioactive materials within the facility. In addition, any transfer of radioactive materials to or from another institution will require the approval of the Committee. All modifications or improvements concerning any facet of the use or transfer of radioactive materials that the Committee deems appropriate in the interest of radiation safety shall be effected at the earliest possible time. The Committee may delegate authority to the Chairman and/or Radiation Safety Officer on such occasions that arise between normal meeting dates that do not warrant a special meeting of the full Committee. In cases of non-compliance, the Committee has the authority to terminate a user's authorization to use radiation sources.

e. The Radiation Safety Committee is the authorizing agency within this institution for each Principal Investigator. A Principal Investigator is a person who by virtue of his/her experience, training and knowledge is approved by the Committee to possess and use radioactive material and to ensure compliance with the terms of his/her authorization even though other individuals may work under his/her supervision. All new uses of radioactive material concerning treatment or experimentation involving humans as patients or subjects require consultation with the Chairman of the Radiation Safety Committee prior to consideration for approval by the full Committee. Clinicians who wish to use radioactive material for the treatment or diagnosis of disease must submit appropriate information before a request for amendment of the license issued by the Nuclear Regulatory Commission to this Veterans Administration Medical Center can be considered by the Committee.

EXPIRES JANUARY 31, 1986

f. The Chief of Nuclear Medicine will provide standard clinical procedures requiring the use of radionuclides within the general policies established by the Committee and the limitations of personnel and facilities available. The Chief of Nuclear Medicine Service will supervise all "Human Use" of radiopharmaceuticals. Radionuclides will be given to patients only by or under the direct supervision of a physician designated as a "user" on the Nuclear Regulatory Commission license.

g. The Radiation Safety Committee will conduct an audit of the Radiation Safety Program on an annual basis to ensure that the radiation absorbed dose received by the employees of this institution are maintained as low as reasonably achievable (ALARA). This audit will include (1) an examination of the radioactive waste disposal program, (2) an examination of past and present radiation exposure records for employees to determine if radiation doses have remained ALARA, (3) review of any investigations that were conducted to identify and correct causes of excessive radiation exposures, (4) review of the results of any NRC inspections that occurred during the previous year, including any corrective actions taken, (5) review of employee training sessions, (6) review of the documents listed in 2(c) above to ensure compliance with any new NRC requirements, (7) review of any reports from the Radiation Safety Officer, (8) review of current radionuclide user list and radionuclide inventory to ensure compliance with individual limits and NRC requirements, and (9) general assessment of the effectiveness of the Radiation Safety Program, including the adequacy of our management control system.

h. Dr. Hassan M. Omar will be Radiation Safety Officer. Dr. Gary B. Stillwagon will be Radiation Safety Consultant.

3. Membership. The Committee membership shall consist of at least one authorized user for each type of use of radioactive material permitted by our license, a representative of Nursing Service, a representative of our management and our Radiation Safety Officer, as required by the NRC. The members will include:

M. L. Fields, M.D., Chief, Nuclear Medicine Service, Chairman
James W. Langston, M.D., Chief, Radiology Service
Charles C. Irving, Ph.D., Chief, Cancer Research Laboratory
Edwin H. Beachey, M.D., ACOS for Research and Development
Camilo U. Paig, M.D., Chief, Radiation Oncology Service
Ray Cox, Ph.D., Cancer Research Laboratory
Hassan M. Omar, Ph.D., Radiation Safety Officer
Alys H. Lipscomb, M.D., Consultant, Nuclear Medicine Service
Gary B. Stillwagon, Ph.D., Radiation Safety Consultant
Marjorie J. Zachariah, R.N., Nursing Service

ex officio member: John Finley, Hospital Safety Officer.

4. Reference. M-2, Part XX, Chapter 2, Paragraph 2.02.

5. Rescission. Medical Center Memorandum 11-5, dated January 3, 1983.

BY DIRECTION OF THE DIRECTOR

RICHARD C.W. HALL, M.D.
Chief of Staff

Distribution: B

VA MEDICAL CENTER
Memphis, Tennessee 38104

MEMORANDUM 115-1
January 29, 1982

SUBJ: Procurement, Handling and Disposal of Radioactive Materials

1. Purpose. To inform as to procurement, use and existing safety standards concerning handling and disposal of radioactive materials.

2. Policy. Procedure below will be strictly adhered to.

3. Implementation. This medical center currently has a license issued by the U.S. Nuclear Regulatory Commission (USNRC) governing the procurement, use and disposal of radioactive materials. One portion of this license covers human applications and is under the direction and supervision of the Chief, Nuclear Medicine Service (Dr. M. L. Fields). The other portion of our license governs research applications employing animals or in vitro techniques (non-human uses). Non-human usage of radioactive materials is under the direction and supervision of the Radiation Safety Consultant (Dr. G. B. Stillwagon), the Radiation Safety Officer (Dr. H. M. Omar), the Associate Chief of Staff for Research and Development (Dr. A. H. Kang) and Dr. R. Cox. This license contains authorizations for the procurement of specific radionuclides as well as regulations governing the use and disposal of these radioactive materials. The Radioisotope Committee must review all proposed clinical and research uses of radionuclides.

4. Procurement.

a. Procurement and use of radioactive materials in humans must be carried out by the Nuclear Medicine Service under the supervision of Dr. Fields and his staff. Since there are tight restrictions on the human uses of radioactive materials, any investigator who proposes to use radioactive materials in humans (including volunteer subjects as well as patients) must discuss his proposal with Dr. Fields and obtain his approval. If the hospital is not licensed for the particular application under consideration, the investigator may request that consideration be given to amend the human use license. Amendment of the license requires the recommendation of Dr. Fields, approval by the Radioisotope Committee and final approval by the USNRC.

b. Any investigator who proposes to use radioactive material for non-human uses, i.e., in animals or in the use of in vitro procedures, must submit an Application to the Radioisotope Committee for Use of Radioactive Material. The application will be sent to the Chairman of the Radioisotope Committee (Dr. Fields) and kept on file in the research office (BECEG-41) if the application is approved by the Radioisotope Committee and the Research and Development Committee. (See Attachment A).

c. Orders for the procurement of radioactive material for non-human use will be sent to Room BECEG-41 for the approval of Radiation Safety Personnel (Dr. Stillwagon or Dr. Omar). This includes radioactive material ordered through the University of Tennessee for delivery to this hospital. The order will be approved only if the investigator has been authorized (approved application on file) to use the particular radionuclide for the purpose requested. To be considered for approval, each order must (1) indicate clearly the total activity ordered (state either the number of millicuries or microcuries per container and the number of such containers ordered or simply the total number of millicuries or microcuries ordered), (2) state our NRC Byproduct Material License Number and (3) be marked as follows:

EXPIRES JANUARY 31, 1985

7A-3 16218

Deliver to: Dr. Stillwagon
Room BECEG-41

d. Radioactive materials must not be brought into or removed from the medical center without the prior knowledge and approval of the Radiation Safety Officer.

5. Radiation Safety Regulations. These regulations apply to the use of radioactive materials obtained for non-human uses. (Human use studies can be performed in the Nuclear Medicine Service only).

a. Eating, drinking and smoking are not permitted in any laboratories or rooms where radioactive materials are used or stored unless authorized specifically by the Radiation Safety Officer.

b. Pipetting by mouth is strictly prohibited and shall never be utilized. Consult the Radiation Safety Officer if aid in avoiding this procedure is desired.

c. Whenever radioactive materials are in use, all injuries no matter how minor shall be monitored to determine if the wound is contaminated. All cases of accidents shall be reported immediately to Radiation Safety Personnel (Dr. Stillwagon, Ext. 7925, 5083, or Dr. Omar, Ext. 5089).

d. Special protection is required for existing wounds in order to prevent the entry of radioactive materials into the body through wounds.

e. Protective clothing appropriate to the conditions shall be worn at all times when working with radioactive materials. However, GLOVES SHALL BE THE MINIMUM PROTECTION REQUIRED IN ALL CASES. Gloves must not be worn away from the work area. Analytical instruments and balances must not be used by the individual wearing gloves to avoid contamination of these instruments. Care must be utilized when removing the gloves to avoid contamination of the hands of the wearer.

f. Safety glasses, face shields or personal eyeglasses should be worn when using high levels of ^{32}P (5.0 mCi or greater).

g. All equipment that may come in contact with loose radioactive material shall be considered potentially contaminated and shall be monitored for contamination before removal to a different room. (Survey meters are available in Room BECEG-21 and Room CWG-19).

h. Whenever high levels of radioactive materials are being used, area monitoring should be performed during and after the activity (6.0 mCi or greater).

i. All individuals shall monitor themselves for contamination before leaving an area where loose radioactive material is suspected to be present.

j. Absorbent paper shall be used on all work surfaces where radioactive materials are utilized.

k. All persons who are designated to wear personnel monitoring devices by the Radiation Safety Officer, according to Medical Center Memorandum 11-33, shall wear such devices at all times during the working hours of the individual.

l. All persons who are permitted to use or operate any source of radiation shall be made fully aware of the procedures specified for that radiation source.

m. All sources of ionizing radiation shall be used in such a manner that radiation absorbed dose rates to personnel are not increased unnecessarily. Radiation Safety Personnel can suggest methods to accomplish this goal. Some of these methods are use of shielding and distance from the source (remote equipment such as long-handled tongs, remote pipettes, etc.) as well as decreasing the time of exposure.

n. All sources of radiation shall be used and stored in such a manner as to prevent unauthorized persons from using or removing the radioactive material or operating the radiation producing machines.

o. All sources of radiation shall be labeled properly in conformance with the standards set forth in Title 10 of the Code of Federal Regulations, Part 20.

p. No source of radiation may be transported from the authority of one user to another without prior approval by Radiation Safety Personnel. This includes lending radionuclides from Principal Investigator to another at this Medical Center as well as to investigators located at other facilities.

q. Animals given radioactive materials are to be housed only in Room BWG-10B unless other arrangements have been made with Radiation Safety Personnel. Administration of radioactive material to animals shall not be accomplished without first notifying Radiation Safety Personnel or their designate, the Assistant Radiation Safety Officer, Ext. 7270.

r. Carcasses only of animals given radioactive materials must be stored in the walk-in freezer in Room BECEG-46 for proper disposal by Radiation Safety Personnel. The log on the door of Room BECEG-46 should be filled in and initialed.

s. Each authorized user of radioactive materials is required to review procedures performed by the user personally or those under his authority to ensure that radiation absorbed doses are maintained as low as reasonably achievable (ALARA). The user is encouraged to utilize the services of Radiation Safety Personnel in this regard. Documentation will be maintained concerning these reviews. This documentation may be in the form of notations in the laboratory notebook of the investigator. Monitoring of the film badge results of the workers under the authority of each authorized user is an excellent form of review of each established procedure.

t. Each worker should review his personal technique as often as possible to ensure that his radiation absorbed dose will remain as low as reasonably achievable (ALARA). Each worker may consult Radiation Safety Personnel in this regard and/or compare procedures with fellow workers.

u. The procedure to follow during emergencies involving radioactive materials is described in Attachment B entitled "Radiation Emergency Procedures."

6. Disposal. Disposal of radioactive material shall be performed in accordance with Attachment C entitled "Procedures and Policies for the Disposal of Low-Level Radioactive Waste."

7. Reference. M-2, Part XX, paragraph 1.03.

8. Rescission. Medical Center Memorandum 115-1 dated August 25, 1980.

BY DIRECTION OF THE DIRECTOR:

E. L. Cashion

E. L. CASHION, M.D.
Acting Chief of Staff

Attachments 3

Distribution: A
(50 copies to 115)

ATTACHMENT A
Memorandum 115-1

APPLICATION TO RADIOISOTOPE COMMITTEE

FOR USE OF RADIOACTIVE MATERIAL

(A separate application must be submitted for each different radionuclide to be used).

I. INVESTIGATOR _____ ROOM NO. _____

TRAINING AND EXPERIENCE OF INVESTIGATOR RESPONSIBLE FOR ISOTOPE USAGE: List levels and type of experience with isotopes. (Not necessary to repeat if application is on file).

II. RADIONUCLIDE _____ CHEMICAL FORM OF RADIONUCLIDE _____

SOURCE OF SUPPLY _____

POSSESSION LIMIT REQUESTED (μCi or mCi) _____

III. TO BE USED _____ IN VITRO or _____ IN VIVO.

IF IN VIVO: SPECIES OF ANIMAL _____ ESTIMATED NO. OF ANIMALS ____

DOSE PER ANIMAL _____ μCi or _____ mCi.

METHOD OF ADMINISTRATION _____

IV. PURPOSE FOR STUDY: Briefly indicate the research or diagnostic value of this study. (If available, give title and number of VA project).

I CERTIFY that I have become familiar with the VA Procedures for the procurement, handling and disposal of radioactive materials and will implement the requirements contained therein in this study.

SIGNATURE _____ DATE _____

APPROVED: _____ DATE _____
Chairman, Radioisotope Committee

(Submit in Triplicate - Include copy of Proposed Procedure from Research Proposal)

ATTACHMENT B
Memorandum 115-1

RADIATION EMERGENCY PROCEDURES
In case of FIRES or OTHER MAJOR EMERGENCIES Involving Radioactive Materials

1. Notify the fire department and other hospital safety personnel.
2. Notify the Radiation Safety Consultant, Dr. Stillwagon, Ext. 7925, 5083. If he is not available, notify Dr. Omar, Ext. 5089, Dr. Cox, Ext. 7238, or Mrs. Shirley Myrick, Ext. 5096.
3. Confine contamination to the smallest area possible using absorbent pads. Do not clean up the area until radiation safety personnel have arrived and area monitoring has been performed. (Radiation survey meters are available in Room BECEG-21 and CWG-19).
4. Radiation safety personnel will determine safe decontamination procedures. These procedures must be followed precisely.
5. After clean up, monitoring shall be performed on all individuals involved and on all materials used during clean up. Personnel may not leave the area until monitored.
6. Compile a complete report of the incident and forward it to the Radiation Safety Consultant, Dr. Stillwagon.

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. NOTIFY: Notify Radiation Safety Personnel as in No. 2 in the section above.
4. 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 disposable gloves.
5. SURVEY: With a G.M. Survey Meter, check the area around the spill, your hands and your clothing for contamination. Survey meters are available in Room BECEG-21 and CWG-19. Use wipe tests if ^{14}C, ^{3}H or ^{51}Cr is involved.
6. REPORT: Compile a report of the incident and submit it to the Radiation Safety Consultant.

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. Do not risk additional exposure needlessly.
4. CLOSE THE ROOM: Leave the room and lock the door(s) to prevent entry. DO NOT LEAVE THE ROOM UNATTENDED.
5. CALL FOR HELP: Notify the Radiation Safety Personnel immediately, as stated above. He will determine appropriate decontamination procedures.
6. PERSONNEL DECONTAMINATION: Contaminated clothing should be removed and stored for further evaluation by Radiation Safety Personnel. If the spill is on the skin, flush thoroughly and then wash with mild soap and lukewarm water.
7. POST CLEAN UP MONITORING: All personnel and clean up materials must be monitored before the emergency can be considered terminated.
8. FILE A REPORT: A complete report of the incident must be filed with the Radiation Safety Consultant, including changes installed to prevent recurrence of similar accidents.

PROCEDURES AND POLICIES FOR THE DISPOSAL OF LOW-LEVEL RADIOACTIVE WASTE

I. POLICIES

A. Each individual should attempt to minimize the volume of low-level radioactive waste that he or she generates. Radiation Safety Personnel can suggest ways to accomplish this goal for specific situations.

B. No liquid wastes shall be placed in the specially labeled drums for disposal purposes.

C. Plastic bags used to contain the radioactive waste materials should be doubled to accommodate glass and/or sharp objects prior to placement of the bags in our waste disposal drums.

II. PROCEDURES

A. All radioactive waste will be placed in the approved plastic bags and housed in specially labeled waste baskets until removal to the 55-gallon drums is effected.

B. Each bag should be labeled as to the radionuclides contained within and the approximate quantity of each radionuclide stated on the label.

C. Separate plastic bags shall be maintained for all material contaminated with Iodine-125.

D. The Assistant Radiation Safety Officer, Ext., 7270, should be contacted when the approved plastic bags are full and ready for permanent disposal.

E. The Assistant Radiation Safety Officer will package each specially labeled drum according to the requirements submitted by the Atomic Disposal Company, 49 CFR, Parts 170-179 and 10 CFR, Part 150.

F. The contents (radionuclide and quantity) of each drum will be entered into the log of Radioactive Waste and maintained in Room BECEG-32.

G. The log of shipments of Low-Level Radioactive Waste transported by the Atomic Disposal Company and the contents of each drum will be maintained in Room BECEG-41.

H. The collection of the plastic bags, the packaging of each drum, the log of shipments and the log of the contents of each drum will be subject to the direct supervision or review by the Radiation Safety Consultant.

I. Procedures for burning of low-level radioactive waste are maintained in Room CWG-19 and BECEG-41.

J. Procedures for disposal of radioactive wastes within the Nuclear Medicine Service shall be included in the Nuclear Medicine Service Radiation Safety Manual which is available within that department.

VETERANS ADMINISTRATION MEDICAL CENTER
Memphis, Tennessee 38104

MEMORANDUM 11-33
March 3, 1982

SUBJ: Personnel Radiation Monitoring Using Film Badges

1. Purpose: To outline medical center policy and procedures for the monitoring of employees receiving occupational exposure to radiation.

2. Policy:

a. It is the policy at this medical center that all personnel who operate radiation-producing machines, such as radiographic and fluoroscopic x-ray machines, or utilize radioactive materials shall wear a personnel monitoring device not only while carrying out the performance of these duties, but during all working hours at this facility regardless of time of day.

b. Proper use of a film badge allows the wearer to keep an accurate record of his or her radiation exposure relative to others performing similar tasks at this medical center. Therefore, it is possible to discover flaws in one's technique which could be causing a higher radiation exposure than co-workers receive, or even discover defects in radiation exposure.

c. Federal Law states that, "Each licensee shall supply appropriate personnel monitoring equipment to, and shall require the use of, such equipment by: Each individual who enters a restricted area under such circumstances that he receives, or is likely to receive, a dose in any calendar quarter in excess of 25 percent of the applicable value specified in paragraph (a) of 20.101" (of 10 CFR).

3. Procedures:

a. The film badge is the personnel monitoring device employed at this medical center.

b. The Radiation Physicist will have overall responsibility for the monitoring program and will review the monthly film badge reports.

c. Film badges will be distributed in the following manner:

1) Radiology Service, through the Quality Assurance Technologist, will be responsible for the distribution of film badges for those employees working in: Radiology Service, Dental Service, Medical Service, Surgical Service, and Nursing Service.

2) Research Service, through a designated Research Technologist, will be responsible for the distribution of film badges for those employees working in: Nuclear Medicine Service and Research Service.

d. When new film badges arrive each month they will be distributed by the above designated individuals throughout their respective areas.

EXPIRES March 31, 1985

e. Any person who is to receive a new badge and is not wearing his or her old badge when approached with a replacement badge, is in violation of both Federal Law and Medical Center Policy, and will have this reported in writing to their Service Chief and the Radiation Physicist. (See Attachment A for sample notification format.)

f. Violators will be subject to appropriate disciplinary action.

g. If the individual who is not wearing his or her old badge can readily produce it, a replacement badge will be issued. If such an exchange cannot take place, then the individual must report within three (3) work days to the designated issuer's office with either their old badge for exchange or pay a $5.00 lost badge replacement charge.

h. If a person cannot be located after two visits to his or her area for the film badge exchange, this person must also report to the offices mentioned above to receive the new film badge.

i. Each film badge in its holder must be surrendered by any employee who terminates his or her employment or the $5.00 lost badge replacement charge will be levied.

j. Each person receiving a film badge for the first time or currently assigned a film badge must sign a copy of Attachment B. The original will be kept on file with the Radiation Physicist and a copy retained in the employee's Service Chief's office. Additionally, the new employee must inform the Service Chief's office concerning any prior occupational radiation exposure. The Service Chief will request a copy of the new employee's previous exposure record from the individual's former employer(s) using the "Previous Exposure Request" form, Attachment C.

k. During surgical procedures, unmonitored personnel in the room where an x-ray machine is being used should seek protection for the few seconds required for the x-ray exposure. If no shielding is provided in the room for this purpose, unmonitored personnel should stand as far away from the beam as possible. Of course, it is understood that all unmonitored personnel are not responsible for the actual operation of the x-ray machine as only monitored personnel can perform this task. Therefore, the presence of these unmonitored personnel near the x-ray machine is not needed for the few seconds required to take the x-ray after the proper positioning of the patient has been fixed for the radiograph.

l. Bedside x-ray exams should be kept to an absolute minimum as emphasized in Medical Center Memorandum 114-1. Visitors must leave the area for the short time required to take the x-ray and other patients should be located as far away from the area as possible. These precautions are necessary because portable x-ray machines pose even greater radiation hazards than fixed units.

4. References: Federal Law, 10CFR20.202(a); Section 19 of the Occupational Safety & Health Act of 1970; MP-3, Part III, para. 32.18; and JCAH Accreditation Manual for Hospitals.

5. Rescissions: Medical Center Memorandum 11-33 dated March 12, 1979. ✓

BY DIRECTION OF THE DIRECTOR:

Ernest L. Cashion

ERNEST L. CASHION, M.D.
Acting Chief of Staff

Attachments: 3

Distribution: A & E: 50 to 114
105 to 115

*Please see Chief of Staff concurrence for changes in Memorandum 11-33 (attached).

115

Chief of Staff (11)

October 28, 1983

Request change in Hospital Memorandum 11-33, dated March 3, 1982.

1. I request that the following change be made in the above referenced memorandum:

"3. Procedures.

c. 2) Research Service, through a designated Research Technologist, will be responsible for the distribution of film badges for those employees working in the Research Service.

3) Nuclear Medicine Service, through a designated Nuclear Medicine Technologist, will be responsible for the distribution of film badges for those employees working in Nuclear Medicine Service."

2. This change allows more efficient use of personnel since relocation of Nuclear Medicine Service to the First Floor from the Ground Floor.

3. I would appreciate your concurrence as we wish to include this change in our Application requesting renewal of our NRC License No. 41-00119-08.

MURRAY L. FIELDS, M.D.
Chief, Nuclear Medicine Service (115)

CONCUR:

For and in the absence of
RICHARD C. W. HALL, M.D.
Chief of Staff (11)

Attachment 1

OFFICE MEMORANDUM

ATTACHMENT "A"
MEMORANDUM 11-33
March 3, 1982

DATE:

TO: (Appropriate Service Chief)

FROM: (Film Badge Issuers)

SUBJ: Violation of Medical Center Policy regarding the Monitoring of Film Badges.

1. On _____(date)_____, when I was in the process of issuing a replacement film badge to _____(name of individual)_____, this individual was not wearing the film badge issued at the beginning of the previous month.

2. As you know, this is in violation of Medical Center Policy as stated in Medical Center Memorandum 11-33.

3. Accordingly, please take the necessary appropriate disciplinary action and report what action you have taken, in writing, to the Radiation Physicist (114) within seven (7) days after receipt of this notification.

SAMPLE

_____
(Signature)

cc: Radiation Safety Officer (114A)

ATTACHMENT "B"
MEMORANDUM 11-33
March 3, 1982

Personnel Monitoring Signature Sheet

I _____ Have received a film badge as part of the personnel monitoring program of the Veterans Administration Medical Center. I am aware that both Federal Law (10 CFR 20.202 (a) and Section 19 of the Occupational Safety and Health Act of 1970), as well as VA Policy (MP-3, Part III, Paragraph 32.18) state that a film badge is required to be worn during all working hours at this facility regardless of the time of day. Additionally, I have read Medical Center Memorandum 11-33 which contains the policies established by this facility concerning film badge usage. I understand my film badge, in its holder, is required to be turned in upon termination of my employment at the VA Medical Center, Memphis or a $5.00 charge will be imposed. If during my employment I lose my badge holder I agree to pay a $5.00 charge for the issuance of a new holder.

_____ _____
Employee Signature Date

_____ _____
Appropriate Service Chief Signature Date

Original should be sent to Radiation Safety Officer (114)
Copy should be kept on file by Service Chief.

Medical Center

1030 Jefferson Avenue
Memphis, TN 38104

Veterans Administration

ATTACHMENT "C"

Dear Sir:

In order to complete the occupational radiation dose history of the following individual, a record of his or her occupational radiation exposure is needed from your institution.

Full Name _____

Social Security Number _____

Full Address of Institution _____

Period of Employment _____

Department _____

An authorization for release by the individual is located on the lower portion of this form.

Please forward the requested information to:

Hassan M. Omar, Ph.D
Radiation Safety Officer
Veterans Administration Medical Center
1030 Jefferson Avenue
Memphis, Tennessee 38104

I hereby authorize the release of any radiation exposure records to the Radiation Safety Office, Veterans Administration Medical Center, Memphis, Tennessee.

_____
Signature

eply Refer To

Acknowledgement of Adherence to the ALARA Concept

The purpose of this form is to itemize the information each individual should possess prior to the performance of any task involving the use of, or possible exposure to, radioactive materials. Each individual should sign this form to verify this information has been obtained prior to the performance of any task involving the use of, or possible occupational exposure to, radioactive materials.

Each individual should:

1. Read Medical Center Memorandum 115-1, "Procurement Handling and Disposal of Radioactive Materials". Emergency procedures are described in this document.

2. Read the Medical Center ALARA (As Low As Reasonably Achievable) Program, that is part of our NRC License, and understand the course of action available to personnel regarding the maintenance of any occupational radiation absorbed dose ALARA.

3. Read Medical Center Memorandum 11-33, "Personnel Radiation Monitoring Using Film Badges".

4. Note that copies of the NRC License governing this institution, all applicable NRC correspondence and NRC regulations are available in Room BECEG-23, AW-128 and CWG-23 for review.

5. Be aware that all radioactive materials are used and stored only in areas properly labeled in accordance with NRC regulations. These regulations must be strictly enforced.

6. Realize radioactive materials are hazardous substances, both carcinogenic and mutagenic. However, radioactive materials can be used quite safely if our safety precautions, stated in the documents above, are followed.

7. Receive training from a supervisor specific for the tasks the individual will be performing, including radiation safety precautions, prior to the first performance of the task.

8. Report any unsafe conditions, such as radiation spills or improper work habits, to the Radiation Safety Officer, as required by the NRC.

9. Be aware individuals may examine their radiation exposure records in Room CWG-23 or AW-128.

10. Know the NCRP and ICRP have recommended that, during the entire pregnancy, the maximum permissible dose equivalent to the fetus from occupational radiation exposure of the expectant mother should not exceed 0.5 rem. The maximum permissible occupational radiation absorbed dose equivalent is 5.0 rems/year. This lower value for the fetus is recommended because the fetus is more radiosensitive than the adult as a result of the presence of a rapid rate of development manifested by high mitotic figures and the presence of unspecialized cells. Cells are more radiosensitive when they divide more often and when they are unspecialized.

Signature of Employee

Date

Copy to: Administrative Officer for Research
Radiation Safety Officer (114A)
Employee

8. TRAINING AND EXPERIENCE

a. HASSAN M. OMAR, Ph.D., Radiation Safety Officer, is a full-time health physicist in the Radiology Service and medical physicist in the Radiation Therapy Division. He is on our License No. 41-00119-08.

b. ROBERT J. WILSON, Ph.D., Physicist Consultant, is Professor, Department of Radiology, Nuclear Medicine Division, University of Tennessee Center for the Health Sciences. He is also on our License No. 41-00119-08.

The only change from our license is the deletion of Gary B. Stillwagon, Ph.D., Radiation Safety Consultant.

ITEM: 8
DATE: 9-23-83

9. Instrumentation

Type		Manufacturer's Name	Model No.	No. Available	Range
a. Survey Instruments					
(1)	Survey Meter	Nuclear-Chicago	2650	1	0-100 mr/hr
(2)	Survey Meter (Cutie Pie)	Texas-Nuclear	2592	1	0-1000 mr/hr
(3)	Exposure Rate-meter	Nuclear-Chicago	9120	1	0.2-200 mr/hr
(4)	Survey Meter (Panoramic)	Victoreen	470A	1	0-1000 mr/hr
b. Dose Calibrator					
(1)	Radioisotope Calibrator Capintec	Nuclear-Chicago	CRC-10	1	
(2)	Radioisotope Calibrator Capintec	Nuclear-Chicago	CRC-30	1	
c. Diagnostic Instruments					
(1)	Gamma Camera	Searle Radio-graphics	LFOV	1	
(2)	Gamma Camera	Technecare Sigma	420	1	
(3)	Gamma Camera	Technecare Omega	500	1	
(4)	Uptake System	Searle Radio-graphics	8725	1	
(5)	Gamma Well	Searle	1185	1	
(6)	Table-Top RIA Counter	The Nucleus	1000/1200	1	
(7)	Gamma Well	Micromedic	4/200	1	

Items 9.a, b, and c are located in Nuclear Medicine Service.

ITEM: 9 -1
DATE: 9-23-83

9. Instrumentation (Radiation Research)

	Type	Manufacturer's Name	Model No.	No. Available	Range
a.	Survey Instruments				
(1)	Survey Meter	Victoreen	493	1	0-1000 mr/hr
(2)	Survey Meter	Victoreen	470R	1	0-10,000 mr/hr
b.	Scintillation Spectrometers				
(1)	Packard 3375	Beta			
(2)	Packard 578	Gamma			
(3)	Packard Counter 3001	Gamma			
(4)	Packard 3255	Beta			
(5)	Packard 2660	Beta			
(6)	Packard 460C	Beta			
(7)	Packard 5230	Gamma			

10. Calibration of Instruments (NUCLEAR MEDICINE)

Methods, Frequency and Standards Used:

a. The three survey instruments listed are calibrated by Robert John Wilson, Ph.D. The calibration sources are housed and used at the University of Tennessee Center for the Health Sciences under Tennessee License No. R-7919-L4 (1984). Dr. Wilson also holds Tennessee License No. R-7982-K2 (1982). The sources for calibration are:

Mfg.	Model	Serial	Radionuclide	Activity	Date
ICN	378	1020	Co^{60}	1.6 mCi	7-12-76
ICN	378	1021	Co^{60}	9.8 mCi	7-12-76
ICN	378	1022	Cs^{137}	1.0 mCi	7-12-76
ICN	378	1023	Cs^{137}	10.2 mCi	7-12-76

The calibration is carried out on a calibration range which allows the remote setting of the distance between the source and the detector. The exposure rate is calculated from the Exposure Rate Constant and the activity and distance. This calculated value is compared with the measured value on the upper 2/3 and lower 1/3 of the meter scale (separated by 50% of F.S.) to determine a calibration factor. A "Survey Instrument Calibration" sheet with a "Ca.ibration Sticker" attached is enclosed.

b. Dose Calibrators. All radiopharmaceutical doses are assayed for activity prior to patient administration. The dose is recorded. The two Capintec dose calibrators (CRC-10 and CRC-30) are checked daily for operational constancy with a Ra^{226} source (Nuclear Chicago Calibration Source Model 184622, Serial No. 126, 15.7 microcuries and NEN Cs^{137} Cat. No. NES 356 (207 microcuries on 5-7-79), Serial No. 3560579A-27. They are also checked daily with a Cs^{137} Standard (New England Nuclear Mo^{99} equivalent Standard Collection Vial Source, 18.7 microcuries). Periodically, both instruments are tested for accuracy of response for commonly used energies.

c. Diagnostic Instruments. Manufacturers' service engineers perform calibration and maintenance procedures on all diagnostic equipment. Daily performance checks (sensitivity, image resolution and linearity) are made on all equipment and the results are recorded.

SURVEY INSTRUMENT CALIBRATION

Date: ______________________

By: ______________________

Instrument:

Electronics

Type: ______________________

Mfg.: ______________________

Model: ______________________

Serial: ______________________

Batteries checked? ______________

Probe

Type: ______________________

Mfg.: ______________________

Model: ______________________

Serial: ______________________

Calibration Source:

Type: ______________________

Mfg.: ______________________

Model & Serial: ______________________

Strength: ______________________

Assay Date: ______________________

Elapsed Time and Decay Factor: ______________

Strength on Calibration Date: ______________

^{60}Co T 1/2 = 5.26 yr. $\Gamma = 13.2 \times 10^3 \frac{mR - cm^2}{hr - mCi}$

$= 2.05 \times 10^3 \frac{mR - in^2}{hr - mCi}$

^{137}Cs T 1/2 = 30.0 yr. $\Gamma = 3.3 \times 10^3 \frac{mR - cm^2}{hr - mCi}$

$= 5.12 \times 10^2 \frac{mR - in^2}{hr - mCi}$

Ref. Radiological Health Handbook (1970) PHS Publ 2016 and quoted references.

Range	Distance (in) Source to Probe	Calculated Exposure Rate	Meter Reading	Exposure Rate / Meter Reading	Correction Factor

DATE ______ BY ______ DUE ______

CALIB EN ______ CK RDG ______

SCALE ______ CORR FACTOR ______

ITEM 10A-1

DATE:

10. Quality Assurance Procedures (NUCLEAR MEDICINE).

Dose Calibrators.

a. Daily Constancy Test. (Perform before removing any radioactive materials from their shielded containers).

(1) Determine predicted activity for ^{137}Cs reference source (NES-356, Serial No. 3560579A-27) based on decay from reference date. Consult ^{137}Cs decay chart and tables, correct predicted activity at 6-month intervals. Determine ±5% limits (example 195 microcuries ±5% = 185 - 205 microcuries) and insert range on log sheet.

(2) Adjust dose calibrator zero and background readings, set for ^{137}Cs assay.

(3) Assay ^{137}Cs source and record reading on daily log sheet.

(4) Verify reading falls within ±5% limits, variations beyond limits indicate need for instrument recalibration and/or repair.

(5) Repeat steps (2) and (3) using instrument settings for ^{99m}Tc, ^{131}I, ^{133}Xe, and other commonly used radionuclides.

b. Quarterly Linearity Test.

(1) Obtain more than 150 mCi ^{99m}Tc for serial assays. Assay at frequent intervals for 48 hours.

(2) Time of first assay is t_o. Calculate change from t_o for each assay.

(3) Using t_o as standard activity, calculate amounts of ^{99m}Tc available at 6, 12, 24, and 48 hours and plot on semi-log paper. Calculate ±5% limits.

(4) Refer to graph to determine if measured values are within ±5% limits.

(5) Errors greater than ±5% indicate the need for instrument repair or recalibration.

c. Annual Accuracy Test.

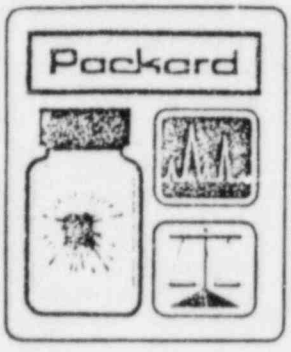
Using reference standards traceable to NBS, assay each standard at the appropriate calibrator setting three separate times. For example, for the Capintec, assay; remove the source and shield it; allow the readout to return to zero; repeat procedure two more times. Calibration checks which do not agree within ±5% of the standard indicate the need for recalibration or repair.

10. Calibration of Instruments (RADIATION RESEARCH and ANIMAL LABORATORY STUDIES)

All the scintillation spectrometer monitors in Item 9 at the Radiation Research labs are calibrated a minimum of twice per year according to a preventive maintenance service contract with the manufacturer using the ^{14}C and ^{3}H standard described in Attachment A. The calibration is normally performed by the service representative of the manufacturer. Consistency of the spectrometers are checked during each run or series of runs by authorized users utilizing standards such as those described in Attachments B and C.

The automatic Gamma counter is calibrated no less than monthly using the Auto Calibration procedure described on Attachment D. This is performed using our 0.1 microcurie ^{129}I source (Simulatory ^{125}I), number C1270.

Attachment A



CERTIFICATE OF RADIOASSAY

TRI-CARB®
SPECTROMETER STANDARDS
(TOLUENE–PPO–M$_2$POPOP)

This set of four radioactivity standards is designed for use in establishing and verifying proper operation of Tri-Carb Liquid Scintillation Spectrometers and to assist in trouble shooting should improper operation occur. The standards should not be used to determine counting efficiency of experimental samples. Each standard, in a flame-sealed Packard glass ampoule, contains a 15.0 milliliter aliquot from a master solution. The scintillation solution is composed of PPO (4 g/liter), dimethyl POPOP (250 mg/liter) and anhydrous toluene. The activity of the master solution is determined by comparison to radioactive Standard Reference Materials issued by the National Bureau of Standards. The NBS Reference Materials are certified to have the following maximum inaccuracies:

Nuclide	Reference Material No.	Accuracy
^{3}H	4947	±1%
^{14}C	4924	±1.5%
^{36}Cl	4943	±2%

The counting errors in the assay of the individual standards are ^{3}H±0.3%, ^{14}C±0.3%, and ^{36}Cl±0.1%. The maximum inaccuracies computed from these data are computed as percent standard error using the following formula:

Percent Error = $\sqrt{e_1^2 + e_2^2} + e_3$ where
e_1 = inaccuracy quoted for NBS Reference Materials (%)
e_2 = counting error (%)
e_3 = systematic errors, e.g. pipetting errors (%). e_3 is negligible in this preparation

Nuclide	Activity
Background Standard	None
^{3}H	163,600 ±1.32% dpm 22 Feb 73 *
^{14}C	[redacted] ±1.50% dpm
^{36}Cl	_____ ±2.10% dpm

* See reverse side for tritium decay table and AEC required statement

RADIOASSAY SECTION
CHEMICALS AND SUPPLIES

Serial No. 109

Catalog No. [redacted]

SECTION CHIEF

DATE

TRITIUM DECAY TABLE

Fraction Remaining

YEARS	MONTHS											
	0	1	2	3	4	5	6	7	8	9	10	11
0	1.000	.995	.991	.986	.981	.977	.972	.968	.963	.959	.954	.950
1	.945	.941	.936	.932	.927	.923	.919	.915	.910	.906	.902	.897
2	.893	.889	.885	.881	.876	.872	.868	.864	.860	.856	.852	.848
3	.844	.840	.836	.833	.828	.824	.820	.817	.813	.809	.805	.802
4	.798	.794	.790	.787	.783	.779	.775	.772	.768	.765	.761	.758
5	.754	.751	.747	.744	.740	.735	.733	.730	.726	.723	.719	.716
6	.713	.709	.706	.703	.699	.695	.693	.690	.686	.683	.680	.677
7	.674	.670	.667	.665	.661	.657	.655	.652	.649	.646	.642	.640
8	.637	.634	.630	.628	.625	.621	.619	.616	.613	.610	.607	.604
9	.602	.599	.596	.594	.590	.587	.585	.582	.579	.577	.574	.571
10	.569	.566	.563	.561	.558	.554	.553	.550	.547	.545	.542	.540
11	.537	.535	.532	.530	.527	.524	.522	.520	.517	.515	.513	.510
12	.508	.505	.503	.501	.498							

Half Life
12.26 Years

These standards are exempt from AEC or Agreement State licensing requirements. "Radioactive Material"– Not for Human Use-Introduction Into Foods, Beverages, Cosmetics, Drugs, or Medicinals, or Into Products Manufactured for Commercial Distribution is Prohibited-Exempt Quantities Should Not Be Combined. Handle standards by plastic cap. When not in use store standards in extra storage positions in Tri-Carb Liquid Scintillation Spectrometer. Should a standard break wipe up with absorbent material and dispose by inclusion in ordinary laboratory waste. Dispose of intact standards by inclusion in ordinary laboratory waste or by return to: Chemicals & Supplies Department, Packard Instrument Co. Inc., 2200 Warrenville Road Downers Grove, Illinois 60515.

Attachment B

CERTIFICATE OF RADIOACTIVITY CALIBRATION

Tritium Reference Source
NES-004

Half-Life: 12.35±0.01 yrs.
Lot Number: 697-199

The activity of Hydrogen-3 was found to be 2.19×10^6 disintegrations per minute per milliliter on June 16, 1978.

DESCRIPTION OF THE SOURCE

Chemical Composition:	^{3}H-Toluene
Volume:	Approximately 10 milliliters
Physical Form:	10 ml combivial
Temperature at Calibration	20° C

DECAY SCHEME	Intensity (%)
β-0.0186 MeV maximum 0.0057 MeV average	100

Reference: M.J. Martin, Nuclear Decay Data for Selected Radionuclides, ORNL-5114, March 1976.

METHOD OF CALIBRATION

The standard was calibrated by liquid scintillation counting using the National Bureau of Standards tritated toluene standard #4947 as an internal standard.

ERRORS

Random Errors (99% confidence level) Precision of the NENC measurement	±2.8%
Systematic Errors Accuracy of the NBS Standard	±1.0%
Overall Error 2.8 + 1.0 =	±3.8%

Date: June 16, 1978

By: Richard Carr
Richard Carr, Sr. Lead Technologist
Calibrated Sources Group
Nuclides and Sources Division

RADIOACTIVE MATERIAL

The radioactive material described or contained herein is exempt from NRC or agreement state licensing requirements. Not for human use. Introduction into foods, beverages, cosmetics, drugs or medicinals, or into products manufactured for commercial distribution is prohibited. Exempt quantities should not be combined.

NEN New England Nuclear
549 Albany Street, Boston, Massachusetts 02118
CALL TOLL-FREE 800-225-1572 Telex 94-0996
(In Massachusetts and International 617-482-9595)

Attachment C

CERTIFICATE OF RADIOACTIVITY CALIBRATION

Carbon-14 Standard
NES-006

Half Life: 5730+40 years
Lot Number 697-186-2

The activity of Carbon-14 was found to be
4.7×10^5 dpm/ml on 3/13/78

DESCRIPTION OF THE STANDARD

Chemical Composition	Toluene-^{14}C
Volume	Approximately 10 milliliters
Physical Form	10 cc. combi-vial
Temperature at calibration	20°C

METHOD OF CALIBRATION

The standard was calibrated by liquid scintillation counting using the National Bureau of Standards benzoic acid standard #4925 as an internal standard.

IMPURITIES

Less than 1% according to the producer of the isotope

ERRORS

Random Errors(3 times the standard deviation)

a. Precision of the NENC measurement ±1.0%

Systematic Errors

a. Accuracy of the NBS standard ±2.0%

Overall Error

1.0 + 2.0 = ±3.0%

RADIOACTIVE MATERIAL

The radioactive material described or contained herein is exempt from NRC or agreement state licensing requirements. Not for human use. Introduction into foods, beverages, cosmetics, drugs or medicinals, or into products manufactured for commercial distribution is prohibited. Exempt quantities should not be combined.

NEN New England Nuclear
549 Albany Street, Boston, Massachusetts 02118
CALL TOLL-FREE: 800-225-1572 Telex: 94-0996
(In Massachusetts and International: 617-482-9595)

M.A. Guichard

TAB 12
AUTO CALIBRATION

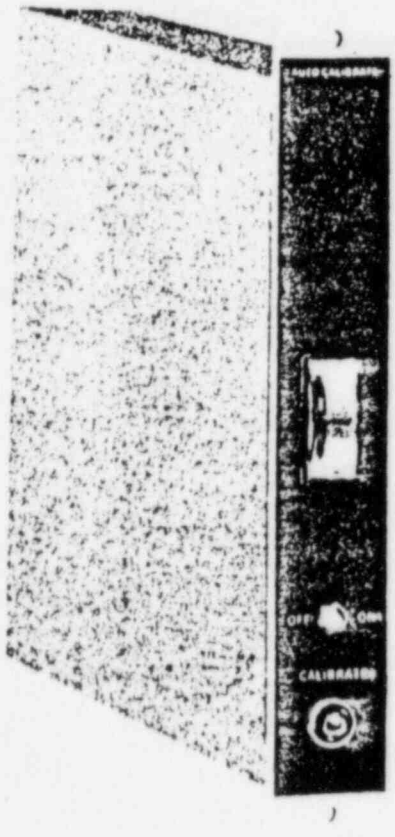


Figure 12-1. Auto Calibration Module.

12-1. AUTO CALIBRATION (See Figure 12-1)

The calibration module provides closed-loop automatic control of system gain.

The calibration module contains a meter, a combination pushbutton/light and an ON-OFF switch. The meter indicates the net gain correction that has been applied to the system. The meter is not calibrated. If the meter indicator stays at one of the extremes, then the system should be recalibrated by a Nuclear-Chicago service representative.

12-2. CALIBRATION

Calibration may be initiated in any of three ways:

1. When the button is pushed to call for calibration, and the module is ON, the calibration sequence will start at the end of counting of the current sample. The conveyor will advance to sample number 0.

2. When the conveyor reaches sample number 0 in the normal sequence of sample counting, and the module is ON, the unit will automatically call for calibration.

3. A calibration sequence will also be called for whenever the power is interrupted, and the module is ON.

The calibration standard (1.5 C, Cs-137, which MUST be in position 0, will be lowered and counted, and the gain tested. Correction, if any, is applied. The calibrator then releases the system to continue normal sample counting.

Note that anytime index position zero has a sample

Attachment E

Amersham

AMERSHAM CORPORATION
A SUBSIDIARY OF THE RADIOCHEMICAL CENTRE

Radiochemical Batch Analysis Results

IODINE-125
Code IMS.30
Batch 6C

Batch analysis sheet 25411

Iodine-125 is supplied as sodium iodide in dilute sodium hydroxide solution, pH 7-11, free from reducing agents.

BATCH TECHNICAL DATA

Activity reference date	19 March 1979
Specific activity	16.05 mCi (594 MBq) ^{125}I/μg of iodine on 19 March 1979
Radioactive concentration	100 mCi (3.7GBq) ^{125}I/ml at the activity reference date
Radionuclidic purity	0.27% ^{126}I at the activity reference date. No other radionuclidic impurity is detected by γ-spectrometry using a 3" x 3" sodium iodide crystal
pH	7-11 (specification)
Radiochemical purity	99.6% of the ^{125}I is present as iodide, as determined by paper chromatography (methanol: acetone, 1:1, v/v)
Iodination efficiency	96% incorporation into ACTH
Reducing agents	$<2 \times 10^{-5}$ M determined by addition of a dilute solution of iodine plus starch indicator. The colour should not be discharged.

Analysed 9 February 1979

USE

Suitable for the labelling of proteins and peptides. For *in-vitro* use only; not for administration as a pharmaceutical.

SAFETY AND HANDLING

Under some circumstances this material may be hazardous. Full details of the precautions required for the safe handling of iodine-125 are given in "Radioiodination techniques", Bolton, A.E., The Radiochemical Centre, Review No. 18, 1977 copies of which are available free on request.

STORAGE AND STABILITY*

It is recommended that the material is stored at ambient temperature (15°-25°C).

Stability trials conducted by our Quality Control Department have shown that the material retains its iodination efficiency on storage; when stored at ambient temperature over 2 months the iodination efficiency as measured by the % incorporation into ACTH remained above 85%.

Neutralization of the alkaline solution occurs during storage and especially on opening due to the absorption of carbon dioxide from the atmosphere. The pH will normally fall to about 7.5 where it will remain for at least 6 weeks. Iodine-12 remains as iodide whilst the pH is above 7.0.

*For further information see:

"Self-Decomposition of Radiochemicals", Evans, E.A., The Radiochemical Centre Review No. 16, 1976.

"The Self-Decomposition of Radioactively Labelled Compounds", Sheppard, C., *Atomic Energy Review*, 10(1), 1972.

11. Facilities and Equipment.

I. Nuclear Medicine Service.

a. General facilities. This is a 922 bed general medical and surgical center. It is constructed of reinforced cement block and brick. The central tower which is fourteen stories tall is flanked by three-story service structures. Nuclear Medicine Service is located in the north service structure on the first floor (middle of three stories).

b. Specific facilities. The service is physically located between the Nursing Home Care Unit and the CT/Ultrasound Suite; open courtyard space is on two sides and corridors are on the ends. There are 14 rooms totalling approximately 2700 NSF. The entire area is designated restricted with the exception of the clerical office.

(1) Refer to Attachment 11A for diagrams of the department.

(2) Equipment. In the Hot Lab, there are two shielded areas for storage, measurement, and preparation of radioactive materials in use. There are also two shielded containers for storage of contaminated waste. There is an area in this lab designated for receipt of radioactive parcels. An area monitor (log series exposure meter on alarming charging base) is in continuous operation in this area. The shielding is of commercial lead materials and is movable. There is also a preparation enclosure with exhaust hood.

II. Radiation Research Service.

The Research Service is located on the ground floor. The walls are constructed of 6 to 8 inch concrete. A four and one-half inch reinforced slab is overhead. All floor surfaces are asphalt tile. The Research Service has approximately 19,500 sq. ft. of space available and 3,500 sq. ft. of animal quarters. Room BWG-18 is the area designated for animals that have received Radioactive tracer compounds. It is equipped with a large disposal.

Steel, plastic-lined receptacles are used for small animal carcasses. These carcasses are stored at -17°C in BECEG-46. Steel, plastic-lined receptacles are also used for paper and small glass item wastes. A lead brick wall is constructed in a VL-1 hood for shielding when needed.

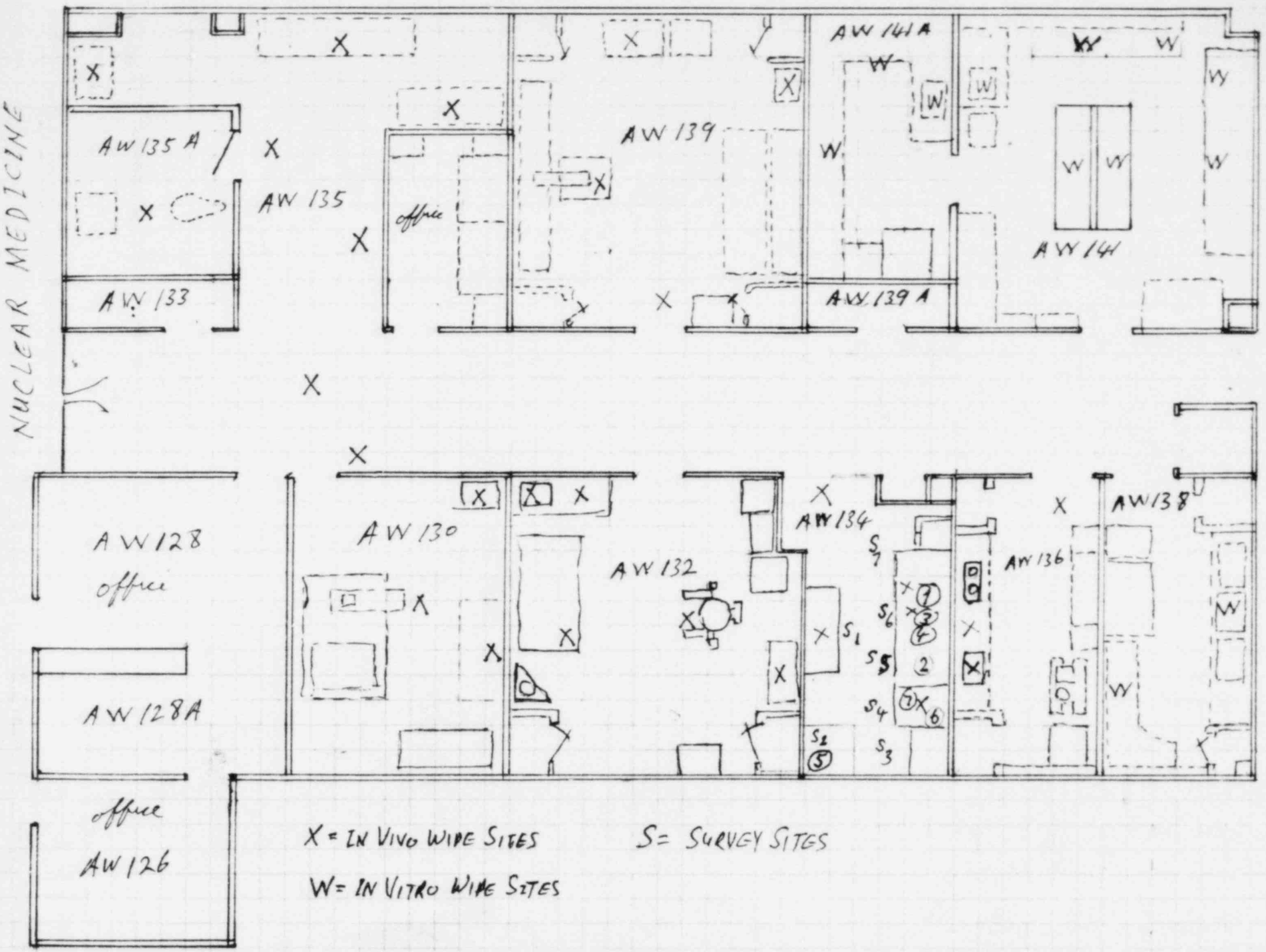
Fume Hoods

Room Number	Hood Type	Location	Fan CFM	Present CFM/sq. ft.
BECEG-11	VL-1	Northwest	560	63
	VL-1	South	560	63
BECEG-12	VL-1	North	560	63
	VL-1	Southwest	560	63

11. Facilities and Equipment (continued)

Fume Hoods (continued)

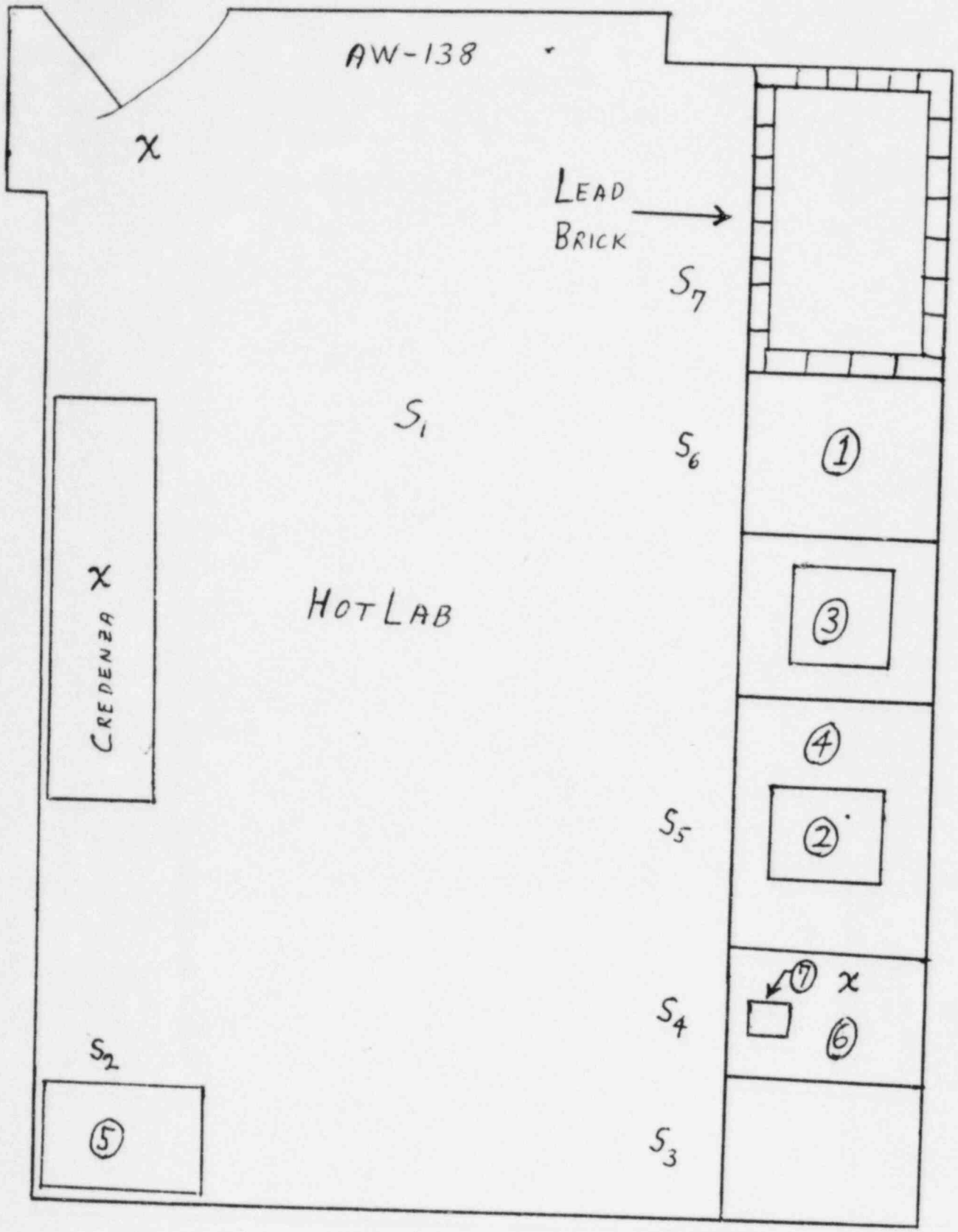
Room Number	Hood Type	Location	Fan CFM	Present CFM/sq. ft.
BECEG-13	VL-1	North	560	63
	VL-1	Southwest	560	63
BECEG-16	VR-3	Northwest	480	38
BECEG-17	VR-3	East	480	38
	VL-3	West	480	63
BECEG-18	VR-3	South	480	38



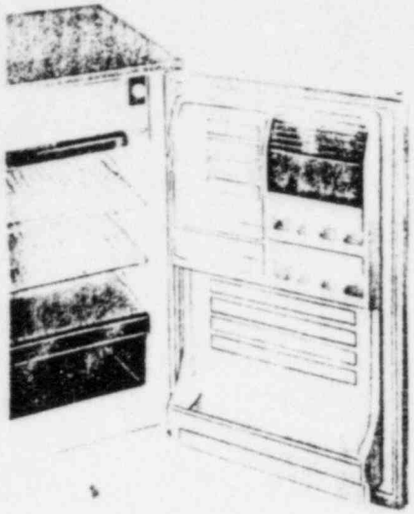
ATTACHMENT 11A

11A-1

ATTACHMENT 11B

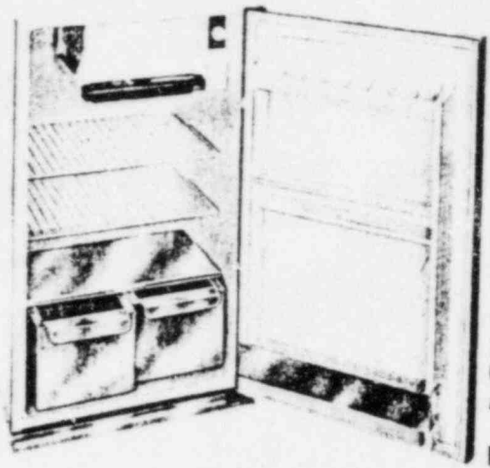


Materials comprising equipment above and the respective dimensions are described in Attachment 11C.



Model LLR-101

LLR-101A



LEAD LINED REFRIGERATOR

Model LLR-101, LLR-101A

The Lead Lined Refrigerator, Model LLR-101, is ideal for hospital and laboratory use. It is five cubic feet and may be used to store and refrigerate radiopharmaceutics, tagged biological and other radioactive materials. Completely lead shielded, this refrigerator eliminates thermal lag by placement of cooling units inside the lead shielding. When used as part of a Modular System, enough space is provided between modules so that it can be slid into position.

The exterior dimensions are 20" wide x 23" deep x 34" high. Shielding on all sides with 1/8" thick sheet lead encased in steel. Finished in a durable baked paint, the refrigerator is keylocked for controlled access.

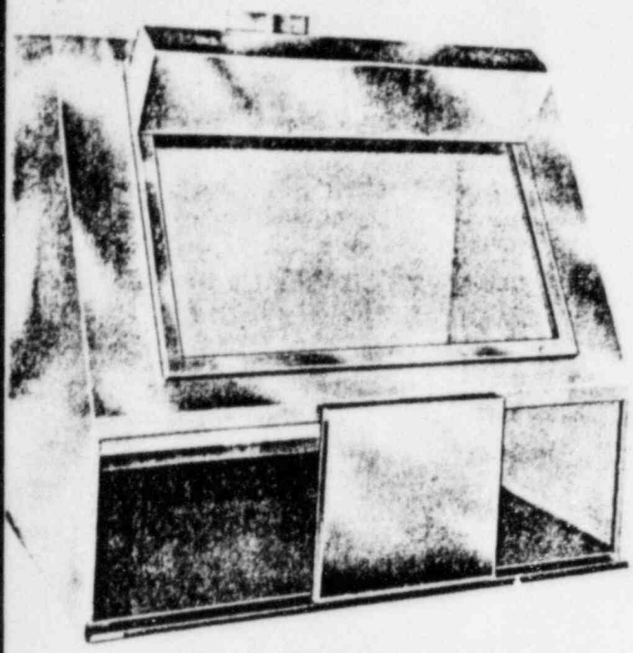
When additional shielding is required model LLR-101A is available. This unit adds to the standard LLR-101 two stainless steel lead lined drawers (¼" lead) in place of the standard plastic crisper drawer shown in the bottom of the refrigerator. Each drawer is 7½" wide x 6 1/8" deep x 6½" long.

Approximate Weight: LLR-101...250 lbs.. LLR-101A...300 lbs.

Model LLR-101 (115 V. 60 Hz. AC) **$1,125.00**
Model LLR-101A (115 V. 60 Hz. AC) **1,950.00**

11A-3

ITEM 1.

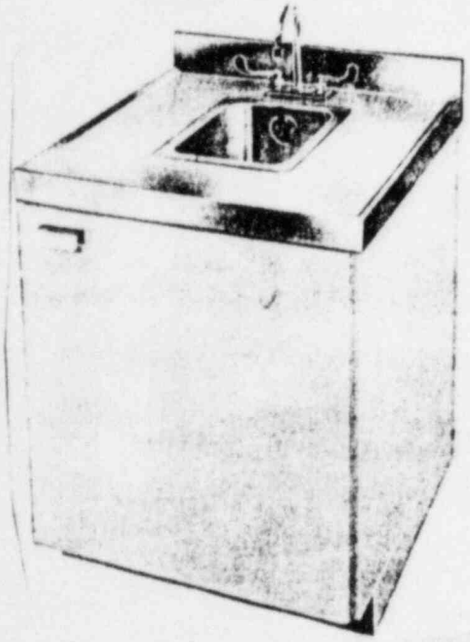


PREPARATION ENCLOSURE
Model PE-101

This module is designed to rest on the counter top of any of our modules. The fume hood enclosure is totally shielded with ¼" thick lead encased in a stainless steel jacket. There is a sliding shield (½" thick lead) on the front opening for personal radiation protection. For complete and unobstructed viewing we have provided a leaded glass panel that runs the full width. The interior is large enough to accommodate all necessary equipment and working space. A rear baffle, with a fixed open upper exhaust slot and an adjustable lower exhaust slot is provided for exhausting gaseous radiopharmaceuticals. A fluorescent light is provided at the top of the viewing panel. Overall dimensions are 36" long x 26½" deep x 33½" high. Approximate Weight: 750 lbs.

Model PE-101 ..... **$5,250.00**

ITEM 2.

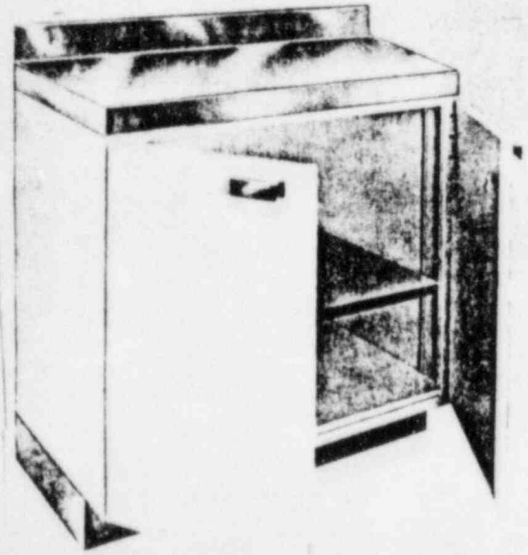


SINK MODULE
Model SI-202

This module is 28½" wide x 30" deep x 36½" high and is provided with a stainless steel sink 10" wide x 14" long x 10" deep. The sink is complete with a goose-neck faucet, hot and cold water mixing valve, anti-splash nozzle, strainer, drain and overflow system.
This module has no lead shielding and the door is not lockable.
Approximate Weight: 215 lbs.

Model SI-202 ..... $895.00

ITEM 3.

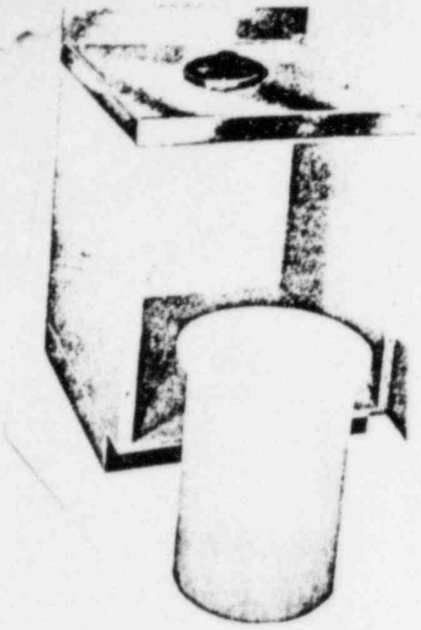


ENCLOSURE BASE MODULE
Model EB-406

This module is the supporting base for the PE-101 Preparation Enclosure. The module is 36½" wide x 30" deep x 36½" high. It provides a double door, full height lead shielded module with an adjustable shelf for storing decaying material. The shelf is 34" wide x 27" deep and can support 100 lbs. Lead shielding ½" thick is placed on all six sides. Doors are key locked.
Approximate Weight: 1700 lbs.

Model EB-406 ..... **$3,360.00**

ITEM 4.



DECAY MODULE
Model DC-203

This module is 28½" wide x 30" deep x 36½" high and has two adjustable shelves for storing decaying material. The shelves are 26" wide x 18" deep and can support 100 lbs. Lead shielding 1/8" thick is placed on all six sides. The door is key locked.

Approximate Weight: 485 lbs.

Model DC-203 ..... **$1,225.00**

ITEM 5.

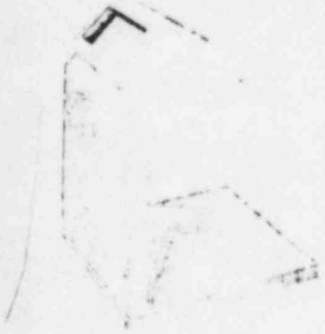
RECEIVING, HOLDING AND STORAGE MODULE
Model RH-600

This module is 30½" wide x 30" deep x 36½" high. It provides a double door, full height lead shielded module with an adjustable shelf for storing decaying material. The shelf is 28" wide and 18" deep and can support 100 lbs. Lead shielding ½" thick is placed on all six sides. Doors are key locked.

Approximate Weight: 1500 lbs.

Model RH-600 ..... **$3,015.00**

ITEM 6.



SLIDING SHIELD
Model SS-111

The Sliding Shield is used to minimize exposure to the technician while handling radiopharmaceuticals or other radioactive materials. This shield has been designed for maximum technician comfort and unimpeded visibility of the work area. Especially useful when handling isotope generators.

Model SS-111 is constructed of 1" thick lead encased in steel. The base containing four nylon rollers (2 plain and 2 grooved) permit effortless positioning to any station. The grooved rollers are placed on the front lip which serve as a track. A removable 4" x 8" leaded glass window equivalent to 1" thick lead and a stainless steel spill-proof safety tray is provided. Overall dimensions are 21 9/16" x 14" wide and the base is 14" x 16 3/8". Finished in a durable polyurethane paint.

Approximate Weight: 150 lbs.

Model SS-111 ..... **$1125.00**

ITEM 7.

12. Personnel Training Program and Frequency.

I. Nuclear Medicine Service.

a. All technical personnel are qualified Nuclear Medicine Technologists or Technicians and have received formal training in radiologic safety procedures appropriate to their respective duties.

b. Hospital Fire and Safety Committee Coordinator keeps records of where radioactive materials are stored and who is trained in survey procedures.

c. Housekeeping employees receive training in proper cleaning techniques, what receptacles to avoid, where radioactive materials are kept, etc.

d. A Radiation Safety Manual is maintained which is reviewed by all technical personnel upon their employment and thereafter upon institution of policy change or at least annually. This manual contains:

(1) Memorandum to all Nuclear Medicine personnel describing regulations in 10 CFR Part 19 and Part 20 stating where these documents are located for examination, and calling attention to Form NRC-3 "Notice to Employees" which is posted in the Hot Lab.

(2) Procedure for receiving and opening packages of radioactive materials.

(3) Laboratory rules for the use of radioactive materials.

(4) Emergency Procedures - Spills.

(5) Survey Procedures.

(6) Disposal Procedures.

(7) Therapy Procedures.

(8) Copy of License.

(9) Copy of Hospital Radiation Safety Program.

(10) A copy of NCRP No. 48: Radiation Protection for Medical and Allied Health Personnel.

(11) A section for filing written reports of accidents involving Radioactive materials.

ITEM: 12-1
DATE: 9-23-83

II. Radiation Research Service.

All personnel are required to become familiar with the Safety Regulations and ordering information as listed in Hospital Memorandum 115-1 (enclosed with this application). All personnel are asked to view and study the following audio-visual technical programs:

1. Principles of Gamma Counting; and

2. Aspects of Liquid Scintillation Counting.

At least once a year a one-half hour seminar is held with all personnel using radioactive materials to review procedures for ordering, monitoring, safety, and disposal of by-product materials. A record of this seminar attendance will be maintained on file.

ITEM: 12-2
DATE: 9-23-83

16269

13. A. Procedure for Ordering and Receipt of Radioactive Material.

This Medical Center currentlly has a license issued by the U.S. Nuclear Regulatory Commission (USNRC) governing the procurement, use, and disposal of radioactive materials. The first portion of this license covers human applications and is under the direction and the supervision of Murray L. Fields, M.D., Chief, Nuclear Medicine Service. A second portion covers the therapeutic use of sealed source (10 CFR 36.100, Schedule A, Group VI) for brachytherapy and is under the direction of Camilio U. Paig, M.D., Chief, Radiation Oncology and H. M. Omar, Ph.D., Medical Physicist. The third portion of our license covers research applications employing animals or In Vitro techniques (non-human uses) and is under the direction and supervision of the Radiation Safety Officer (RSO), H. M. Omar, Ph.D., the Associate Chief of Staff for Research and Development (ACOS), Edwin H. Beachey, M.D., and Ray Cox, Ph.D.

(1) In the Nuclear Medicine Service, all the orders for radioactive materials will originate in the office of the Chief, Nuclear Medicine Service, Murray L. Fields, M.D., and be authorized by him or his designee who will ensure that the requested materials and quantities are authorized by the license and that possession limits are not exceeded.

(2) Orders for the procurement of radioactive material for non-human use will be sent to Room BECEG-23 for the approval of the Radiation Safety Officer, H. M. Omar, Ph.D. This includes radioactive material ordered through the University of Tennessee for delivery to this hospital. The order will be approved only if the Investigator has been authorized by the Radiation Safety Committee to use the particular radionuclide for the purpose requested. To be considered for approval each order must (i) indicate clearly the total activity ordered, (ii) state our NRC By-product Material license number and (iii) be marked as follows: Deliver to: Dr. H. M. Omar, Room BECEG-23.

(3) Orders for sealed source (10 CFR 36.100, Schedule A, Group IV) for brachytherapy in the Radiation Therapy Division will originate in the office of the Chief, Radiotherapist, C. U. Paig, M.D., and authorized by him or his designee.

(4) The Radiation Safety Officer, Hassan M. Omar, Ph.D., will ensure that requested materials and quantities are authorized by the license and that possession limits are not exceeded.

B. Procedures for Receipt of Materials During Off-Duty Hours.

(1) Security personnel will escort the carrier of the radioactive material to Room AW-141.

(2) The package will be placed on the work bench unless the package has been damaged. In the latter case, the package will be placed in the radioactive material safe in Room AW-134. If the package requires refrigeration, it shall be placed in the refrigerator in Room AW-141. A note should be left on the refrigerator indicating that a package has been placed inside during off-duty hours.

ITEM: 13-1
DATE: 9-23-83

13. B. (continued)

(3) Security personnel will lock the room and the package will remain there until the next regular-duty hour. At this time, the package will be processed in our usual manner.

14. Procedures for safely opening packages containing radioactive material.

I. Nuclear Medicine Service.

A. Policy: Receipt of Radioactive Materials.

Read 20.205 of Title 10 CFR and Appendix C "Guide for Specific Procedures" (copy found in Radiation Safety Manual). Note: Everything currently received in the Nuclear Medicine Service at this VAMC is exempted from the requirements of 20.205 as regards monitoring of radiation levels and wipe testing of external surfaces.

Any package which is leaking or shows evidence of damage shall be given special attention. Place any leaking package in the hot sink in Room AW-134 and notify the supervisor. Survey and wipe tests will then be conducted as needed to determine the extent of any radioactive contamination.

B. Instructions for safely opening packages.

(1) Radiopharmaceuticals received from Nuclear Pharmacy, Inc.

a. Radiopharmaceuticals delivered in routine or emergency shipments during regular working hours shall be received from the NPI messenger in Room AW-134. The messenger will leave the shipping container (ammunition box) with security seal intact and remove the box with residuals of the preceding day's order for return to NPI. Emergency shipments for call-back studies performed outside regular hours will be delivered by NPI messenger to the telephone operator, Room CW-137, for subsequent technologist receipt and transport to AW-134.

b. The receiver should wear gloves while performing the following steps:

(i) Remove the security seal, open the box, remove dose record sheets and protective foam pad.

(ii) Remove each pig in turn, verify plastic overwrap is intact. Verify label information is appropriate as to material, amount, date, prescription number, and licensee and corresponds to the information on the dose record sheets.

(iii) Remove and discard plastic overwrap, retaining the prescription label and invoice.

(iv) Place each pig in its respective shielded area within the preparation enclosure.

(v) Remove the top cap, invert each pig in succession, verify no leakage.

14. I. B. (1) (continued)

c. If any of the following conditions are noted, do not proceed until NPI has been contacted for clarification:

(i) The label on the pig does not correspond to the Rx label.

(ii) There is a discrepancy between the information on the dose record sheets and either the pig or Rx label.

(iii) The pig appears damaged or the plastic overwrap is not intact.

(iv) Upon inversion of the pig, leakage or breakage is evident.

(2) All other packages.

a. All radioactive packages obtained from out-of-city vendors shall be delivered unopened to BECEG-22. The secretary in that office will notify us of its arrival, so we can pick it up. Should the carton be damaged, it should be placed in a plastic bag and transported to AW-134 for survey and wipe testing.

b. At present, all such packages received contain RIA materials including license-exempt quantities of radioactive materials; therefore, routine survey and wipe testing procedures are not indicated.

c. Be acquainted with NRC and VAMC guidelines for receipt and appropriate processing of radioactive packages in the event that procurement practices are revised.

II. Research Service.

A. General Set-Up.

1. All packages containing radioactive materials will be inspected for damage, leakage, or contamination by monitoring with a beta-gamma survey meter.

2. A log book will be maintained to show the results of such monitoring.

3. Packages will be delivered to one specific location (BECEG-23) for receipt and inspection. Treat as contaminated until proven otherwise, especially if damaged.

4. Arrange to open and inspect packages as soon after receipt as possible, but not later than three (3) hours during normal working hours, or 18 hours if received after normal work hours.

14. II. (continued)

B. Procedures for Package Inspection.

1. Place package on surface with absorbent material. Plastic or other protective gloves and lab coats should be worn for opening packages for protection of surveyor.

2. Observe package for leakage stains. Record condition.

3. Monitor the unopened package with a survey meter. If the radiaton level exceeds 200 mR per hour at the surface, or 10 mR per hour at three (3) feet, record in log book and proceed with caution. A wipe test is done to determine if the radiation is on the outside of the package. Wipe 100 cm^2 area of outer package with dry wipe, and measure amount of removable activity with count rate meter. NOTE: If radiation measurements exceed the levels in Step 3 above, DO NOT OPEN PACKAGE. Immediately notify the Radiation Safety Officer for further instructions. The Radiation Safety Officer will notify the appropriate officials of the State Health Department, the final delivery carrier, and the vendor.

4. If radiation levels of the outer container are within prescribed limits, open the outer package and remove packing slip.

5. Open inner package to verify contents (compare packing slip, purchase order, label or inner container) and integrity of final source container (inspect for breakage of seals or vials, loss of content, discoloration of packing material).

6. Another wipe test is done to determine if the inside of package is contaminated. Wipe external surface of final source container with moistened filter paper held with forceps, assay and record in log book. If internal contamination (greater then 500 dpm) is found, the shipment should be decontaminated by the Radiation Safety Officer senior technician prior to use. However, contaminated shipments should not be used in patient studies but will be disposed of as radioactive waste.

7. Monitor the packing material and empty packages for contamination before discarding. Record meter reading in log book.

a. If contaminated (any reading above background level), treat as radioactive waste.

b. If not contaminated, obliterate radiation labels before discarding to regular trash.

C. Radioisotope Receipt Log.

1. A log book will be maintained for all incoming packages of radioactive materials and the results of monitoring recorded.

2. A sample format for the log book is depicted below:

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14. II. C. (continued)

ISOTOPE RECEIPT LOG BOOK

DATE	ISOTOPE	ACTIVITY (mCi)	VENDOR	PACKAGE CONDITION	mR AT SURFACE OF 3 FEET	mR/HR EMPTY PACKAGE

15. General Rules for the Safe Use of Radioactive Materials (Nuclear Medicine).

A. Laboratory Radiation Safety Rules.

(1) Wear your film badge while on duty. Wear ring TLD while handling radioactive materials or patients. Leave badge in the department when off duty.

(2) Draw up radiopharmaceutical doses only in the shielded preparation enclosure in the hot lab. Wear gloves when drawing doses. Discard gloves after measuring doses. Monitor hands with area monitor before leaving lab.

(3) Turn on hood exhaust and close lab door if venting ^{131}I vial or if loading ^{133}Xe vial in calidose gun. If breakage of ^{133}Xe dose occurs, verify exhaust switch is on high speed and vacate the hot lab, leaving the door closed for five minutes. When transferring ^{133}Xe to the lung function unit or when performing a ventilation scan, have the exhaust fan on low speed and the imaging room door closed until patient and LFU washout are complete.

(4) Store doses pending administration in syringe shields.

(5) Use a syringe shield when injecting radiopharmaceuticals.

(6) If you prepare, measure, or administer a therapeutic ^{131}I dose, be certain to obtain a thyroid burden measurement within 48 hours.

(7) Refrain from using food, beverages, cigarettes, cosmetics, medicines, or similar items in the vicinity of unsealed radioactive sources.

(8) If you spill any radioactive material:

a. Confine the spill with absorbent paper.

b. Warn others to avoid spread.

c. Clean up and decontaminate the area.

Consult the manual or get help if you do not know what you are doing.

(9) Dispose of radioactive syringes only in the shielded Dispo hot box. Return all residual radiopharmaceuticals and empty vials to NPI for disposal. Discard any other articles contaminated with radioactivity in the shielded storage module (if other than ^{99m}Tc, tag with radionuclide and date).

B. Wipe Test - In Vivo Area (Weekly Procedure).

(1) Using location key, obtain a wipe from each site numbered A-Z (26 separate sites). Use cotton-tipped applicator saturated with alcohol (be certain not to use ^{99m}Tc-contaminated alcohol) to wipe the surfaces.

15. B. (continued)

(2) Place wipes in appropriately numbered 12x75 cm assay tubes, breaking off the sticks above the tube rims.

(3) Count the wipes in the 1185 well counter for 1 min/ea. Set Channel 1 for ^{99m}Tc as follows: Manual, Base 90 kev, Window 100 kev, C gain 8, F gain 0. Set Channel 2 for ^{131}I with pushbutton.

(4) Include for counting: an empty tube for background, the ^{137}Cs source, and a ^{99m}Tc sensitivity standard prepared as follows:

a. Withdraw "1 drop" of ^{99m}Tc-O_4 from the bulk vial and eject it into a 100 ml volumetric flask. Place the flask in the dose callibrator and record the activity and the time. Q-S the flask and mix.

b. Withdraw 0.1 ml from the flask and add it to a second 100 ml volumetric flask, Q-S and mix. This makes a 1:100,000 dilution of the original "drop." Pipet 1 ml of the final dilution into the counting tube.

c. Calculate the counter sensitivity for ^{99m}Tc by dividing the tube count by the mC activity (correcting for decay if necessary).

(5) Record all wipe and standard counts in the Survey and Disposal notebook.

16. Emergency Procedures (Research Area).

A. In case of FIRES or OTHER MAJOR EMERGENCIES involving Radioactive Materials:

(1) Notify the fire department and other hospital safety personnel.

(2) Notify the Radiation Safety Officer, Dr. H. M. Omar, Ext. 5089. If he is not available, notify Dr. Cox, Ext. 7238, or Mrs. Shirley Myrick, Ext. 5096.

(3) Confine contamination to the smallest area possible using absorbent pads. Do not clean up the area until radiation safety personnel have arrived and area monitoring has been performed. (Radiation survey meters are available in Room CWG-19).

(4) Radiation safety personnel will determine safe decontamination procedures. These procedures must be followed precisely.

(5) After clean up, monitoring shall be performed on all individuals involved and on all materials used during clean up. Personnel may not leave the area until monitored.

(6) Compile a complete report of the incident and forward it to the Radiation Safety Officer, Ext. 5089.

B. 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) NOTIFY: Notify Radiation Safety Personnel as in No. 2 in the section above.

(4) 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 disposable gloves.

(5) SURVEY: With a G.M. Survey Meter, check the area around the spill, your hands and your clothing for contamination. Survey meters are available in Room CWG-19. Use wipe tests if ^{14}C, ^{3}H, or ^{51}Cr is involved.

(6) REPORT: Compile a report of the incident and submit it to the Radiation Safety Officer.

C. 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.

16. C. (continued)

(3) SHIELD THE SOURCE: If possible, the spill should be shielded but only if it can be done without further contamination of without significantly increasing your radiation exposure. Do not risk additional exposure needlessly.

(4) CLOSE THE ROOM: Leave the room and lock the door(s) to prevent entry. DO NOT LEAVE THE ROOM UNATTENDED.

(5) CALL FOR HELP: Notify the Radiation Safety Personnel immediately, as stated above. He will determine appropriate decontamination procedures.

(6) PERSONNEL CONTAMINATION: Contaminated clothing should be removed and stored for further evaluation by Radiation Safety Personnel. If the spill is on the skin, flush thoroughly and then wash with mild soap and lukewarm water.

(7) POST CLEAN UP MONITORING: All personnel and clean up materials must be monitored before the emergency can be considered terminated.

(8) FILE A REPORT: A complete report of the incident must be filed with the Radiation Safety Officer including changes installed to prevent recurrence of similar accidents.

16. C. (8) (continued)

RADIATION ACCIDENT REPORT

_____ Person filing report

_____ Date of Accident

_____ Date of Report

1. What radioisotope was spilled? _____

2. Give a brief account of what happened. _____

_____

_____

_____

_____

_____

3. Was your person contaminated? _____

4. Was clean up accomplished satisfactorily? _____

5. Survey the area and record the exposure rate:

   _____ mr/hr Background _____ mr/hr

   Instrument _____ Person surveying _____

6. Approximate time required for cleanup _____

7. Recommendations for avoiding a similar accident in the future: _____

_____

_____

_____

_____

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17. Area Survey Procedures (Nuclear Medicine Service).

A. Daily Surveys:

Dose preparation and injection will be survey daily after dose vials are closed. These surfaces (hot bench in hot lab and injection tray in camera room) are to be covered with absorbent paper at all times. If contamination is discovered (a reading on log series survey meter that is higher than background), the paper will be changed disposing of contaminated paper in the hot basket.

B. Monthly Surveys:

Standardized sites as diagrammed in the Survey/Disposal book (see Item 11) will be surveyed routinely.

(1) Hot Lab. Each numbered station will be surveyed with the 2650 survey meter and the exposure rate recorded in the Survey and Disposal Record book (7 sites).

(2) Radioassay Lab. Each survey site will be wipe tested for ^{125}I contamination. The wipes will be assayed in the well counter and the results recorded in the Quality Control record book. Wipes assaying .001 microcuries ^{125}I or greater will signify contamination which will necessitate surface decontamination procedures (12 sites).

C. Weekly Surveys:

Each survey site will be wipe tested on ^{99m}Tc and ^{131}I contamination. Wipe will be assayed in a well counter and the results recorded in the Survey and Disposal book (24 sites).

D. Description of Wipe Test and Survey Sites:

(1) Monthly Survey (survey meters).

Hot Lab:
(a) Center room.
(b) Storage module.
(c) Syringe disposal area.
(d) Preparation enclosure.
(e) Work station (So.).
(f) Work station (No.).
(g) Flood source storage (indicated on Attachment 11A as "S", "S_2". etc.).

(2) Monthly Wipe Test ^{125}I (well counter).

Twelve sites in IN VITRO suite (indicated on Attachment 11A as "W") and instrument room.

(3) Weekly Wipe Test ^{99m}Tc and ^{131}I (well counter).

Twenty four sites in IN VIVO section (indicated on Attachment 11A as "X").

17. Area Survey Procedures (Radiation Research Service).

Routine Survey Program:

All laboratories and animal rooms where byproduct materials are used will be routinely surveyed by the wipe test and monitored with a survey meter. The surveys will be conducted at monthly intervals. These results are recorded on a standard form and maintained on file. The form includes name of person conducting survey, drawing of area, date, and measured exposure rates. Areas to be checked will include sink, working bench tops, hoods, door knobs, and floor. Any area containing .005 mCi will be considered contaminated and will be decontaminated by the user of the materials, not housekeeping personnel. After decontamination, the area will be checked again to ensure decontamination.

18. Waste Disposal (Procedures and Policies for the Disposal of Low-Level Radioactive Waste).

A. Policies.

(1) Each individual should attempt to minimize the volume of low-level radioactive waste that he or she generates. Radiation Safety Personnel can suggest ways to accomplish this goal for specific situations.

(2) No liquid wastes shall be placed in the specially labeled drums for disposal purposes.

(3) Plastic bags used to contain the radioactive waste materials should be doubled to accommodate glass and/or sharp objects prior to placement of the bags in our waste disposal drums.

B. Procedures.

(1) All radioactive waste will be placed in the approved plastic bags and housed in specially labeled waste baskets until removal to the 55-gallon drums is effected.

(2) Each bag should be labeled as to the radionuclides contained within and the approximate quantity of each radionuclide stated on the label.

(3) Separate plastic bags shall be maintained for all material contaminated with Iodine-125.

(4) The Assistant Radiation Safety Officer, Ext. 7270, should be contacted when the approved plastic bags are full and ready for permanent disposal.

(5) The Assistant Radiation Safety Officer will package each specially labeled drum according to the requirements submitted by the Atomic Disposal Company, 49 CFR, Parts 170-179, and 10 CFR, Part 150.

(6) The contents (radionuclide and quantity) of each drum will be entered into the log of Radioactive Waste and maintained in Room BECEG-32.

(7) The log of shipments of Low-Level Radioactive Waste transported by the Atomic Disposal Company and the contents of each drum will be maintained in Room BECEG-41.

(8) The collection of the plastic bags, the packaging of each drum, the log of shipments and the log of the contents of each drum will be subject to the direct supervision of review by the Radiation Safety Officer.

(9) Procedures for burning of low-level radioactive waste are maintained in Room CWG-19 and BECEG-41.

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18. Waste Disposal Procedures (continued)

C. Nuclear Medicine Service.

(1) Syringes.

a. Place contaminated syringes only in red-striped shielded box on hot bench.

b. When box is full, tape dated card over hole and place inside waste decay module.

c. Old boxes will be surveyed at intervals and those which have decayed to background level* will be taken to SPD for disposal.

d. Survey instrument-side window probe with shield open, choose a place where room background is low for surveying disposables. Record date, number of boxes and survey readings in Survey/Disposal log book.

(2) Solid Waste.

a. Place all solid contaminated waste in the shielded dump well lined with a plastic bag. Sort and confine to separate small bags items contaminated by different radionuclides. Label bags with date and radionuclide before storage in decay module. (Monitoring small bags in dose calibrator prior to storage will eliminate unnecessary storage of uncontaminated items).

b. At intervals, stored bags decayed through 10 half lives will be surveyed and those reading background level* will be disposed of in common trash.

c. Record disposal date, number of bags, and readings.

(3) Radiopharmaceuticals.

a. From radiopharmacy--unused material and containers are returned for disposal to radiopharmacy the next work day. Coordinating technologist is responsible for packing dose pigs securely in the transport box.

b. Others--unused portions of in-house dose preps (^{99m}Tc) should be stored behind prep enclosure for 3 days at which time they may be discarded in common trash (remove radioactive labels).

(4) Liquid Waste.

Radioactive RIA eluates wash water, urine, blood, and dilution standards will be disposed of in the hot lab sink, RIA lab sinks or toilet, flushed well with water.

*Background level is operationally defined here at the reading on the survey meter observed in an area where no radioactive sources are located (typically .03 - .1 MR/Hr). A reading twice this level (or above) indicates contamination sufficient to prevent disposal as common trash (continue decay storage).

18. Waste Disposal Procedures (continued)

D. Disposal of our Research Waste via Incineration.

The waste is composed of disposable pipettes, disposable syringes, animal carcasses and related material. Fifty-five gallon drums will accomodate the waste prior to incineration. Each drum will contain the following approximate, initial activity levels: ^{14}C-300 µCi, ^{3}H-500 µCi, ^{125}I-0 to 100 µCi, but averaging about 20 µCi. Calculations describing the contribution to the environment expected as a result of this additional release follow the next section.

E. Proposed method for waste disposal by incineration:

(1) All work will be supervised by the Radiation Safety Officer or the Assistant Radiation Safety Officer. Any work not directly supervised by the Radiation Safety Officer will be reviewed by the Radiation Safety Office.

(2) Employees will wear gloves during this procedure.

(3) All ashes will be removed from the incinerator prior to execution of this procedure. A small amount of this ash (15-20 g) will be retained for later use.

(4) Fifty-five gallon drums containing Research waste will be loaded into the incinerator hopper, one drum per hopper (each hopper will hold approximately three drums).

(5) At the conclusion of the incineration of the waste materials, all ashes will be removed and placed into one of the drums. (Only ashes from Research waste will be in this drum since all other ashes were removed prior to incineration of the Research waste).

(6) Small samples (m = 1-2 g) will be removed from six locations in the ash waste for analysis.

(7) Three samples of the six just extracted will be counted in our liquid scintillation counter for ^{14}C and ^{3}H and three samples will be counted in our gamma well counter for ^{125}I.

(8) Counting will be performed as follows:

a. Two samples of the ash removed before incineration of the Research waste, i.e., blank ash, will be placed in two scintillation vials, one sample in each vial.

b. A small portion (several lambda) of the calibrated liquid standards described on Attachment B and C will be placed in each of the vials containing blank ash.

c. A third sample of the blank ash (m = 1-2 g) will be placed in one of the vials used in our Searle Automatic Gamma System and a small portion of the liquid standard described on Attachment E added.

18. Waste Disposal Procedures (continued)

d. One additional vial for each counter will be prepared to serve as a background.

e. Counts will be performed in the following order: standard, background, samples. In this manner, counts obtained in the various samples vials can be converted to activity by comparison with the number of counts received in the "standard" vials. These latter vials contain a known activity.

(9) The activity obtained in each sample will be compared to the following values, obtained from 10 CFR 20, App. B, Col. 2: 8×10^{-4} μCi/g - ^{14}C, 2×10^{-7} μCi/g - ^{125}I, 3×10^{-3} - ^{3}H (assuming 1 g/ml). Additionally these are the corresponding exempt concentration (10 CFR 30.70) - ^{14}C - 8×10^{-5} μCi/g, ^{125}I - 1×10^{-6} μCi/g, ^{3}H - 3×10^{-3} μCi/g.

(10) If all sample activities fall below these levels, the Research waste ash may be returned to the general waste ash and handled as any other ash. If one or more of the sample activities is above the $(MPC)_w$, the drum containing this ash will be resealed and stored in our usual area set aside for Research radioactive waste containers. If the nuclide yielding the excessive activity level is ^{125}I, the possibility of utilizing the 60d halflife of ^{125}I will be explored, i.e. allowing the sealed drum to remain on site until the activity level falls within acceptable limits. Under no circumstances, however, will ash be released without counting representative samples according to the methods previously outlined. If the activity level will not fall below acceptable limits within a reasonable time span, the drum will be shipped for burial, according to our usual procedure, by a commercial firm.

As a side note, the initial activity of ^{125}I found in each drum would be expected to be diminished somewhat by the time incineration is required (halflife ^{125}I = 59.7 days). Currently our waste containers accumulate waste over a period of several months before shipment to the burial site occurs.

F. Calculations.

(1) Air concentration.

Data: Nearest inlet 35 ft - ground distance due South
42 ft - air distance
8300 ft^3/min - flow rate into building
2 ft x 8 ft - inlet size.

Incinerator: Manufactured by Environmental Control Products,
Model 500-T
S.N. 0573-27
Stack height - 37 ft
Second Incinerator -
Consumate - Model C-120-P
S.N. 2507
Stack height - 22 ft
Burnup time - 2 min.

18. Waste Disposal Procedures (continued)

F. (1) (continued)

Volume: The volume of air expected to yield the highest concentration would be a triangular volume centered on the incinerator outlet and having a base composed of the nearest inlet. Volume = ($\frac{1}{2}$ x 8) (42) (2) = 336 ft^3.

Activity: ^{125}I - 100 µCi (initial)
$MPC_a = 8 \times 10^{-11}$ µCi/cc (10 CFR 20)
^{14}C - 500 µCi; $MPC_a = 1 \times 10^{-7}$ µCi/cc
^{3}H - 500 µCi; $MPC_a = 2 \times 10^{-7}$ µCi/cc.

Meterology: The Memphis area is moderately hot in the summer and moderately cool in the winter. Additionally, there is a mild continental effect. Average rainfall is 50.63 inches/year and prevailing winds operate south to north and north to south at 10-12 mph.

For ^{125}I - Activity in volume under above draft conditions, burnup and release rate (volume = 336 ft^3) = 4.05 µCi. According to 10 CFR, Part 20.106(a), concentrations will be averaged over one year. Then, if 30 drums are incinerated per year:

Concentration: $^{125}I = 4.8 \times 10^{-11}$ µCi/cc

Again, ^{125}I activities will range 0 - 100 µCi and average about 20 µCi per drum.

Similarly, $^{14}C = 2.4 \times 10^{-10}$ µCi/cc
$^{3}H = 2.4 \times 10^{-10}$ µCi/cc.

Sample for: ^{125}I (4.05 µCi/[(336)ft^3(12x2.54)$^3Cm^3/ft^3$)x2/60]
30/(365.25x24) = 4.8×10^{-11} µCi/cc.

Repeating for Consumate,

$^{125}I = 5.7 \times 10^{-11}$ µCi/cc
$^{14}C = 2.8 \times 10^{-10}$ µCi/cc
$^{3}H = 2.8 \times 10^{-10}$ µCi/cc.

(2) Ash concentration.

Assume all activity in the ash can be leached out into the general water supply.

Poundate incinerated for year:

$$2 \frac{\text{barrels}}{\text{hopper}} \times 40 \frac{\text{lb}}{\text{barrel}} \times 3 \frac{\text{hoppers}}{\text{hr}} \times 8 \frac{\text{hr}}{\text{d}} \times 5 \frac{\text{d}}{\text{wk}} \times 52 \frac{\text{wk}}{\text{yr}} = 5 \times 10^5 \frac{\text{lb}}{\text{yr}}$$

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18. Waste Disposal Procedures (continued)

F. (2) (continued)

If we assume no radioactive decay occurs between the time the waste is first placed in the waste container and when finally tested for radionuclide content (in reality 2-6 months will elapse), then for the average initial nuclide content:

$$\text{For } ^{125}\text{I} \quad \frac{20\mu\text{Ci}}{40\text{ lb} \times 454\text{ g/lb}} \times 30 \frac{\text{drums}}{\text{yr}} \times 40 \frac{\text{lb}}{\text{drum}} \times \frac{\text{yr}}{5\times10^{5}\text{ lb}} = 2.6 \times 10^{-6}$$

$$^{14}\text{C} \quad 4.0 \times 10^{-5} \frac{\mu\text{Ci}}{\text{g}}$$

$$^{3}\text{H} \quad 6.6 \times 10^{-5} \frac{\mu\text{Ci}}{\text{g}}$$

The above calculation for ^{125}I assumed no decay and also utilized the average initial activity. In reality decay will occur and initial activities will range 0-100 μCi. The results of the ash sample analysis in Step 8 in the incineration procedure will yield information determining the ^{125}I activity and dictate the course of action to follow (as described in Steps 9 and 10 above).

19. Therapeutic Use of Radiopharmaceuticals.

A. Radioiodine Therapy for Hyperthyroidism.

(1) Hospitalization is not required but candidates are generally in-patients.

(2) Patients are instructed to urinate only in the toilet for 24 hours after therapy and if nausea occurs within three hours after therapy, to vomit in sink or toilet if possible and to notify us if vomiting occurs.

(3) Technologists shall measure and prepare therapy doses only under the fume hood, wearing disposable gloves.

(4) The dose is assayed in a dose calibrator immediately prior to oral administration.

(5) The technologist who prepares and administers the therapy dose shall have a neck assay performed on the thyroid uptake equipment within 24 hours. (100 counts above background represents a thyroid burden of 0.05 microcuries ^{131}I). Should thyroid burden be detected, immediate review of protocol will follow.

(6) Patients receiving radioiodine therapy must sign an authorization form (copy attached).

B. Radioiodine thyroid ablation for carcinoma.

(1) Only one patient has been so treated in the past ten years.

(2) Should we treat any patients in the future, the procedures described in Appendix K will be followed.

C. Radiophosphorus for treatment of leukemia or polycythemia.

(1) Doses are assayed in a dose calibrator prior to oral administration.

(2) No special precautions are used.

CONSENT FOR RADIOACTIVE IODINE THERAPY

Mr.
Ms._____ _____willingly gives consent for the treatment of his/her hyperthyroidism with Radioactive Iodine ($Na^{131}I$). The following modalities of treatment were explained to him/her: 1. Antithyroid pills 2. Surgery 3. Radioactive Iodine.

The following possible complications following radioactive treatment were also discussed with him/her: 1. Thyroiditis 2. Sialadenitis 3. Hypothyroidism 4. Suboptimal response to treatment and underdosage of Radioactive Iodine requiring further treatment 5. Development of ophthalmopathy 6. Unclear and ill-defined relationship of cancer and Radioactive Iodine treatment.

Witness	Signature of Patient
1.....	.....
2.....	Date.....

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DATE: 9-23-83

20. Therapeutic Use of Sealed Sources.

A. Interstitial and Intracavitary - Temporary Implant.

General Operating Room Procedure Required to implant "dummy" Sources:

(1) Anesthesia shall be administered by normal Medical Center policy.

(2) The attending Surgeon shall prepare the appropriate anatomic region for the Radiation Therapist.

(3) The Radiation Therapist shall insert the appropriate after-loading devices and confirm the location by x-ray.

(4) The patient shall be returned to his private room after appropriate Recovery Room procedures.

(5) The Radiation Therapist, Radiation Safety Officer (RSO) shall procure the proper sources to the patient's room using the radiation transport cart.

(6) The Radiation Therapist or RSO shall insert the sources.

(7) The RSO shall determine dose rates near the patient and determine time allotments for nurses and visitors.

(8) The RSO shall account for all sources at the termination of treatment of the patient and survey the room, retained linens and bathroom materials before the room is used by another patient.

B. Interstitial - Permanent Implant.

General Operating Room Procedures Required:

(1) The Radiation Therapist, Radiation Safety Officer (RSO) shall procure the proper number of sources to the operating room and maintain the sources until they are required for implantation. Transportation and storage of the sources in the operating room will be performed using the radiation transport cart.

(2) Anesthesia shall be administered by normal Medical Center policy.

(3) Attending Surgeon shall prepare the appropriate anatomic region for implantation.

(4) The Radiation Therapist shall perform implantation.

(5) Source distribution will be confirmed by x-rays.

(6) The operating room equipment shall be surveyed by the RSO before transporting the patient to locate any lost source.

20. Therapeutic Use of Sealed Sources (continued)

(7) Visitation and nursing rules regarding the radiation hazard shall be determined by the RSO. All rules are subject to review and modification by the Radiation Therapist regarding special medical requirements of the patient.

C. Special Precautions Concerning Source Handling.

General:

(1) Sources shall be handled only by the Radiation Therapist and Radiation Safety Officer.

(2) All nursing and operating room personnel shall wear film badges.

(3) All those who must handle sources shall wear wrist or finger dosimeters.

D. Source Accountability.

(1) A sign - Sign our Procedure (see next page). A hard back book with non-removable pages will be used.

(2) Quarterly inventory schedule.

(3) Sources accounted for at termination of treatment by count and by a radiation survey of the area.

SOURCE USE TABLE

Radionuclides	Form	Number Seeds or Wires Removed	Time/Initial	Number Seeds or Wires Returned	Time Returned/Initial

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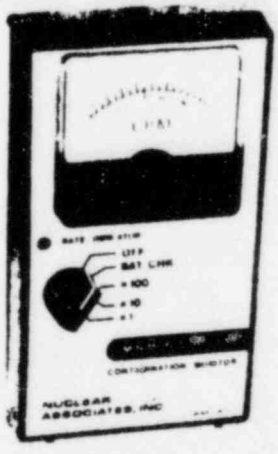
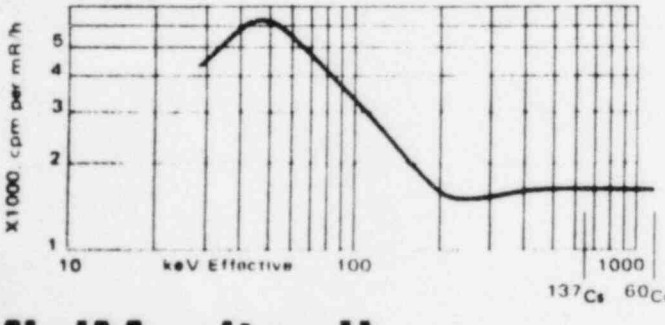
ATTACHMENT A

MiniMonitor 125 Contamination Monitor





- **High Sensitivity (Lower Detection Limit — 0.002 μ**
- **Three Ranges (0-500, 5K and 50K cpm).**
- **Large-Area, Screened Detector Permits Contact Surface Measurements.**

For the first time, a compact, **sensitive monitor is ava** for the detection of ^{125}I surface contamination levels low as 0.002 μCi.

Detector: Halogen-quenched GM pancake tube, 1.2"

Readout: 2½" analog meter, marked 0 to 500

Ranges: 0-500, 0-5,000, 0-50,000 cpm.

Accuracy: ± 10% of full scale

Controls: Off, Battery Test, x100, x10, x1 ranges — all on one s

Time Constants: 10 secs (x1), 2 secs (x10), 0.3 secs (x100)

Battery Complement: Four "AA" alkaline cells (500-hour

Operating Temperature: -20°C to +55°C (-4°F to +13

Temperature Dependence: ± 15% over noted temperature r

Construction: All solid state electronics. High impact plastic

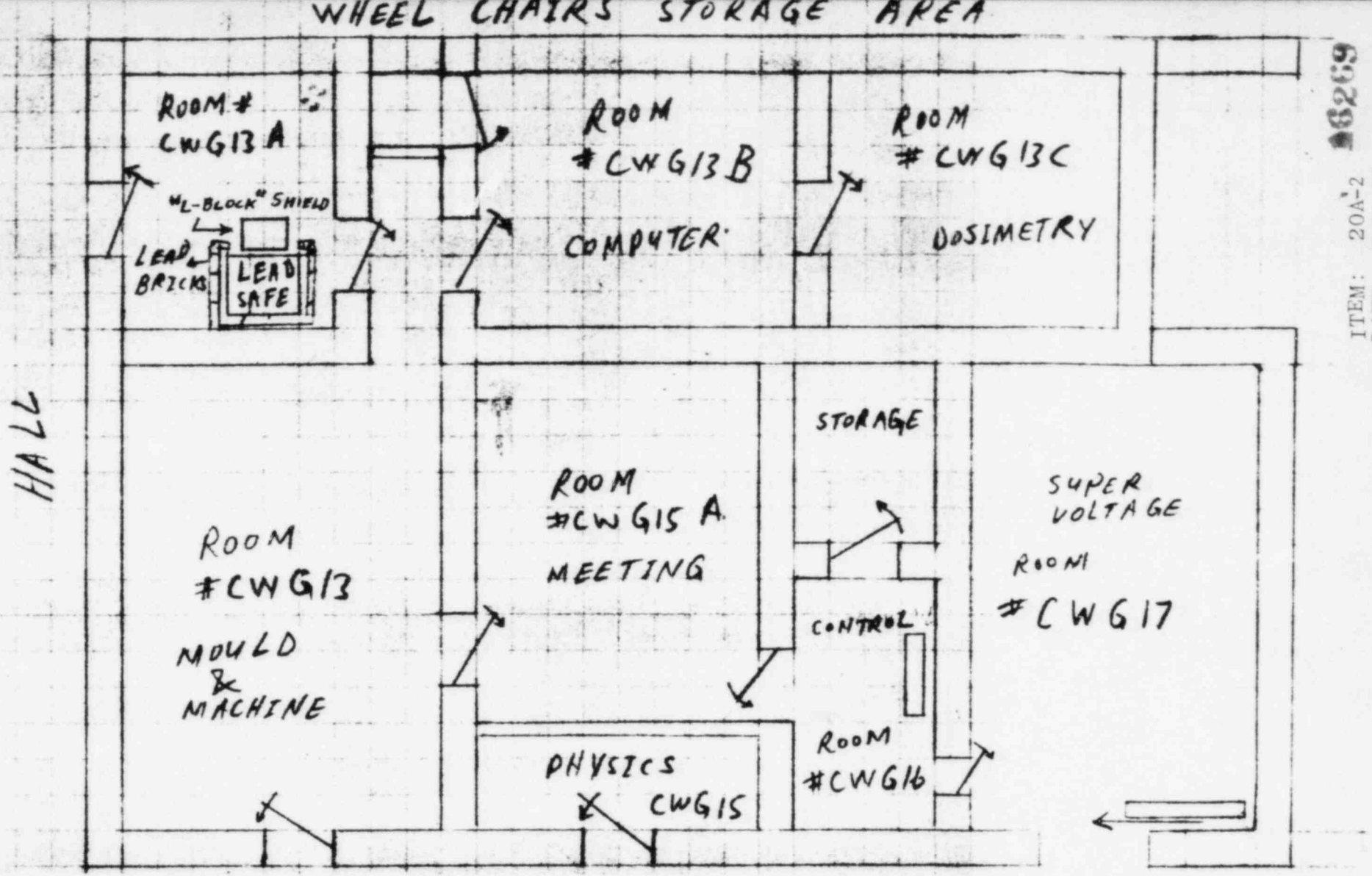
Accessories Supplied: Plastic contamination shield. Lic free check source.

Size: 6" high x 3½" wide x 2" thick. **Weight**: 22 ounces

05-572 MiniMonitor 125 Contamination Monitor

MiniMonitor II

ITEM: 20 A-1
DATE: 9-23-83



ATTACHMENT B

ITEM: 20A-2 #8269
DATE: 9-23-83

Shielding: Lead safe - 4" lead
Lead bricks - 2" lead
L-block lead shield - 2" lead

Assume "worst case" - 600 mCi ^{60}Co
Exposure rate constant = 1.307 Rm^2/hrCi (NCRP-41)
Lead shielding = 4 + 2 = 6" = 15.24 cm
HVL = 12 mm (NCRP-49)

Exposure rate at 1 m from source = 1.307 Rm^2/hr Ci x 0.6 Ci x $1/m^2$ exp (-ln2/1.2 x 15.24cm) = 0.12 mR/hr

Therefore, exposure rate at the nearest unrestricted area (hall) = 0.05 mR/hr, not including the shielding provided by the wall in the hall and the occupational factor which will be less than 1.0 for a hall.

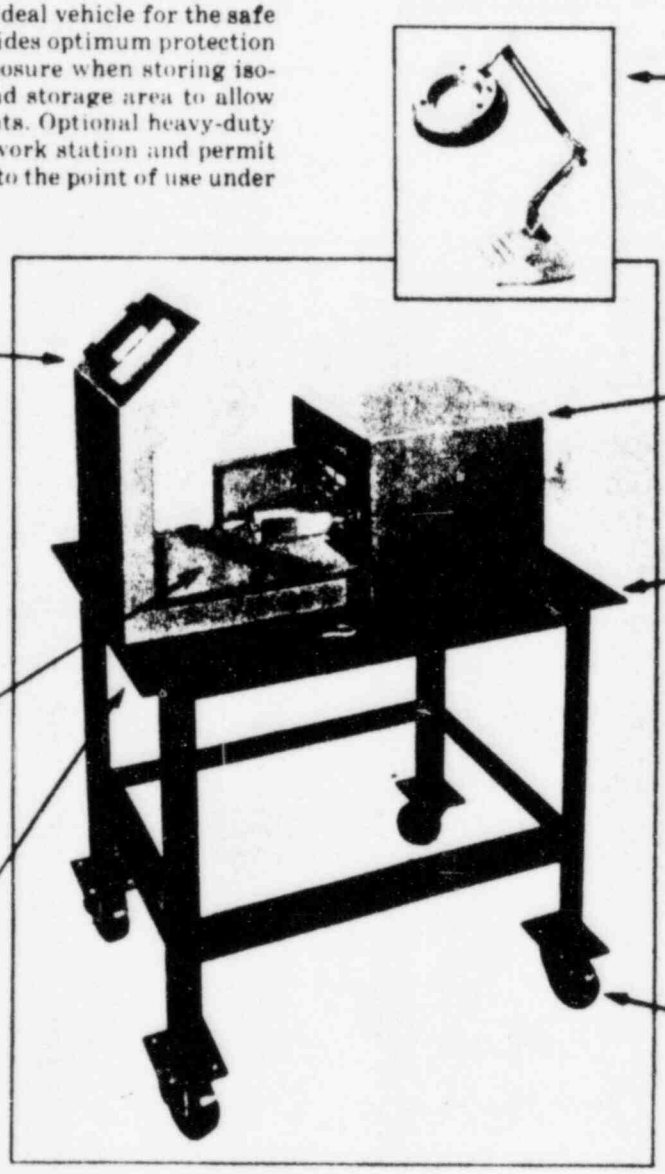
Equipment in Room CWG-13A is described in Attachment C.

ATTACHMENT C

Radioisotope Shielded Work Station

- **Provides optimum work conditions when using radioisotopes.**
- **Designed for maximum protection and versatility.**

This sturdy work station is the ideal vehicle for the safe storage of radioisotopes. It provides optimum protection to personnel from radiation exposure when storing isotopes and has sufficient work and storage area to allow flexibility when using its contents. Optional heavy-duty 5" casters lend mobility to the work station and permit transportation of radioisotopes to the point of use under hazard-free conditions.



Magnifying-Viewing Lamp. Aluminum construction with a weighted base and circular, shadow-free fluorescent illumination. Has 2X magnification. Swing arm permits maximum maneuverability. 110V, AC.

L-Block Lead Shield. Solid lead shield, 5 cm thick (2"), protects head and torso from radiation. Tilted lead-glass window, 5 cm thick x 10 cm high x 20 cm wide (2" x 4" x 8") has a density of 6.2 gm/cm³ and allows a safe, unobstructed view of the work area. Overall size 56 cm high x 35 cm wide x 42 cm long (22" x 14" x 16½"). Weighs 180 Kg (410 lbs.). An optional stainless steel work tray is available (see below).

Shielded Storage Safe. Choice of sizes (6-drawer unit is shown). Additional details are on next page.

Steel Table. Table provides a solid support surface for components of work station. Smooth bevel-edged worktop offers adequate area for tool and instrument placement. Table support frame is solid steel with welded corner joints for maximum strength. Has 10 cm x 10 cm (4" x 4") floor supports. Overall size 71 cm x 91 cm x 86 cm high (28" x 36" x 33¾"). Weighs 54 Kg (120 lbs.).

Stainless Steel Tray For L-Block Lead Shield. 38 cm x 33 cm x 2 cm high (15" x 13" x ¾").

Storage Drawer Fits under work-top. 50 cm x 61 cm x 18 cm (19¼" x 24" x 7").

Swivel Casters Heavy-duty, 13 cm (5") casters assure easy mobility for work station.

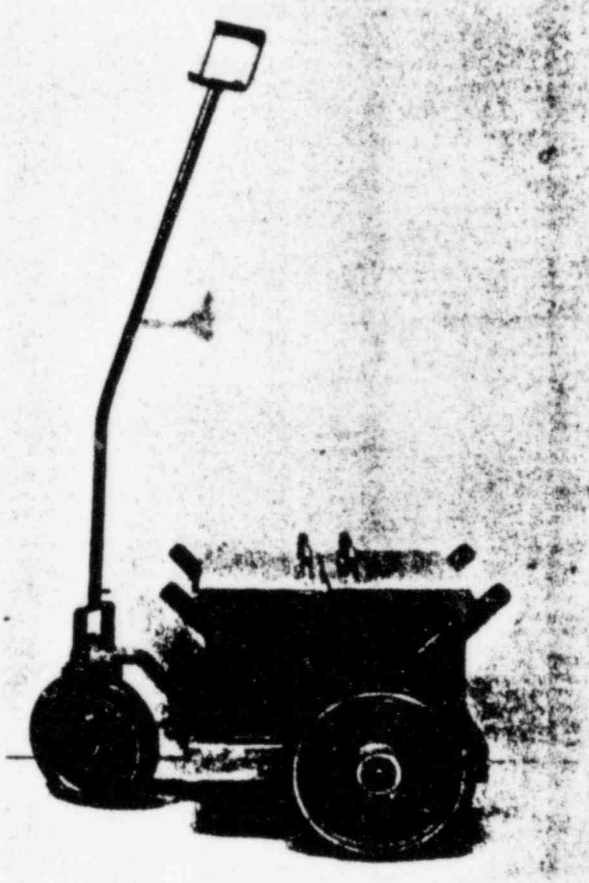
As a guide to determine maximum isotope content for a desired surface radiation level, the following Tenth Value Layers (in lead) are provided:*
Radium 5.5cm, Cesium-137 2.2cm, Cobalt-60 4.1cm, Iridium-192 2.0cm, and Gold-198 1.1 cm.

*National Council on Radiation Protection and Measurements, Report No. 40, "Protection Against Radiation from Brachytherapy Sources."

67-752	L-Block Lead Shield (22" x 14" x 16½")	$1875.00
67-751	L-Block Lead Shield (16½" x 14" x 14")	1125.00
67-761	Stainless Steel Tray (for 67-752 only)	50.00
67-749	Steel Table with Drawer	500.00
67-750	Steel Table on Casters with Drawer	750.00
67-753	Magnifying-Viewing Lamp	150.00
	Shielded Storage Safes	See next page

ITEM: 20A-3
DATE: 9-23-83

RADIATION TRANSPORT CART WITH 1/2" LEAD
MODEL 950



SPECIFICATIONS

Radiation Container:

- 1/8" Welded Stainless Steel Exterior Container
- 1½" thick Zinc Plated Overlapping Steel Doors
- Heavy Duty Door Hinges
- 1/2" Lead Lined Sides and Bottom
- Easy to removed 1/16" Welded Stainless Steel Inner Container with inside dimensions of 11 7/8" x 10 1/4" x 10 7/8" high

Radiation Cart:

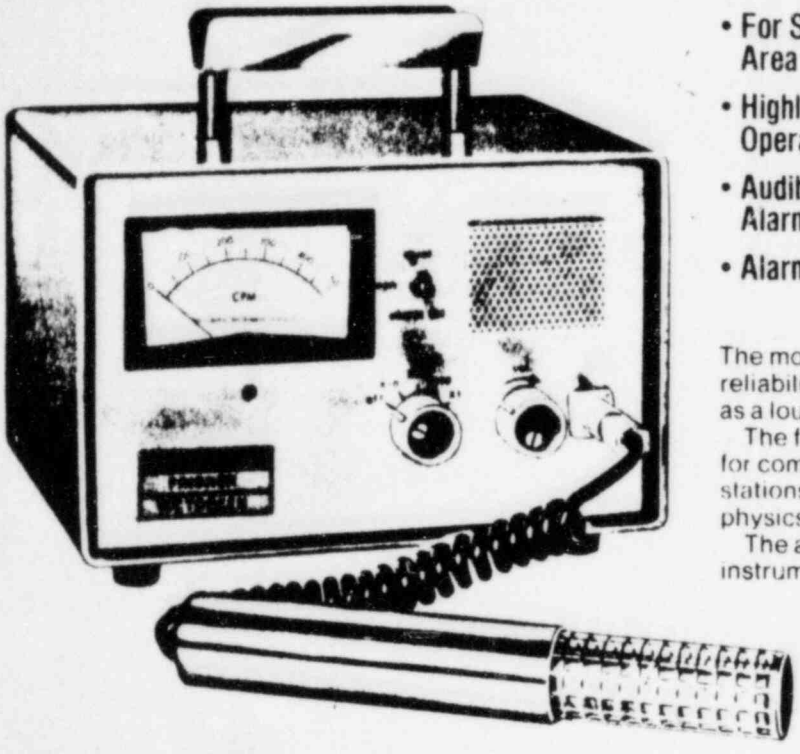
- Zinc Plated, Tubular Welded Steel Frame with 3/4" axels
- Two 10" and one 8" Polyurethane Threaded, Aluminum Core, Ball Bearing Wheels with total load rating of 3,000 lbs. for easy rolling
- 39" Removable Stainless Steel Handle
- Heavy Duty Stainless Steel Swivel Yoke

ITEM: 20 A-4
DATE: 9-23-83

495 Frisker Bench Top Monitor

05 730

ATTACHMENT E



- **For Surface Surveys as well as Constant Audible Area Monitoring.**
- **Highly Reliable Circuit and Power Supply. Line Operated.**
- **Audible Countrate Volume Variable Independent of Alarm Volume.**
- **Alarm Trip Point Visible on Meter.**

The model 495 frisker combines practicality with reliability. It has a variable audible counting rate as well as a loud audio-visual alarm.

The frisker accepts either GM or scintillation probes for complete versatility around hospitals, nuclear power stations, radio-chemistry labs and many general health physics applications.

The alarm point can be set over the entire range of the instrument with a set-point shown on the meter.

Specifications:

Radiation Detected: Alpha, beta, gamma and X-ray depending upon detector used.

Operating Ranges: 0-500, 5000, 50,000 and 500,000 counts per minute in 4 linear ranges.

Precision: Within 5% of full scale at STP over operating ranges specified above.

Response Time: 90% of final reading within 12 sec. on 500 cpm range, 3 sec. on 5000 cpm range and 1 sec. on two highest ranges.

Calibration: Pulse generator. A separate internal calibration potentiometer adjusts each range.

Environmental Effects: Temp. limits – 20° to + 50°C at 30% relative humidity. Humidity limits 0-99%, non-condensing. Temp. dependence within 0.2% per °C.

Initial Stabilization Time: None.

Detector: Not supplied. Choose any GM or scintillation probes from the "probes" section of this catalog.

Display: Meter with 6.35 cm (2.5") scale, marked 0-500 cpm.

Power Requirements: 115 v. AC, 50 or 60 Hz. 220 v. AC available when specified.

Recorder Output: 0-10 mv. from screwtype, terminal strip on rear panel.

Connectors: MHV type for probe connection on the front panel.

Controls: 5 position rotary range and power switch and spring-loaded alarm set/reset switch and rotary speaker volume control all on front panel.

Alarm: Solid state electronic non-contacting alarm, completely adjustable over full scale. Audible indication is repetitive "beep" sound and meter face lights up bright red to provide visual indication.

Check Source: None provided.

Detector Output Voltage (Detector): 900 v. for use with all VINC probe assemblies.

Construction: Steel wrap-around cabinet with steel slide-in chassis. Brushed aluminum front panel. Mar-resistant matte finish.

Dimensions: 15.5 cm. (6-1/8") high, 23.2 cm. (9-1/8") wide, and 21.4 cm. (8-1/2") high, overall.

Weight: 3.4 Kg. (7-1/2 lbs.) net, 6.8 Kg. (15 lbs.) shipping.

Shipping Volume: 0.1 m^3 (2.5 ft^3).

ITEM: 20 A-5
DATE: 9-23-83

21. Procedures and Precautions for Use of Radioactive Gases (^{133}Xe Ventilation Scan).

A. Preparation.

(1) Exhaust and ^{133}Xe.

(a) Turn on room exhaust fan in hot lab and close door.

(b) Assay ^{133}Xe dose ampoule and load in shielded chamber of calidose gun. If ampoule breakage should occur, vacate hot lab leaving door closed for 10 minutes to evacuate gas from room.

(c) Transfer ^{133}Xe in gun to image room, keep fan on and image room door closed during ^{133}Xe load, during patient exam until washout is completed, and during system washout.

(d) Verify trap unit operational--set trap air flow to 50.

(e) Verify intact hose coupled to LFU exhaust and gas inlet port of trap.

(2) LFU.

(a) Turn on main power. Determine whether system is empty or contains residual Xenon. If empty (sequencer is in upper OFF position and volume indicator reads zero), proceed with step 2. If system contains Xenon (sequencer is in lower OFF position and volume indicator reads 3-6 liters), proceed to step 5.

(b) Verify CO_2 cartridge in place and functional--replace absorber if lavender color noted.

(c) Verify spirometer tank fill level, add water to FILL line if needed.

(d) Advance sequencer to Xe FILL. Depress BELL ↑ button until volume indicator reads 1 liter.

(e) Connect tubing to wall O_2 regulator and O_2 hose in left access door of LFU. Set wall O_2 regulator to 3 L/min. Turn on front panel O_2 switch and adjust flowmeter to 150 cc/min. Turn O_2 switch off.

(f) Advance sequencer to MIX. Inject ^{133}Xe with Calidose gun through injection port on arm. Retain ampoule for camera peaking.

(g) Depress BELL ↑ button until volume indicator reads 6 liters.

(h) Allow MIX to continue at least 2 min.

(i) Advance to AIR.

(j) Attach disposable mouthpiece or mask to 6 in. section of flexible respirator tubing to bacteriostatic filter to LFU breathing port. Have ready disposable nose clip.

21. Procedures and Precautions for Use of Radioactive Gases (^{133}Xe Ventilation Scan, continued).

(3) Camera (LFOV).

(a) Load video tape and place voice marker.

(b) Load cassette, select large format, balance photometer for initial breath image.

(c) Select preset time of 20 sec.

(d) Place foot switch in accessible location.

(e) Leave camera peaked on ^{99m}Tc until patient is positioned.

(f) Position camera for supine or upright image depending on patient's condition.

(4) Patient.

(a) Explain test to patient, ascertain ability to cooperate and position required.

(b) Position patient appropriately, adjust camera to patient using flood source transmission. Repeak camera to ^{133}Xe.

(c) Insert mouthpiece and noseclip or attach face mask with harness.

(d) Test and observe patient's breathing and breath holding ability.

(e) If patient is unresponsive to commands, omit initial breath image and begin equilibrium imaging immediately after advancing to INHALE.

(f) If patient requires Oxygen at a rate greater than 4 liters/min., do not attempt ventilation study as oxygen deprivation and patient distress is likely.

B. Test.

(1) When ready to proceed, as patient exhales advance sequencer to INHALE, observe first signal light. As patient inhales maximally the second INHALE signal lights and an audible solenoid click is heard start camera.

(2) Patient holds this initial breath as long as possible then resumes tidal breathing.

(3) Record counts in initial breath image, rebalance photometer to equilibrium setting and select preset 300 K count.

(4) As patient resumes tidal breathing turn on O_2 switch, start camera.

21. Procedures and Precautions for Use of Radioactive Gases (^{133}Xe Ventilation Scan, continued).

(5) As patient breathes, observe excursions of volume indicator and adjust O_2 flowmeter as needed to maintain constant excursion rate.

(6) Obtain two (2) equilibrium images in succession.

(7) When ready to begin washout, turn on trap power by setting timer to 10 min. Reset camera for 30 sec. dynamic images. Rebalance photometer to washout setting.

(8) Advance sequencer to WASHOUT. Start camera. Turn off O_2 switch. Continue serial images until no activity remains in lungs.

(9) Advance sequencer to lower OFF. Remove patient from system. Discard mouthpiece and filter.

(10) Proceed with perfusion scan.

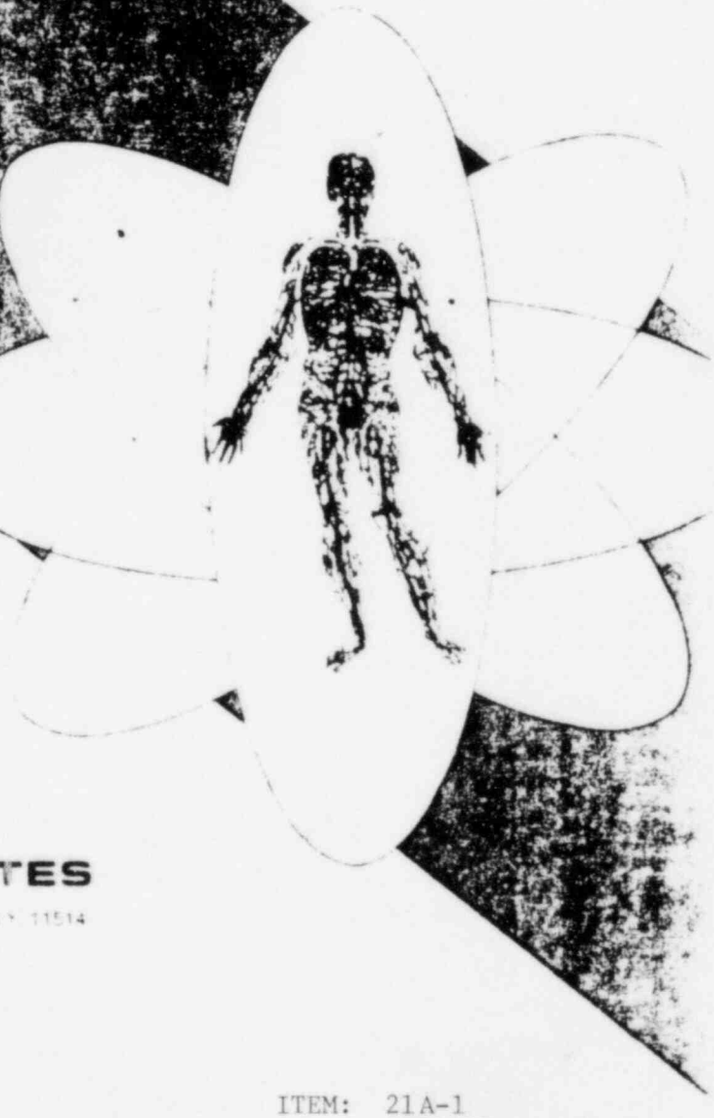
--If reuse of ^{133}Xe is not desired, after step 10 reset trap timer for 10 min., advance to SYSTEM WASHOUT. Observe volume indicator return to zero, or if it does not, press BELL ↓ . After 10 min. exhaust interval, advance sequencer to top OFF and turn off main power.

--If reuse of ^{133}Xe is desired, leave sequencer in lower OFF position and turn off main power.

Nuclear Medicine Instruments & Accessories

CATALOG M

ATTACHMENT A

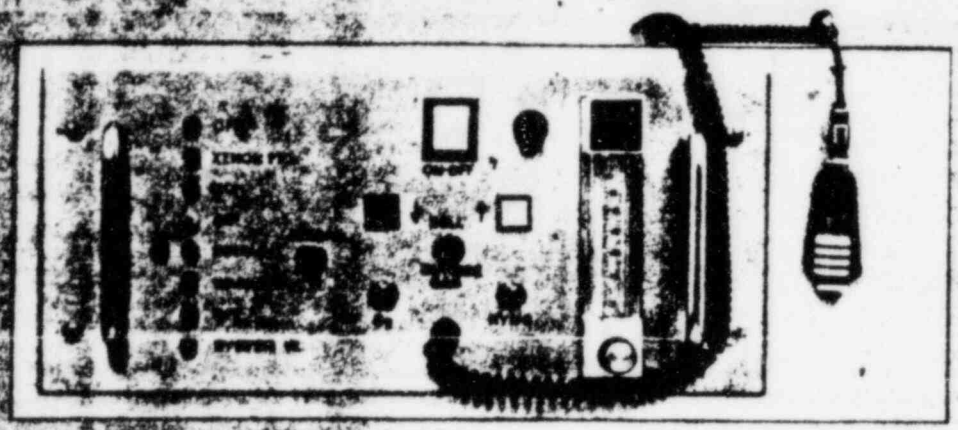


VICTOREEN

NUCLEAR ASSOCIATES

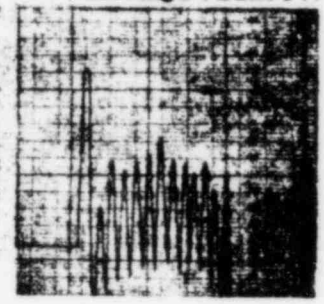
Division of VICTOREEN INC • Carle Place N.Y. 11514

ITEM: 21A-1
DATE: 9-23-83



Control Panel showing automatic and manual control functions, oxygen flowmeter, and hand-held remote controller.

Kymograph Display showing FVC and TV.



Automatic functions allow one technician to perform an entire study with the convenient hand controller.

The automatic functions, indexed by a remote hand switch, are in the following sequence:

OFF—Unit is off.

XENON FILL—In this position, a front panel gas port is activated. Xenon or any other gas (nitrogen, oxygen, etc.) may be added to the system. This cycle is also used when introducing ethylene oxide gas for sterilization.

MIX CYCLE—Internal blowers automatically mix the air xenon oxygen to homogeneity within two minutes.

PATIENT AIR—Patient is positioned and breathes ambient air (through the system) to adjust to the mouthpiece and system.

INHALE—In this cycle, the patient is breathing on the closed loop spirometer system. To assist the technician during a single breath study, an audible "click" is heard on the patient's first inspiration. This signals for the injection of the xenon bolus through the injection port. The kymograph is automatically started in this position.

PATIENT WASHOUT—Patient inhales ambient air and washes out through the system. When the camera indicates that the patient is sufficiently free of xenon, the operator moves to the "OFF" position.

OFF—The patient is removed from the system, and the remaining xenon is held in storage in the spirometer. If additional data is desired, the patient may be re-introduced to the system.

SYSTEM WASHOUT—An internal blower flushes the entire system rapidly and guarantees that no residual xenon remains.

Sequential functions can be overridden at any time by means of the remote controller.

The patient can become acclimated to the system (before the analysis begins) by breathing ambient air through the unit. The shielded arm (with mouthpiece) is adjustable from 40" to 50" above floor level to accept adult and adolescent patients in erect and supine positions.

Manual Control Functions

RAISE BELL—Adds air to the system at any time by activating a pump. Momentary switch operation.

LOWER BELL—Adjusts the bell volume to the clinician's requirements before the study begins. Momentary switch operation.

OXYGEN REGULATOR & FLOW VALVE—Provides O_2 replenishment (or O_2 fill) to the spirometer system. Precision flowmeter (with needle valve) regulates the O_2 supply.

EXTERNAL GAS INLET—Used to charge the system with xenon from an external source or to admit a sterilizing agent (i.e., ethylene oxide).

KYMOGRAPH — MANUAL ON-OFF SWITCH — For use in other than the automatic mode.

AUTO SHUT-OFF—Turns off the unit in case of bell over-fill, and actuates an audible alarm.

BELL OVER-FILL RELEASE—Releases the bell and places the unit automatically in the washout mode.

INJECTION PORT — For adding xenon into the system with a xenon gun. Port is located next to mouthpiece.

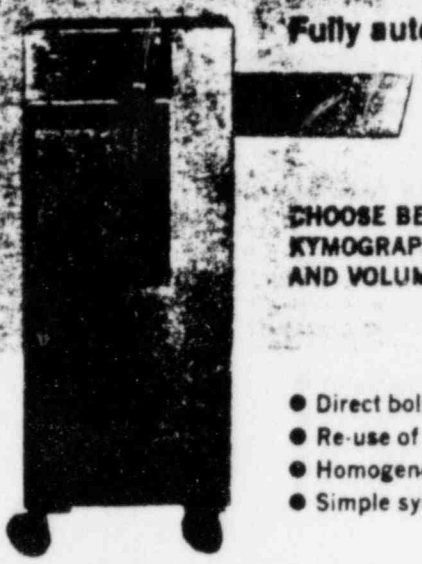
Contains 7.5-liter spirometer, optional 3-speed kymograph recorder, means for an internally-mounted oxygen and xenon supply, 3 blowers, and removable soda lime (CO_2) absorber. All controls are on front panel. Fully shielded by lead and mounted on casters. Doors in the main frame provide access to instrument and accessories. 22" x 23" x 55" high without arm. Arm extends 21" from side of console. Includes an adapter for supine studies.

36-001	Lung Function Unit with kymograph		$5600.00
36-002	Lung Function Unit without kymograph		4900.00
36-003	Lung Function Unit with added shielding for xenon-127. With kymograph		5900.00
36-004	Lung Function Unit with added shielding for xenon-127. Without kymograph		5200.00
36-005	Kymograph Chart Paper	roll	10.00
36-006	Kymograph Self-Inking Pen	6	15.00
36-007	Disposable Mouthpiece		4.00
36-008	CO_2 Absorber, 2 lb. container	ea.	5.00
		20 containers	70.00
36-009	Disposable Bacteriostatic Filters	10	37.50
36-010	Face Mask, Medium		25.00
36-011	Face Mask, Large		25.00
36-012	Face Mask Harness. Holds mask in place		11.00

A 10-minute, 35-mm slide/cassette audio-visual program on the performance capabilities of the Lung Function Unit is available on loan on request.

ITEM: 21A-2
DATE: 9-23-83

Xenon Lung Function Unit

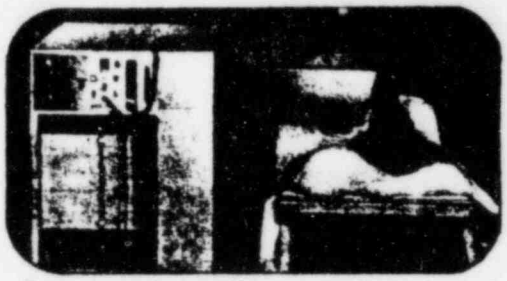


Fully automatic, self-contained with push-button and remote operation

CHOOSE BETWEEN KYMOGRAPH CHART RECORDER AND VOLUME DISPLAY

- Direct bolus injection.
- Re-use of xenon gas.
- Homogeneous gas mixing.
- Simple system sterilization.

Lung Function Unit is shown with Volume Display



Shown with Kymograph

Erect or supine studies are easily performed by lowering adjustable arm to patient's level.

This fully-automated, self-contained system enables the clinician to perform pulmonary function studies efficiently and with minimum effort. It allows single breath, equilibrium, washout, and oxygen uptake studies routinely. Effluent gas is trapped in the system and expelled only on the operator's command. Xenon air mixtures are withdrawn from the system automatically. Accidental gas release is eliminated by an automatic shutdown washout mode.

SPECIAL FEATURES

Remote Controller: Unlike any other system, all functions are selected by means of a hand-held remote controller attached to a 10-foot coil cord. The technician can administer to the patient and index the system as desired while operating the gamma camera.

Resistance-free breathing: A series of pumps and blowers, used in combination with the spirometer, assures resistance-free breathing for the patient.

Spirometer: An 8.5-liter, water-seal spirometer, governed to 7.5 liters, serves as a resistance-free reservoir for the patient's breathing. The tank and bell are easily drained, and water sterility can be maintained by adding a free iodine radical to the water itself.

Kymograph*: The kymograph recorder provides a direct-volume readout of the patient's inspired expired air volume on an easy-to-read 10" chart. Pulmonary function parameters such as Forced Vital Capacity (FVC), Forced Expiratory Volume (FEV), Tidal Volume (TV), and Oxygen Uptake can be easily determined from the charted data. This information greatly enhances the correlation of data between the nuclear medicine clinician and the respiratory staff. With chart speeds of 30, 60 and 1200 mm/minute, a variety of display presentations are possible. Direct calibration of camera efficiency for radioxenon is easily obtained.

*Kymograph is supplied only with Models 36-001 and 36-003. Models 36-002 and 36-004 include a graduated scale on which the volume level of the spirometer is displayed.

Adjustable arm: Whether doing a supine or upright study, the lead-shielded, counter-weighted 21" arm adjusts to your patient's position. It moves vertically from 40" to 50" above the floor, permitting an interference-free view of the patient and allowing the instrument to be positioned next to the gamma camera. An adapter for supine studies is provided.

Homogeneous gas mixtures: Automatic feeding of homogeneous gas mixtures, with provision for the manual addition of oxygen at any time, minimizes the total dead space within the system. The mixing of gases is under the technician's control at all times. An internal in-line blower creates a homogeneous gas/air mixture within 15 seconds after the introduction of radioxenon and provides continuous resistance-free breathing.

Self-contained xenon and oxygen supply: Both xenon gas and standard oxygen bottles with regulators can be mounted internally for maximum ease of administration. Radioactive gas may also be administered through an exterior gas inlet or through a serum cap on the adjustable arm. This cap allows the direct injection of xenon gas by syringe, permitting the patient to receive either a bolus of xenon or a homogeneous mixture.

Bolus injection port, conveniently located on the adjustable arm, allows direct delivery of a bolus of xenon to your patient.

System sterilization between patients is easily done by flushing ethylene oxide through the internal system. A disposable bacteriostatic filter can be placed on the mouthpiece port to isolate the unit from contamination.

Fully lead shielded...safe for both the patient and staff. When the system is loaded with 70 mCi of xenon-133 gas, for example, the radiation level at ANY external surface is equivalent to background.

Complete mobility makes positioning easy, whether the patient is ambulatory or confined to a stretcher. Silent, ball-bearing rubber casters (5" D.) assure exceptional ease of movement. Two of the casters have wheel locks to immobilize the system during studies.

ITEM: 21A-3
DATE: 9-23-83

22. Procedures and Precautions for Use of Radioactive Materials in Animals.

All laboratories and animal rooms where byproduct materials are used will be routinely surveyed by the wipe test and monitored with a survey meter. The surveys will be conducted at monthly intervals. These results are recorded on a standard form and maintained on file. The form includes name of person conducting survey, drawing of area, date and measured exposure rates. Areas to be checked will include sink, working bench tops, hoods, door knobs, and floor. Any area containing .005 μCi will be considered contaminated and will be decontaminated by the user of the materials, not housekeeping personnel. After decontamination, the area will be checked again to ensure decontamination.

Liquid wastes are disposed of by sanitary sewer as per Section 20.303, Title 10 CFR. The water usage at this hospital is approximately 370,000 gallons per day.

Steel plastic lined receptacles are used for small animal carcasses. These carcasses are stored at -17°C in BECEG-46. Steel, plastic-lined receptacles are also used for paper and small glass item wastes. A lead brick wall is constructed in a VL-1 hood for shielding when needed.

Small animal carcasses are incinerated pursuant to Sections 20.106(b) and 20.302, Title 10 CFR and Appendix B, Table II, Title 10 CFR 20. These items are stored in steel-covered receptacles at -17°C until incineration. The amount of radioactive material incinerated at one time would be around 1-5 millicuries. The need for incinerating occurs only about three times a year.

The Assistant Radiological Safety Officer accompanies in a government vehicle each shipment of combustible waste to the incinerator and witnesses the disposal of the material. The ashes are then monitored with a scintillation spectomete. the next day. A record of these data is maintained.

ITEM: 22
DATE: 9-23-83

23. Procedures and Precautions for Use of Radioactive Materials Specified in Item 6B.

A. Each lab employing radioactive materials must perform wipe tests monthly to detect any radiation contamination in the lab.

B. The procedure to perform wipe tests is as follows:

(1) Select several areas in the lab that could become contaminated during the course of handling radioactive materials. Examples of likely areas include (a) in and around all sinks where radioactive containers and instruments are cleaned, (b) on lab desks and in hoods where radioactive materials are used and on the floor in front of these areas, (c) on the floor around all radioactive waste containers.

(2) Make a diagram of the lab and label each area selected in item (1) above on the diagram so that the same area will be checked each month.

(3) Use filter paper or other absorbent paper to perform the wipes. Label each sheet of paper according to the scheme in item (2).

(4) Wipe a circular motion beginning in the cernter of the area to be tested and expand the circular wipe outward until approximately 100 cm^2 (a circle roughly 4½ inches in diameter) have been covered.

(5) Each piece of paper used should be assumed contaminated until proved non-contaminated by counting. Place each piece of paper into the same type of vial used to count the radionuclide used in the lab.

(6) Place two non-contaminated pieces of the same type of paper into separate vials to be used for the efficiency and background determinations. Place a known quantity of radioactivity into one of the vials, using a micropipette or other device, to assess counter efficiency.

(7) Count each vial (samples, background and efficiency). Subtract counts per minute (cpm) recorded in the background vial from the cpm recorded for all the other vials. Determine counting efficiency: counts per minute recorded in the efficiency vial - known activity (dpm) placed in the efficiency vial.

(8) Divide the cpm recorded for each sample by the counting efficiency determined in item (7). Compare the results to the following limits:

I-125, P-32	200 cpm
C-14, H-3, S-35, Cr-51	2200 cpm

Contaminations below these values do not require cleanup. Contaminations above these values must be removed and results of the cleanup checked by a second wipe test.

C. Results of all wipe tests must be maintained in each lab available for inspection by the Radiation Safety Officer personnel and NRC Inspectors.

ITEM: 23

DATE: 9-23-83

Medical Center
1030 Jefferson Avenue
Memphis TN 38104

Veterans Administration

December 31, 1984

In Reply Refer To: 614/115

Dr. Francis A. St. Mary
Material Licensing Branch
Division of Fuel Cycle and
Material Safety
Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Dr. St. Mary:

This is in reference to your letter dated December 6, 1984, concerning our letter dated October 1, 1984 to amend By-Product Material License No. 41-00119-08 (Reference Control No. 18330).

According to NRC Regulatory Guide 8.20 (Revision 1, September 1979, copy enclosed), the procedures you described in your letter are required when quantities of Iodine-125 or Iodine-131 handled in unsealed form are greater than 10% of the values mentioned in Table 1 of the above mentioned Guide.

According to Table 1, processes with possible escape of iodine carried out within a fume hood of adequate design, face velocity, and performance reliability for bound to non-volatile agent are allowable up to 100 mCi.

All our Research groups and Nuclear Medicine Service are using activities of 10 mCi which is far below the values of Table 1.

We will be looking forward to your response to the Amendment proposed in our letter dated October 1, 1984. Please do not hesitate to contact me at any time whould you desire any additional information.

Sincerely,

H. M. Omar

HASSAN M. OMAR, Ph.D.
Radiation Safety Officer

Enclosures 2

1p.