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

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
Fifth and Fort Streets
Boise, ID 83702

TELEPHONE NO.: AREA CODE (208) 336 5100

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

2. PERSON TO CONTACT REGARDING THIS APPLICATION

Lawrence L. Knight, M.D.

TELEPHONE NO.: AREA CODE (208) 338 7240

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

a. ☐ NEW LICENSE
b. ☐ AMENDMENT TO LICENSE NO. _____
c. ☒ RENEWAL OF LICENSE NO. 11-18311-01

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

Lawrence L. Knight, M.D.
John B. Tweeten, M.D.
Frederick R. Oyer, M.D.

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

Roger G. Stano, M.S.

6.a. RADIOACTIVE MATERIAL FOR MEDICAL USE

RADIOACTIVE MATERIAL LISTED IN:	ITEMS DESIRED "X"	MAXIMUM POSSESSION LIMITS (In millicuries)
10 CFR 31.11 FOR IN VITRO STUDIES	X	3 mCi H3-20 mCi
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	2000 mCi
10 CFR 35.100, SCHEDULE A, GROUP IV	X	AS NEEDED
10 CFR 35.100, SCHEDULE A, GROUP V		AS NEEDED
10 CFR 35.100, SCHEDULE A, GROUP VI		

ADDITIONAL ITEMS:	MARK ITEMS DESIRED "X"	MAXIMUM POSSESSION LIMITS (In millicuries)
IODINE-131 AS IODIDE FOR TREATMENT OF HYPERTHYROIDISM		
PHOSPHORUS-32 AS SOLUBLE PHOSPHATE FOR TREATMENT OF POLYCYTHEMIA VERA, LEUKEMIA AND BONE METASTASES		
PHOSPHORUS-32 AS COLLOIDAL CHROMIC PHOSPHATE FOR INTRACAVITARY TREATMENT OF MALIGNANT EFFUSIONS.		
GOLD-198 AS COLLOID FOR INTRACAVITARY TREATMENT OF MALIGNANT EFFUSIONS.		
IODINE-131 AS IODIDE FOR TREATMENT OF THYROID CARCINOMA		
XENON-133 AS GAS OR GAS IN SALINE FOR BLOOD FLOW STUDIES AND PULMONARY FUNCTION STUDIES.	X	325 mCi

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

ELEMENT AND MASS NUMBER	CHEMICAL AND/OR PHYSICAL FORM	MAXIMUM NUMBER OF MILLICURIES OF EACH FORM	DESCRIBE PURPOSE OF USE
	See attached page 1a.		

INFORMATION REQUIRED FOR ITEMS 7 THROUGH 23

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

7. MEDICAL ISOTOPES COMMITTEE	
X	Names and Specialties Attached; and
	Duties as in Appendix B; or *(Check One)*
X	Equivalent Duties Attached Item 7 and Radiation Protection Guide (RPG) part 1
8. TRAINING AND EXPERIENCE	
	Supplements A & B Attached for Each Individual User; and
	Supplement A Attached for RSO. Please see item 8.
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 RPG, part 13
X	Appendix D Procedures Followed for Dose Calibrator; or *(Check One)*
	Equivalent Procedures Attached
11. FACILITIES AND EQUIPMENT	
X	Description and Diagram Attached Item 11a, b, c
12. PERSONNEL TRAINING PROGRAM	
X	Description of Training Attached Item 12, RPG part 4
13. PROCEDURES FOR ORDERING AND RECEIVING RADIOACTIVE MATERIAL	
X	Detailed Information Attached Item 13 RPG, Part 11.2
14. PROCEDURES FOR SAFELY OPENING PACKAGES CONTAINING RADIOACTIVE MATERIALS *(Check One)*	
	Appendix F Procedures Followed; or
	Equivalent Procedures Attached RPG part 12

15. GENERAL RULES FOR THE SAFE USE OF RADIOACTIVE MATERIAL *(Check One)*	
	Appendix G Rules Followed; or
X	Equivalent Rules Attached RPG, parts 5, 6, 9
16. EMERGENCY PROCEDURES *(Check One)*	
	Appendix H Procedures Followed; or
X	Equivalent Procedures Attached RPG, parts 10, 22, 23, 24
17. AREA SURVEY PROCEDURES *(Check One)*	
	Appendix I Procedures Followed; or
X	Equivalent Procedures Attached Item 17 and RPG, part 9
18. WASTE DISPOSAL *(Check One)*	
	Appendix J Form Attached; or
X	Equivalent Information Attached Item 18 and RPG, part 25
19. THERAPEUTIC USE OF RADIOPHARMACEUTICALS *(Check One)*	
	Appendix K Procedures Followed; or
X	Equivalent Procedures Attached RPG, parts 16, 17, 18, 19, 20, 21
20. THERAPEUTIC USE OF SEALED SOURCES	
N/A	Detailed Information Attached; and
	Appendix L Procedures Followed; or *(Check One)*
	Equivalent Procedures Attached
21. PROCEDURES AND PRECAUTIONS FOR USE OF RADIOACTIVE GASES (e.g., Xenon – 133)	
X	Detailed Information Attached Item 21
22. PROCEDURES AND PRECAUTIONS FOR USE OF RADIOACTIVE MATERIAL IN ANIMALS	
X	Detailed Information Attached RPG, part 26
23. PROCEDURES AND PRECAUTIONS FOR USE OF RADIOACTIVE MATERIAL SPECIFIED IN ITEM 6.b	
X	Detailed Information Attached RPG, part 4

APPLICATION FOR MATERIALS LICENCE - MEDICAL

6b. Radioactive material for uses not listed in Item 6a.

Uses: Isotopes listed below will be used for physiologic and distribution studies in animals and in vitro studies involving the labeling and quantitative assays.

Element and Mass Number	Chemical and/or Physical Form	Maximum Number of Millicuries of Each Form
C-14	Labeled organic cpds or radiopharmaceuticals	20
H-3	Any chemical or physical form	20
I-125	Microspheres, Iodide-labeled organic cpds	20
I-131	Iodide-labeled organic cpds or radiopharmaceuticals	20
Au-198	Chloride or other labeled organic cpd	10
~~Ca-43~~	Labeled organic cpd	10
Ca-45	Labeled organic cpd	10
Ce-141	Microspheres	10
~~Co-57~~	Labeled organic cpd, cyanocobalmin	10
Co-58	Labeled organic cpd	10
Cr-51	Microsphere or other labeled organic cpd	10
Cu-64	Labeled organic cpd	10
~~F-18~~	Labeled organic cpd	10
~~Fe-55~~	Labeled organic cpd	10
Fe-59	Labeled organic cpd	10
In-113m	Labeled organic cpd or radiopharmaceutical	10
K-42	Labeled organic cpd	10
Mn-54	Labeled organic cpd	10
Na-24	Labeled organic cpd	10
Nb-95	Microspheres	10
Ni-63	Labeled organic cpd	10
P-32	Labeled organic cpd	10
S-35	Labeled organic cpd or radiopharmaceutical	10
Sc-46	Microspheres	10
Se-75	Labeled organic cpd	10
Sr-85	Microspheres or other labeled organic cpd	10
Tc-99m	Labeled organic cpd or radiopharmaceutical	10
Tl-201	Labeled organic cpd	10
Y-40	Labeled organic cpd	10
Zn-65	Labeled organic cpd	10

What is this isotope Y-90

We realize that some of the materials requested are not covered by NRC regulations, but we have done this for completeness and are asking for approval by Dr. Smith of VA Central Office of those items which are not covered by the Atomic Energy Act of 1954.

24. PERSONNEL MONITORING DEVICES

TYPE (Check appropriate box)			SUPPLIER	EXCHANGE FREQUENCY
a. WHOLE BODY		FILM		
		TLD	Morrison Knudsen Company	Monthly
		OTHER (Specify)		
b. FINGER		FILM		
		TLD	Morrison Knudsen Company	Monthly
		OTHER (Specify)		
c. WRIST		FILM		
		TLD		
		OTHER (Specify)		

d. OTHER (Specify)

25. FOR PRIVATE PRACTICE APPLICANTS ONLY

a. HOSPITAL AGREEING TO ACCEPT PATIENTS CONTAINING RADIOACTIVE MATERIAL

NAME OF HOSPITAL: N/A

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:

(2) LICENSE FEE ENCLOSED: $ _____

b. APPLICANT OR CERTIFYING OFFICIAL *(Signature)*

(1) NAME *(Type or Print)*: JAMES A. GOFF

(2) TITLE: MEDICAL CENTER DIRECTOR

c. DATE: September 28, 1984

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.

NRC FORM 313M SUPPLEMENT A
(9-81)

U.S. NUCLEAR REGULATORY COMMISSION

TRAINING AND EXPERIENCE
AUTHORIZED USER OR RADIATION SAFETY OFFICER

1. NAME OF AUTHORIZED USER OR RADIATION SAFETY OFFICER	2. STATE OR TERRITORY IN WHICH LICENSED TO PRACTICE MEDICINE
Roger G. Stano, M.S.	

3. CERTIFICATION

SPECIALTY BOARD A	CATEGORY B	MONTH AND YEAR CERTIFIED C
American Board of Radiology	Therapeutic Radiologic Physics	1976

4. TRAINING RECEIVED IN BASIC RADIOISOTOPE HANDLING TECHNIQUES

FIELD OF TRAINING A	LOCATION AND DATE(S) OF TRAINING B	TYPE AND LENGTH OF TRAINING	
		LECTURE/ LABORATORY COURSES (Hours) C	SUPERVISED LABORATORY EXPERIENCE (Hours) D
a. RADIATION PHYSICS AND INSTRUMENTATION	University of Wisconsin 1970-1972	2500 hrs.	2000 hrs.
b. RADIATION PROTECTION	University of Wisconsin 1970-1972	620 hrs.	620 hrs.
c. MATHEMATICS PERTAINING TO THE USE AND MEASUREMENT OF RADIOACTIVITY	University of Wisconsin-70-72 Northern Michigan Univ. -68-70	1080 hrs.	
d. RADIATION BIOLOGY	University of Wisconsin 1970-1972	288 hrs.	
e. RADIOPHARMACEUTICAL CHEMISTRY	Marshfield Clinic, Marshfield, Wis. 1972-1976 Mountain States Tumor Inst. Boise, Idaho 1976-1984		200 hrs.

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

ISOTOPE	MAXIMUM AMOUNT	WHERE EXPERIENCE WAS GAINED	DURATION OF EXPERIENCE	TYPE OF USE
^{137}Cs	100 mCi	Mountain States Tumor Institute	8 years	see below
^{125}I	100 mCi	Mountain States Tumor Institute	6 years	
^{192}Ir	50 mCi	Mountain States Tumor Institute	5 years	
^{60}Co	9000 Ci	Mountain States Tumor Inst.	Please see page 5a	

ISOTOPE	MAXIMUM AMOUNT	WHERE EXPERIENCE WAS GAINED	DURATION OF EXPERIENCE	TYPE OF USE
^{14}C	10 mCi	Marshfield Clinic	6 years	see below
^{3}H	20 mCi	VAMC Boise, ID.	3 years	

Type of use with the above radionuclides was partitioned as follows:

1.	Surveys for waste disposal of liquids, gas, solids	2400 hrs.
2.	Calibration of radioiodine dosage for imaging, therapy of hyperthyroidism, therapy of thyroid cancer.	400 hrs.
3.	Preparation of kits and manipulation of Mo-Tc generators for imaging procedures	400 hrs.
4.	In vitro assay utilizing C^{14}, H^{3}	400 hrs.
5.	Monitoring therapy utilizing sealed sources - Cs-137, Ir-192, I-125	2400 hrs.
	TOTAL	6000 hrs.

Veterans Administration

Memorandum

Date: September 10, 1984

From: Medical Center Director (00)

To: Lawrence L. Knight, M.D., Chairman
David A. Hindson, M.D.
Sandra G. Jue, Pharm. D.
Byron K. Meador, C.N.M.T.
Heidi L. Parke
I. Jo Scantling, R.N.
Roger G. Stano, M.S., Radiation Safety Officer
Robert F. Tipton
John B. Tweeten, M.D.
Robert E. Vestal, M.D.

Subj: Establishment of Radiation Control and Radioactive Drug Research Committee and Appointment of Membership

1. This memorandum is to establish a Radiation Control and Radioactive Drug Research Committee (RCRDRC) at the VAMC, Boise, Idaho. By establishment of this committee with a broad base of experts it is intended to ensure that licensed radioactive materials, and other sources of ionizing radiation, be used in a manner that is safe to workers, patients, the public and the environment. This committee shall ensure that all research involving administration of internally as well as externally applied sources of radiation to human subjects shall take into consideration a risk-benefit analysis of the study and that the patient be fully informed of the consequences of his participation in the research protocol. In this regard the RCRDRC will function in an advisory capacity to the Institutional Review Board (Human Subjects Review Committee) of the University of Washington in Seattle, which performs the reviews of research involving human subjects at the VA Medical Center in Boise. The Boise VA Medical Center is affiliated with the University of Washington School of Medicine under the oversight of a Dean's Committee.

2. This committee shall be fully aware of its responsibilities and of the conditions under which radioactive materials may be considered safe and effective for the purpose for which intended as mandated in 20CFR361 (copy of which will be in chairman's office) and which is further enumerated in Part 4 of the VAMC Boise Radiation Protection Guide, promulgated on September 1, 1984.

3. In its role as Radiation Control Committee, the committee shall be responible for safe use of those radioactive materials which are covered under U.S. Nuclear Regulatory Commission Rules and Regulations for protection against radiation 10CFR20, but other sources of ionizing radiation as well, particularly radionuclides such as those produced in particle accelerators (e.g., cyclotrons), those naturally occurring radionuclides such as radium and radon, found in higher isotopic abundance than in nature, and those sources of radiation such as diagnostic and therapeutic X-ray apparatus.

4. The committee shall meet at least quarterly, a quorum shall consist of at least 2/3 of the members being present, and when considering research uses in humans must include the presence of the designated experts in nuclear medicine, radiopharmacy and radiation safety/dosimetry. Passage of a request for use of radioactive materials or radiation sources shall require a minimum of 2/3 favorable votes of the members present.

5. Minutes shall be kept of all meetings, with attendance of individual members voted by name. Results of all votes shall be indicated as yes, no, or abstain. Members who have a protocol before the committee may be included in the members present for purposes of quorum requirements but shall absent themselves during voting on their protocol.

6. Effective October 1, 1984, the above named persons are appointed to this expanded Radiation Control Committee and Radioactive Drug Research Committee. Dr. Lawrence Knight will serve as Chairman. This expanded committee will replace the previously established Radiation Safety Committee and will assume the additional responsibilities outlined in this memorandum and in the Radiation Protection Guide of the Boise VAMC.

JAMES A. GOFF
Medical Center Director

0805

Medical Center

5th and Fort Streets
Boise, ID 83702

Veterans Administration

September 28, 1984

Training and Experience

LAWRENCE L. KNIGHT, M.D. - User and Director, Radiation Control

Please refer to application dated September 19, 1978, leading to issuance of NRC license 11-18311-01.

JOHN B. TWEETEN, M.D. - User

Please refer to application dated December 3, 1979, and letters dated March 17, 1980, and October 26, 1981, NRC license 11-18311-01.

FREDERICK R. OYER, M.D. - User

Please refer to application dated November 15, 1983, leading to amendment No. 04, NRC license 11-18311-01.

ROGER G. STANO, M.S. - Radiation Safety Officer

Supplement A attached.

In Reply Refer To:

Item #8
Sept. 1984
Boise VAMC

Medical Center

5th and Fort Streets
Boise, ID 83702

Veterans Administration

September 28, 1984

1. Survey Meters

a. Manufacturer's name: Victoreen Cutie Pie
Manufacturer's model number: 740-F
Number of instruments: 1
Minimum range: 0 mR/hr to 25 mR/hr
Maximum range: 0 mR/hr to 25,000 mR/hr

b. Manufacturer's name: Victoreen GM Meter
Manufacturer's model number: 491-30
Number of instruments: 1
Range: .01 mR/hr to 100 mR/hr

c. Manufacturer's name: Victoreen Frisker Bench Top Monitor
Manufacturer's model number: 495 Probe 489-35
Number of instruments: 1
Ranges: 0-500 cpm
0-500,000 cpm
in 4 linear ranges

d. Manufacturer's name: Searle low level survey meter
Manufacturer's model number: 9120
Number of instruments: 1
Range: 0.02-200 mR/hr

2. Dose Calibrator

Manufacturer's name: Squibb
Manufacturer's model number: CRC-17
Number of instruments: 1

3. Diagnostic Instruments

a. Type of instrument: Scintillation Gamma Camera
Manufacturer's name: Ohio Nuclear
Manufacturer's model number: 4105

b. Type of instrument: Gamma Well Counter
Manufacturer's name: Searle
Manufacturer's model number: 1197

c. Type of instrument: Liquid Scintillation Counter
Manufacturer's name: Beckman
Manufacturer's model number: LS 100 C

d. Type of instrument: Liquid Scintillation Counter
Manufacturer's name: Beckman
Manufacturer's model number: LS 7500 D.P.

In Reply Refer To:

Item #9
Sept. 1984
Boise VAMC

Medical Center

5th and Fort Streets
Boise, ID 83702

Veterans Administration

September 28, 1984

Facilities and Equipment

Nuclear Medicine Suite - Building 85 (Item 11-A)

This is only one in which radionuclides are handled in millicurie quantities. The suite is below ground level: two sides are outside walls, while the remaining two abut on a hallway and the radiology file room. An ultrasound facility is included at one end of the nuclear medicine section. The hot lab and camera room, both restricted areas, are locked and posted when not in use. Counter tops are stainless steel, as is the sink. The floor is asphalt vinyl tile. The refrigerator has a 1/8" lead lining, and the storage/work area within the hood is lined with 2" lead bricks. A lead glass shield is utilized in the radiopharmaceutical preparation area immediately adjacent to the hood.

The storage and decay room is located in close proximity to the nuclear medicine suite (approximately 25 feet) and abuts on a hallway and the building mechanical space. The area is restricted, posted, and kept locked. Radionuclides stored for decay are appropriately shielded: specifically, used generators are stored behind 2" lead brick. This space shares ventilation with the nuclear medicine suite (both are isolated from the remainder of the building ventilation system) in a manner described in items 11-D and 21.

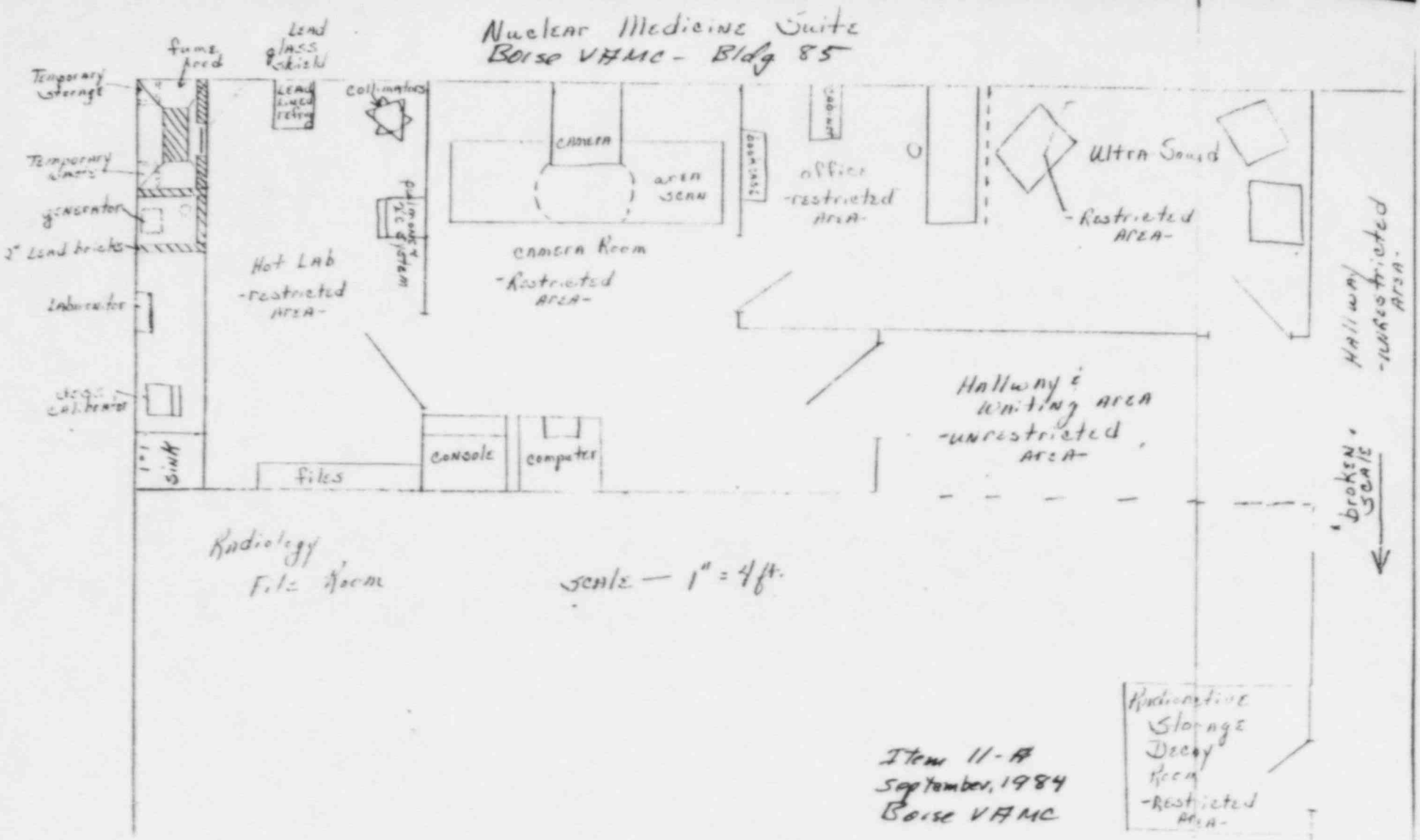
Radioassay Laboratory - Building 85 (Item 11-B)

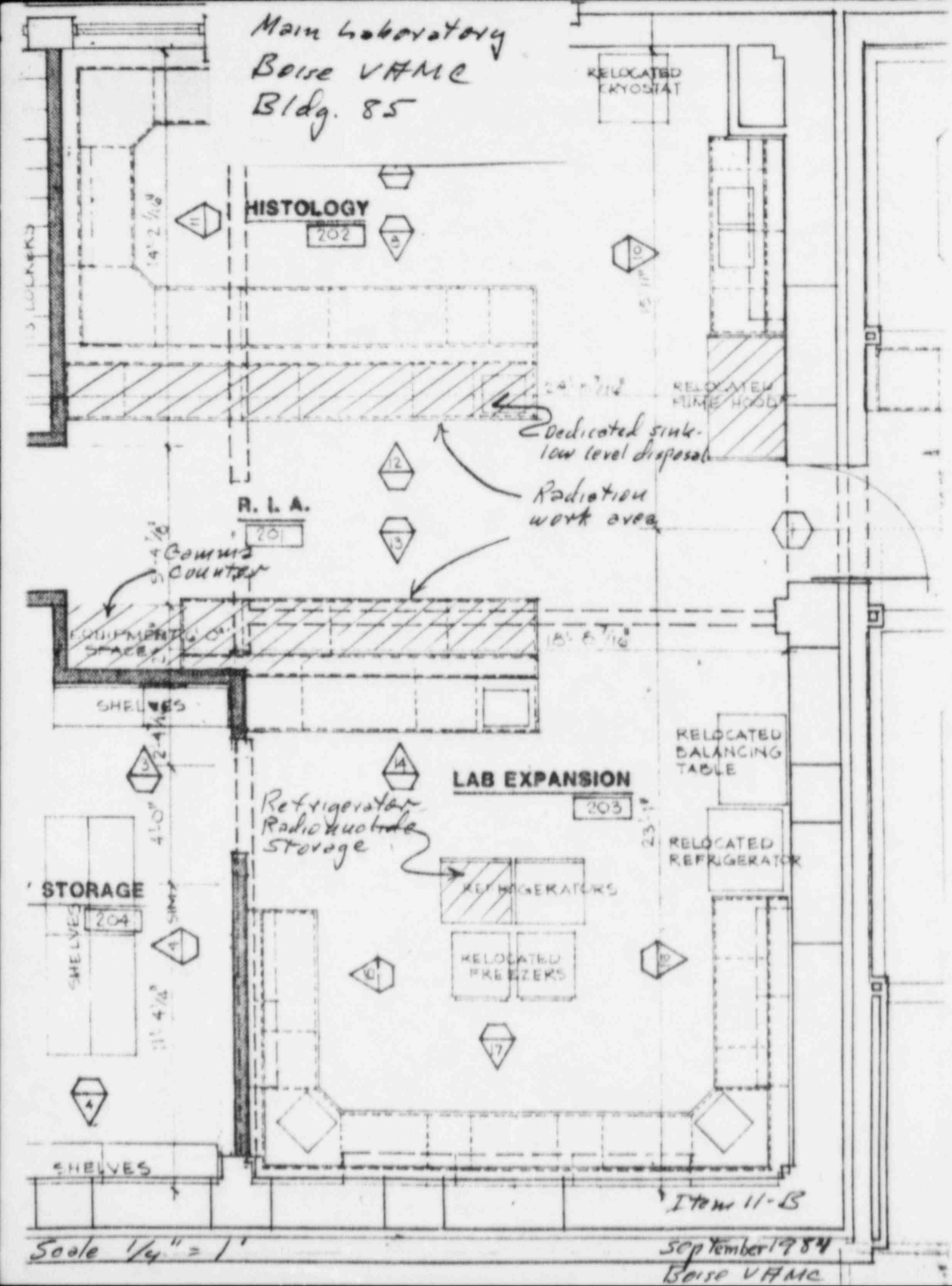
This area is part of the clinical laboratory. Radionuclide usage consists largely of I-125 in small quantities, typically 100 microcuries monthly throughout and less than 200 microcuries in storage at any given time. A posted refrigerator is used for storage, and a dedicated sink is used for disposal of microcurie quantities into the sanitary sewage system (institutional flow is approximately 176,000 gallons per day). Counter tops are laboratory grade composition, and floors are asphalt vinyl tile. A roof-vented fume hood is available within the area if needed. The work area is posted.

Research Laboratory - Building 67 (Item 11-C)

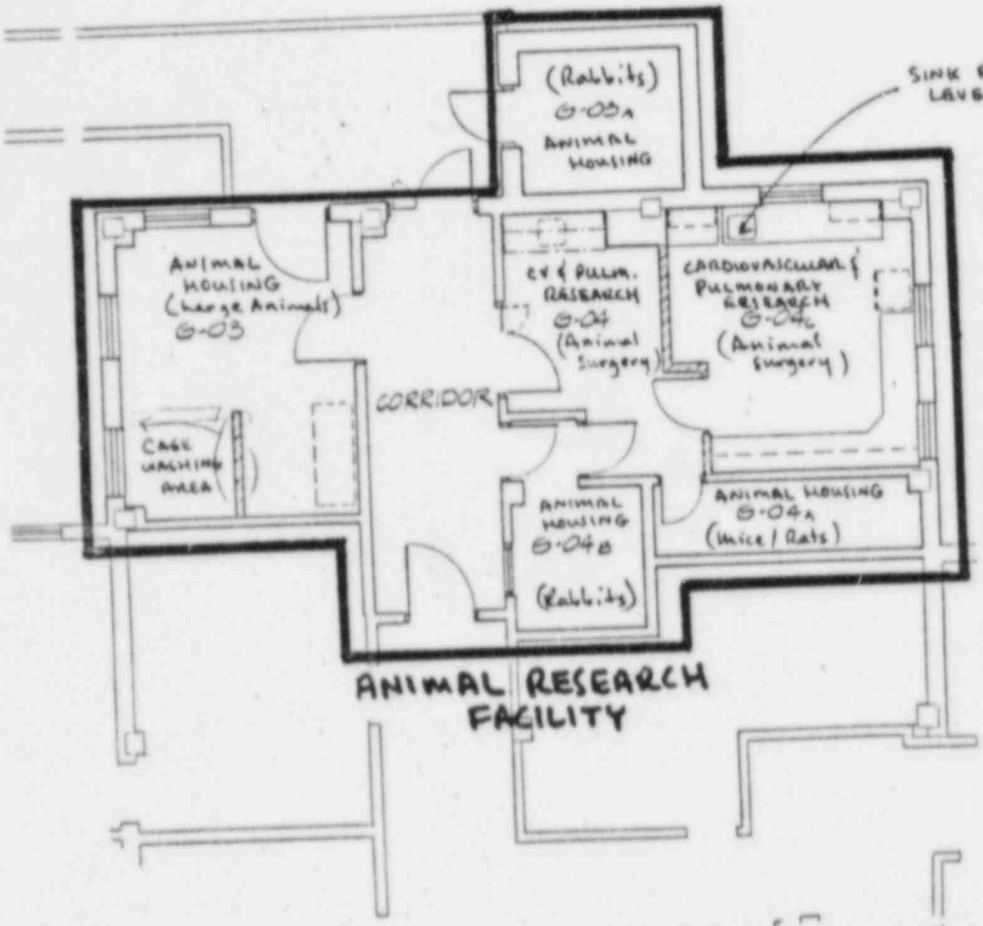
Radionuclide usage consists predominantly of in vitro procedures, utilizing mainly H-3, C-14, and small quantities of I-125. Monthly throughout put of H-3 and C-14 is typically less than 10 millicuries. With gradual expansion of biomedical research at this facility, use of other isotopes for research purposes in anticipated. These are likely to include and or all of the isotopes listed in Item #18. In particular P-32 and radioactive microspheres will be needed by investigators already in the research program. The latter will be used in animal research projects. Although iodination procedures are not currently authorized, or needed, it is important that these be permissible when research needs require them. All current and future use of isotopes will continue to be under the strict control of the Radiation Control and Radioactive Drug Research Committee.

The work areas in the Research Laboratory are posted and feature a laboratory fume hood dedicated to radioisotope work, formica counters and either vinyl flooring or waxed floor tile. A remodeling project will soon begin with anticipated completion by March or April 1985. All counter tops will be replaced with impermeable epoxy resin surfaces. Storage refrigerators and freezers are included within the work area and are appropriately marked for storage of radioisotopes. Three posted sinks in the contiguous area allow disposal of microcuries quantities of waste into the sanitary sewer system. Radioactive material which meets de minimus allowances of C-14 and H-3 in liquid medium, (e.g. organic base scintillation cocktail) and animal carcasses will be incinerated. When necessary, other radioactive waste will be shipped to the Northwest Regional Disposal Site in Hanford, Washington. This would include ash from incineration of animals which have received radioactive microspheres.

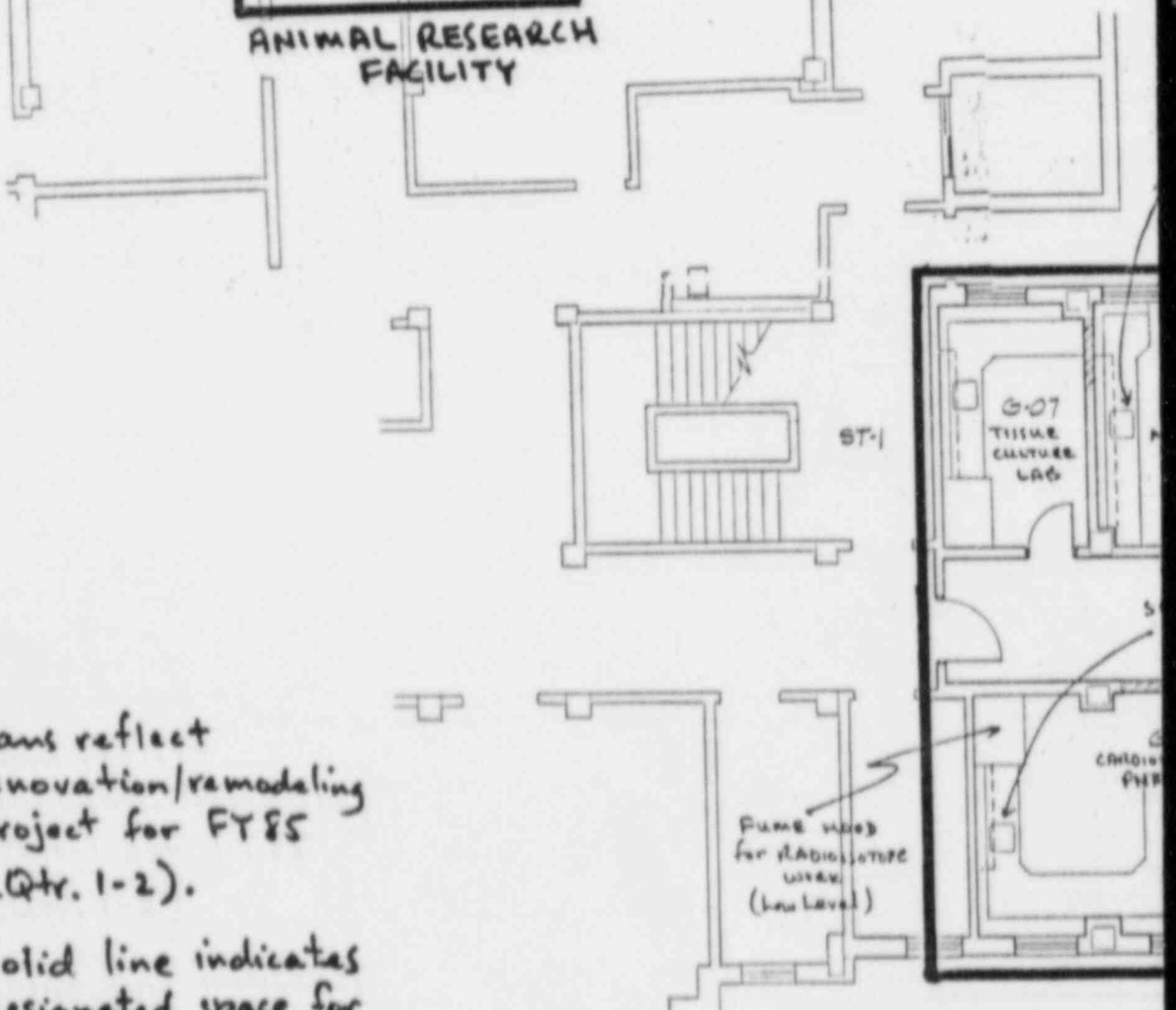

Nuclear Medicine Suite
Boise VAMC - Bldg 85
fume hood
Lead glass shield
Temporary storage
Temporary shield
generator
2" Lead bricks
Laboratory
decay cal. board
sink
Lead lined ceiling
collimators
Hot Lab
-restricted area-
files
camera
area scan
camera Room
-Restricted area-
console
computer
office
-restricted area-
Ultra Sound
-Restricted area-
Hallway
Waiting area
-unrestricted area-
Hallway
-unrestricted area-
broken scale
Radiology
File Room
scale — 1" = 4 ft.
Radioactive Storage Decay Room
-Restricted area-
Item 11-A
September, 1984
Boise VAMC


Main Laboratory
Boise VAMC
Bldg. 85
RELOCATED CRYOSTAT
HISTOLOGY
202
RELOCATED FUME HOOD
Dedicated sink-low level disposal
Radiation work area
R. L. A.
201
Counting Counter
EQUIPMENT SPACE
SHELVES
RELOCATED BALANCING TABLE
LAB EXPANSION
203
Refrigerator Radionuclide Storage
RELOCATED REFRIGERATOR
REFRIGERATORS
STORAGE
204
SHELVES
RELOCATED FREEZERS
SHELVES
Item 11-B
Scale 1/4" = 1'
September 1984
Boise VAMC

RESEARCH L
&
ANIMAL RESEAR
BOISE V
Bldg.
(Ground



ANIMAL RESEARCH FACILITY



Plans reflect renovation/remodeling project for FY85 (Qtr. 1-2).

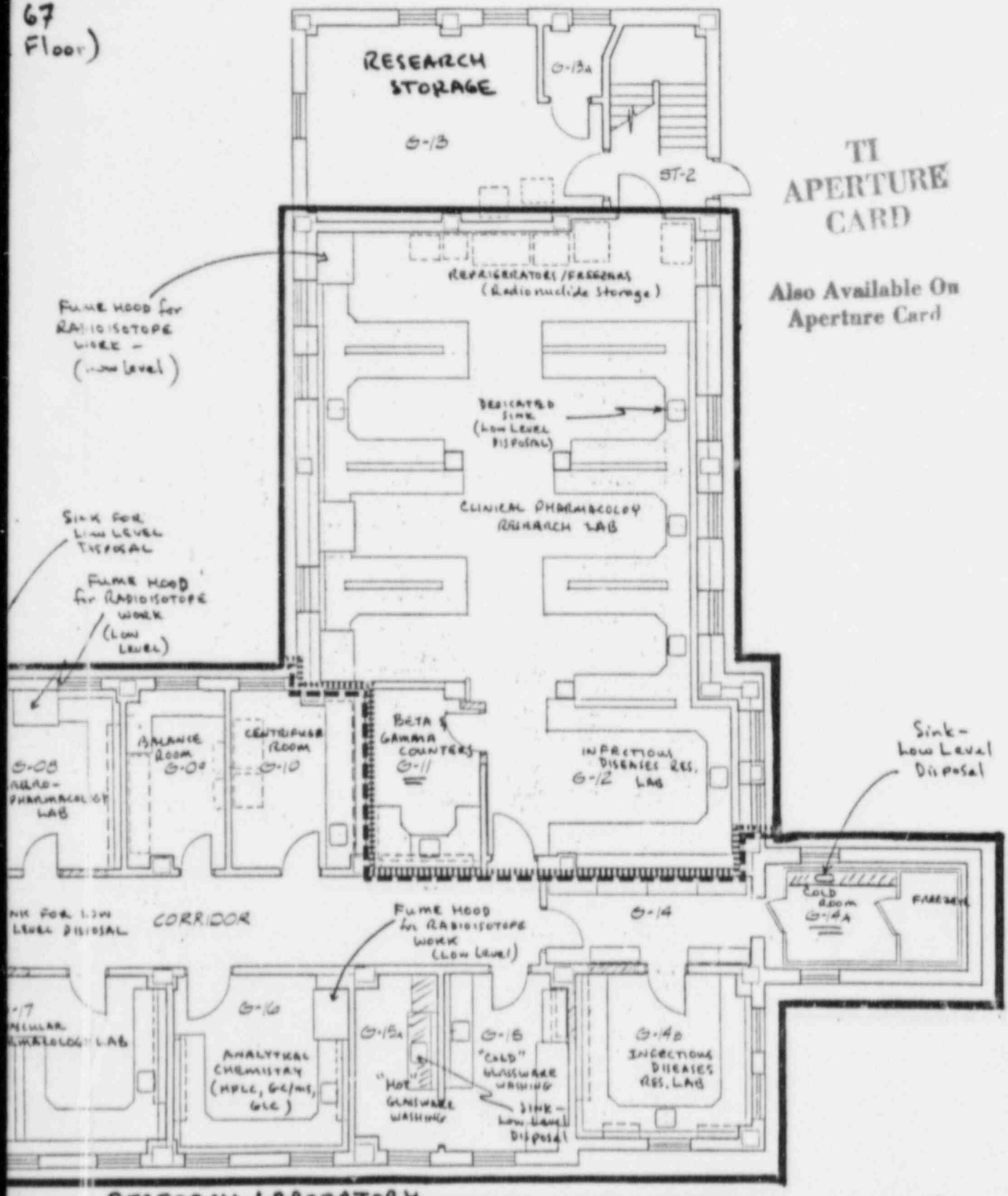
Solid line indicates designated space for research uses of radionuclides.

ABORATORY

CH FACILITY

AMC

67
Floor)



RESEARCH LABORATORY

Item # 11-C
Sept. 1984
Boise VAMC

Veterans Administration

Memorandum

Date: September 28, 1984

From: Acting Chief, Engineering Service (138)

To: Director, Radiation Control (113)

Subj: Nuclear Medicine Exhaust System

1. This memorandum confirms the previous memorandum dated February 29, 1980.

2. The Nuclear Medicine Service at the Boise VA Medical Center occupies rooms G-15, G-15A and G-16 on the ground floor of Bldg. 85.

3. These rooms are served by a Barry model BVF Junior, belted ventilating fan and its associated ductwork system as indicated on the attached sketch.

4. The rooms are completely isolated from the building's recirculating air duct system. The discharge of the exhaust fan is on the rooftop level of the emergency generator room in Bldg. 85. This roof area is restricted from all personnel with the exception of maintenance personnel, who must occasionally work in the area. These personnel will be required to notify Nuclear Medicine Service prior to entering the roof area. Signs indicating this rule will be placed on all doors to the roof area.

5. The roof area has two windows on an adjacent building wall. These windows are within 10 feet of the fan discharge. The building is totally air-conditioned and the windows are kept closed at all times except for maintenance and washing. The windows are operable only with the use of a special key. The space is occupied less than 2 hours per day.

6. The exhaust system has been designed so that the rooms have a negative pressure with respect to the adjacent building spaces.

7. Engineering Service will perform a monthly inspection of the system to check air volumes, motor, and fan conditions as a part of their regular preventative maintenance program. Records of these results will be recorded on a data sheet prepared for this purpose and kept in the Nuclear Medicine area.

Jerome D. Fischer

JEROME D. FISCHER
Acting Chief, Engineering Service

Item #11-D
Sept. 1984
Boise VAMC

TRAINING REQUIREMENTS

	Groups	Content	Hours
1)	New employees, incl. lab workers, nurses, housekeeping, security.	Orientation, where and how ionizing radiation (I.R.) is used at VAMC. Warning Signs, rad'n assoc c patients, security of R.A.M.	2 (repeat annually)
2)	Fertile females, their supervisors and co-workers who are rad'n workers.	Regulatory Guide 8.13 Biol. Eff. of I.R. on the developing embryo/fetus. Carcinogenesis.	1 Hr Lect - Handout R.G. 8.13 and supp. 1 hr Q+A period 1 hr test + CRITIQUE Docum. by Sign.
3)	Rad'n Workers-Chem Lab (In Vitro Studies) (Nuclides covered by General License)	Nature and extent of Rad'n hazard assoc c inhalation of ^{3}H, ^{14}C, ^{125}I. Means for minimizing exposure. Wipe test, air monitoring, area survey methods, DISPOSAL, decontamination, bio assay. record keeping; Quality Control	6 hr Lect + Lab Demo. Practical test of use of G-M, and Scint. survey meter for ^{125}I, LSC for counting of wipes
4)	Rad'n Workers, Research Lab In Vitro + Animal Studies, $\beta\gamma$ radionuclides	All above, i.e., 1,2,3, plus Basic Physics; Nuclear nomenclature, Prod'n of radionuclides Modes and rates of rad'n decay, Interaction of rad'n with matter, range, HVL. Instrumentation; Liquid Scint Chng, Ext. x-ray probes, Survey meter, GM and Ionization Chambers. Personal Dosimetry, Film Badge, TLD, Pocket Dosimeters, air monitors. Dosimetry; Activity units, Ci, and derivatives; Exposure and dose units Roentgen, rad, rem, sievert, gray. Quality Factor, relative Biologic Effect, Dose Equivalent. Calculation of dose from internal emittors. Sources of dose information. Statistics of radioactivity counting; sample size, background, preset time, preset count, mimimal detectable activity, wipe and leak testing,	11 hrs (above) 19 hrs 30 total.

TRAINING REQUIREMENTS (continued)

Groups	Content	Hours
	quality control charts, tests of accuracy and precision of counting. Radiation Biology: Acute effect of excessive exposure to ionizing radiation on selected tissues - the integument, G.I. tract and gonads. Chronic and late effects of I.R. Carcenogenesis, leuk-enogenesis, genetic effects of i.r. Risk estimates, absolute and relative models. Rules and Regulations concerning use of radiation. NRC licensee condition @ VAMC, 10CFR19, 10CFR20, Disposal of Rad. Waste (methods).	

Veterans Administration

Memorandum

Date: September 28, 1984

From: Lawrence L. Knight, M.D.
Director, Radiation Control (113)
Chief, Laboratory Service

To: All Authorized Users of Radioactive Materials (R.A.M.)

Subj: Procurement of Radiation Sources

1. The acquisition, use, storage, disposal and transfer of sources of ionizing radiation, above levels found naturally, are subject to the control of the Radiation Control and Radioactive Drug Research Committee (RCRDRC), at the VAMC, Boise, Idaho.

2. No sources subject to this control may be brought aboard nor removed from the VAMC without proper authorization. To ensure compliance with the terms and conditions of the license issued to the VAMC by the Nuclear Regulatory Commission, the following procedures are required:

a. Purchase:

(1) All orders for purchase, and receipt of sources of ionizing radiation shall be cleared through the Radiation Control Office. Any gifts of radiation sources, or transfer from other institutions or persons shall be cleared through the Radiation Control Office.

b. X-ray Sources:

(1) An authorized user desiring to order X-ray radiation sources shall advise the radiation safety office of this first. The Radiation Safety Officer (RSO) shall arrange for whatever pre-installation surveys are necessary and evaluate shielding requirements and operational conditions which may be imposed on such source.

c. Radioactive Materials:

(1) The authorized user must advise the Radiation Control Office of the identity of the radioactive material, the activity at time of shipment or assay, the chemical/physical form, whether or not the material requires refrigeration or freezing, and the vendor or other source.

(2) The Radiation Control Office (Assistant to Radiation Safety Officer, ext. 7478) shall notify that the activity and form are within the inventory limits established for that investigator. Having determined that the order is within limits, the Radiation Control Office shall assign a control number from a log book maintained in the office. Entry shall be made in this log, along side the assigned number, of the name of the investigator, the activity of radionuclide, its identity, form, refrigeration requirements, and the source.

d. Receiving and Distribution:

(1) All incoming shipments of radioactive materials are directed to the Nuclear Medicine Unit, regardless of the name of the individual addressee. The chief Nuclear Medicine technologist shall store these materials

in the hot lab in refrigerator or freezer if required and immediately notify the Director of Radiation Control and the investigator. The Director of Radiation Control shall verify that the material has been authorized, process it, prepare inventory forms, and either decline or hold for pickup by the investigating agent.

(2) Alternatively, the Director of Radiation Control may authorize delivery of certain shipments of low-level radioactive material direct to the using investigator or department. Under such circumstances, the recipient investigator or service chief is responsible for immediate notification of the Radiation Control Office upon receipt of such material. All other requirements for control of purchase and receipt of R.A.M. as noted above, must be satisfied.

LAWRENCE L. KNIGHT, M.D.
Director, Radiation Control
Chief, Laboratory Service

Schedule for Radiation Safety Officer
or His Agent

AREA	FREQUENCY	BY WHOM
Elution Prep and	Daily	Nuc Med Tech
Injection Areas	Weekly	RSO
Air Flow Monitoring	Weekly	RSO
Lab Areas	Weekly	Tech
	Monthly	RSO
Xe Storage, Use	Weekly	Tech
+ Disposal Area	Monthly	RSO
Leak Tests	Quarterly	RSO
Sealed Sources		
CAL of Survey Meters	Semi-annual	RSO
User Inventories	Monthly	RSO
X-ray Apparatus	Quarterly	RSO
(¼ Each Time)		
Dose Calibrator	Daily	Nuc Med Tech
	Quarterly	RSO
Isotope Comm	Quarterly	RSO
Review of Personnel Badges	Quarterly	RSO
ALAPA System	Quarterly	Director, Radiation Control

Item #17
Sept. 1984
Boise VAMC

DISPOSAL OF RADIOACTIVE MATERIAL VIA SANITARY SEWER SYSTEM

Given: Flow = 2.2×10^6 gallons/month. Source of information: Chief, Engineering Department, Boise VAMC

2.2×10^6 g/month ÷ 30 d/m = 7.3×10^4 gallons/day

7.3×10^4 g/d x 3.785 L/g x 10^3 ml/L = 2.76×10^8 ml/day

MPC ^{125}I = 4×10^{-5} µCi/ml

4×10^{-5} µCi/ml x 2.76×10^8 ml/day = 11×10^3 µCi/day

= 11 millicurie/day

without exceeding MPC.

For radionuclides used at the VAMC in unsealed forms, the one which is most restrictive in terms of maximum permissible concentrations is ^{125}I. Other radionuclides come close to the ^{125}I MPC, such as ^{45}Ca, ^{121}I, ^{62}Ni, ^{32}P and ^{90}Y. We propose to dispose of no more than 1 millicurie total of any or all of these six radionuclides in any given day via sanitary sewer.

Nuclide	MPC 10CFR20, App. B, Table 1, Col. 2
^{45}Ca	3×10^{-4}
^{125}I	4×10^{-5}
^{131}I	6×10^{-5}
^{63}Ni	8×10^{-4}
^{32}P	5×10^{-4}
^{90}Y	6×10^{-4}

Another group of radionuclides which are currently used or may be used in the future include:

Nuclide	MPC Ci/ml
^{42}Ca	1×10^{-3}
^{14}C	2×10^{-3}
^{57}Co	2×10^{-3}
^{53}Co	4×10^{-3}
^{64}Cu	1×10^{-2}
^{18}F	2×10^{-3}
^{198}Au	2×10^{-3}
^{3}H	1×10^{-1}
^{113m}In	4×10^{-2}
^{55}Fe	2×10^{-3}
^{59}Fe	2×10^{-3}

^{54}Mn	$4x10^{-3}$
^{42}K	$9x10^{-3}$
^{75}Se	$9x10^{-3}$
^{24}Na	$6x10^{-3}$
^{85}Sr	$3x10^{-3}$
^{35}S	$2x10^{-3}$
^{99m}Tc	$2x10^{-1}$
^{201}Tl	$9x10^{-3}$
^{65}Zn	$3x10^{-3}$
^{51}Cr	$5x10^{-3}$
^{141}Ce	$3x10^{-3}$
^{95}Nb	$3x10^{-3}$
^{46}Sc	$3x10^{-3}$

We propose to dispose of no more than 10 millicuries total of any or all of these radionuclides in any given day, via the sanitary sewer.

As part of the authorization for individuals to use radioactive material at the VAMC, a condition will be imposed, limiting the amount of radioactive material that any one authorized user may dispose of via designated "hot sinks" in any one day. The purpose of this procedure is to ensure that institutional disposals noted above will not be exceeded, but will allow individuals to dispose of wash and rinse water incidental to decontamination of glassware equipment, floors, tables and drainboards. Authorization will be granted only for soluble or readily dispersible materials.

Inventory sheets (below) will be posted at each "hot sink" for user to indicate their estimations of radioactive materials disposed of each day in this manner. Large volumes of dialysate containing ^{131}I or ^{125}I may be transferred to the Radiation Safety Office for disposal by slow trickle into sewer over extended times, or for storage to allow for decay.

The limits indicated above on disposal of r.a.m. via sanitary sewer system do not apply to ^{3}H and/or ^{14}C in liquid scintillation medium or animal tissue fluids at "de minimus" concentrations or below. The release of radioactive materials into the sewer from excreta of patients and other persons containing radioactive materials are excluded from the limits indicated.

DISPOSAL VIA "HOT SINKS"

Located in Room _____

Authorized Area _____

Radionuclides used in this Lab. _____

Date	Time	Radionuclide	Form	µCi	Initial

Totals

Radionuclide _____ _____ µCi

Radionuclide _____ _____ µCi

Radionuclide _____ _____ µCi

Radiation Safety Officer _____

Medical Center

5th and Fort Streets
Boise, ID 83702

Veterans Administration

September 28, 1984

The Veterans Administration Medical Center in Boise, Idaho would like to apply for 325 mCi possession limit on Xenon-133 gas. The purpose of this gas is to do pulmonary ventilation studies.

Dosage Employed:	Average patient dose - 15 mCi. Higher doses will be used only when professional medical judgement indicates it to be necessary.
Patient Load:	Estimate: A maximum of 5 per week, 260 patients per year.
Source of Radiopharmaceutical:	New England Nuclear Corporation, Diagnostic Division, 601 Treble Cove Road, No., Billerica, MA 01862. Two catalog numbers NRP-186, Gas Calidose dispenser, and NRP-127 Xenon-133 gas in unit dose vials. NDA approved, package insert enclosed.
Imaging Equipment:	Ohio-Nuclear Serial #588, Gamma Camera Model #410.
Special Equipment:	a. Delivery System - Pulmonex Xenon system manufactured by Atomic Products Corporation Center, Moriches, New York 11934. Product literature enclosed. b. Disposal System - Pulmonex System has its own built-in gas trap. See produce literature.
Dose Calibration:	All doses for patient use will be checked immediately prior to administration with a Squibb Dose Calibrator Model No. CRC-17. Product literature enclosed.
Personnel Safety:	All personnel working in the department will use whole body TLD badges as well as TLD finger badges.

Description of Storage Area (Hot Lab):

The Xenon-133 gas will be stored in its 1/8 inch thick lead shipping container within the storage cave, under fume hood, until required. A description of the hot lab cave is enclosed in this application (facilities and equipment). The radiation monitoring equipment and radiological safety procedures are the same when Xenon-133 is to be used as previously described in license application dated March 7, 1980. In addition, a fume hood has been installed over the storage cave and its associated work area. This hood will operate on a continual basis with an air flow volume of 300 cfm. (See enclosed drawing). The total volume of the nuclear medicine hot lab is 1350 cubic feet. Air can enter the suite through ceiling vents, and doors. All air leaving the suite is through exhaust vents or the fume hood which also keeps the suite at a slight negative pressure relative to the environ. The maximum concentration of Xenon-133 over 168 hours in seven consecutive days for this restricted area has been calculated on the following basis:

a. Maximum amount of Xenon-133 activity per week is 325 mCi. (Xenon-133 traps will be stored in this area when not is use, (Storage of new and used also here).

b. Estimated escape fraction (maximum Xenon-133 activity lost due to leakage and inadvertent release while in storage is 0.05.

c. Air flow volume will be 300 cfm.

Therefore using the above data and appropriate conversion factors C can be calculated.

$$C = \frac{A}{V} \times f = \frac{(325\ mCi)\ \ (1 \times 10^{3})\ \mu Ci/ml}{(300\ cfm)\ \ 2.85 \times 10^{8}\ ml/wk/cfm} \times 0.05 =$$

$1.9 \times 10^{-7}\ \mu Ci/ml$ per 168 hr. week

This verifies that the MPC of 1×10^{-5} $\mu Ci/ml$ as stated in section 20.103 CFR Part 20 and Schedule B, Table 1 of Part 20 will not be exceeded. In fact it is less than 2% of MPC.

MAXIMUM CREDIBLE ACCIDENT

Loss of Xenon in hot lab short prevail of time.

325 mCi x 10^3 μCi/mCi = 3/25 x 10^5 μCi

Room Vol = 1350 cu ft x 28.3 L/cu ft = 3.82 x 10^4 L.

If assume rapid complete mixing,

$$\text{initial conc.} = \frac{3.25 \times 10^5 \mu Ci}{3.82 \times 10^4 \text{ L} \times 10^3 \text{ ml/L}} = 8.5 \times 10^{-3} \mu Ci/ml$$

$$\frac{8.5 \times 10^{-3} \mu Ci/ml}{10^{-5} \mu Ci/ml (MPC)} = 850 \times MPC$$

If room air renewal rate is 300 CFM, and Vol = 1350 Cu Ft, then

$$\text{fractional renewal/min} = \frac{300}{1350} = 0.222$$

Room air $T_{\frac{1}{2}}$ is then $\frac{0.693}{0.222}$ = 3.12 min

To reduce to MPC, from 850 x MPC would take

$$1 = 850 \text{ L} - 0.693t/3.12$$

$$t = 10 \times T_{\frac{1}{2}} = 31 \text{ min}$$

In the event of an accident release of the Xenon-133 in this area, the following procedure will be implemented:

The hot lab will be immediately evacuated of any patients and other personnel. The hot lab will be sealed (doors closed) off from re-entry for a period of 30 minutes. This will allow for reduction of air conc. by a factor of 1/800 (see attached memo and diagram from chief of maintenance). Before re-entry the room will be surveyed with the Low-Level survey meter to insure the radiation levels have returned to normal for the area. The 30 minute period will ensure dilution of the Xenon on air based upon the following calculation:

$$C = Co \frac{1}{2^{30/3.12}}$$

The air which is exhausted from this room is released directly into an unrestricted area located directly above the nuclear medicine suite. This roof area will be checked for any maintenance personnel and evacuated for a period of two hours in the event of an accidental release of Xenon-133. This release point is isolated from all air intakes and

adjacent building by a distance exceeding 5 feet (building), (air intake 150 ft.). The calculations for the unrestricted area are presented at the end of the utilization discussion.

Description of Procedure:

The Xenon-133 gas will be used in the following manner. Xenon will be stored inside its lead container (manufacturer supplied), behind 2 inch lead bricks under the fume hood. When needed for patient use, the Xenon-133 vial will be removed from the lead shielding, utilizing rubber gloves, and long forceps placed in the dose calibrator for calibration, and returned to fume hood. The patient will be instructed on the details of the procedure with special emphasis on the area where his/her cooperation is needed. Just prior to the study, one or more practice runs will be done before the Xenon-133 gas is used. Utilizing rubber gloves and long forceps and working behind a lead glass shield in the fume hood, the unit dose vial will be loaded into the shielded calidose dispenser furnished by New England Nuclear. It will then be taken to the imaging area where the lung ventilation procedure will be done. The dispenser will then be affixed to the Pulmonex lung breathing apparatus. The Xenon-133 gas will be administered to the patient via this unit. The patient will have the mouthpiece from the Pulmonex system in his mouth, nose clamps will be used to prevent the patient from exhaling the Xenon-133 into the room. The patient will then be instructed to take a deep breath in and hold it, then to breathe naturally into the Pulmonex system as the technician operates the remote control switch of the unit. The patient will be allowed to breathe only through the Pulmonex system until all Xenon-133 is cleared from the lungs. (Approximately 4 minutes).

Description of Imaging Room (utilization area):

All Xenon-133 lung ventilation procedures will be performed in the camera room as shown on the enclosed diagram. Air will enter this room through the door and two ceiling vents. The air can only leave the nuclear medicine suite via a ceiling vent which has a measured air volume rate of 190 CFM. This vent is connected to the exhaust duct of the fume hood in the hot lab. This room has a slight negative pressure at all times. The maximum concentration of Xenon-133 for this restricted area is calculated below:

a. Maximum amount of Xenon-133 per week 75 mCi. Estimate based on patient use noted above.

b. Estimated escape fraction (maximum Xenon-133 activity lost due to leakage and inadvertent release) is 0.25.

c. Air flow volume is 190 cfm in this room.

Therefore using these values and appropriate conversion factors, C can be calculated.

$$C = \frac{A}{V} \times f = \frac{(75\ mCi)\ (1 \times 10^{3})}{(190\ cfm)\ (6.797 \times 10^{7})}\ 0.25$$

$$= 1/4 \times 10^{-6}\ \mu Ci/ml \text{ per 40 hr. week}$$

This verifies that the MPC of 1×10^{-5} μCi/ml as stated in Section 20.103 CFR, Part 20 and Schedule B, Table 1 of Part 20 will <u>not</u> be exceeded.

The maximum concentration of Xenon-133 for the unrestricted area, the roof exhaust, is calculated below:

(325 x 0.05) + (75 x 0.25) = 35 millicuries per week lost

35 mCi/wk x 52 wks/yr = 1820 mCi = 1.82×10^{6} μCi

b. Total air volume from all areas equal 1030 cfm. (Hot lab + storage area + mechanical room + imaging room). These are added together because they are dumping into the same exhaust duct which leads to the roof.

Therefore using the preceding values and appropriate conversion factors, C can be calculated.

$$C = \frac{A}{V} = \frac{1.82 \times 10^{6}\ \mu Ci\ Lost}{1030\ CFM \times 2.83 \times 10^{4}\ ml/cu\ ft \times 5.24 \times 10^{5}\ min/year}$$

$$= 1.2 \times 10^{-7}\ \mu Ci/ml$$

NOTE:

Hot Lab	300 cfm
Camera Room	190 cfm
Storage Area	50 cfm
Mechanical Room	490 cfm

This verifies that the MPC of 3×10^{-7} μCi per ml as stated in Section 10.106 10 CFR, Part 20 and Schedule B, Table 2 of Part 20 will not be exceeded, and that Section 20.1 (c) of 10 CFR, Part 20 is being complied with.

<u>Maximum Credible Accident for Imaging Room</u>.

1. Loss of a single dose vial of 15 millicuries, suddenly, with prompt mixing within imaging suite.
   Room Volume 1850 cu ft x 2.83×10^{4} ml/cu ft = 5.23×10^{7} ml
   Room air exhaust flow 190 cu ft/ min
   $$\text{Initial concentration} = \frac{1.5 \times 10^{4}\ \mu Ci}{5.23 \times 10^{7}\ ml} = 2.87 \times 10^{-4}\ \mu Ci/ml$$

   This initial concentration is equivalent to 28.7 times the MPC (air) 40 hrs/wk for radiation worker. In fact, if this release

went unnoticed, and if room air fractional replacement were 190 cu ft/min ÷ 1850 cu ft = 0.1 replaced per minute, the room air half time would be $\frac{0.693}{0.1}$ = 7 minutes

Given that $Cf = Co\ (e^{\frac{-.693t}{7}})$ it would take t = to ~5 times the half time of room air renewal to reduce Cf to less than MPC (air) 40 hr/wk.

The entire exposure in this environment during time for complete removal of the Xenon would be equivalent to exposure at Co (28.7 x MPC) for only $\frac{7}{0.693}$ = 10 minutes.

In summary, the exposure to individuals in this room during this entire period would be equivalent to exposure @ 28.7 x MPC for 10 minutes, or a cummulative exposure of $28.7 \times \frac{10}{60} = 4.87$ MPC Hours, i.e., equivalent to exposure at MPC for a total of 4.87 hours. In view of this, immediate removal of staff and certain patients is not indicated. Personnel should be asked to leave quietly by the chief Nuclear Medical Technologist if their services are not needed to provide patient care. Patients undergoing clinical studies may, depending on circumstances, continue with their study. It is not advisable to remove the patient who is undergoing the Xenon study. When patient studies are completed, and they have left, personnel may remove themselves for 35 minutes to allow room ventilation, and then return after a radiation survey by RSO or designate has revealed no increased conc of Xenon-133 at floor level. The 35 minutes will insure changes of air in these rooms based upon the following calculations:

$$Cf = Co \frac{1}{2^{t/T_{\frac{1}{2}}}}$$

$Cf/Co = 1/32$ for $t = 5 \times T_{\frac{1}{2}}$

The Disposal Phase:

The disposal of the Xenon-133 gas will be done by trapping the Xenon-133 gas in the Pulmonex system. The method used is that of absorption of the Xenon-133 gas into a charcoal trap. This is enclosed in its own lead casing which is inside the lead lined Pulmonex system. To check if the system is leaking, we attach a Xenalarm, Xenon-133 trap monitor to the Pulmonex system. Should the area concentrations exceed 1×10^{-2} μCi/ml, than a warning light comes on and a buzzer sounds. Appropriate action is taken to lower the Xenon-133 levels. The Xenalarm system was calibrated by the Atomic Products Company before shipping and instructions for calibration were included, and these instruction are followed. Periodic checks and records are maintained.

When the Pulmonex system is not in use, it is stored in the hot lab next to the fume hood. Weekly, after the last Xenon-133 lung ventilation study each week, a physical sample of the trapped effluent is counted. This procedure consists of filling a polyethylene bag with air out of the Pulmonex tray system. The bag is sealed and placed in front of the gamma camera and counted for one minute on the appropriate settings. The counts per minute are recorded in a record log and compared with previous readings. A replacement filter is installed whenever there is a significant increase in the weekly CPM. The saturated filter is placed in a plastic bag, using rubber gloves and tongs, then into a radiation waste barrel in the hot lab. When a survey shows no activity above background, it is disposed of in the normal trash.

Equipment Operation and Monitoring for Leakage:

a. The Calidose Dispenser Delivery System is checked prior to use to insure proper operation. The manufacturer's operating instructions are followed:

b. The Pulmonex lung unit is checked weekly for leaks by filling with air and checking for leakage. Its operation is checked during the practice runs prior to administration of the Xenon-133 gas. The manufacturer's operating instructions are followed.

c. The Xenon trap will be monitored with the Xenalarm. The Xenon trap will be checked prior to each ventilation procedure to insure that it is securely connected to the unit.

d. All exhaust vents will be checked quarterly to confirm their continued efficiency. In addition, they will be checked whenever structural changes are made that could affect their efficiency. The air flow will be checked with a volumetric air balance flow hood. A record of the quarterly checks will be maintained in the nuclear medicine department.

Facilities and Equipment:

The nuclear medicine suite is located below ground level and two walls are outside walls, while the other wall is adjacent to the radiology department. The ultrasound room houses the nuclear medicine technician office as well as ultrasound equipment. The camera room and hot lab room make up the rest of the nuclear medicine suite. In addition, a storage room for spent generator decay, etc. is located down the hall from the nuclear medicine suite. These area are all classified as restricted areas. The halls adjacent are unrestricted areas.

All counter tops are stainless steel with a stainless steel sink and fume hood. The floor is asphalt vinyl tile. The refrigerator has a 1/8 inch thick lead lining on all sides, top and bottom. The storage and work area under the fume hood are lined with 2 inch lead bricks. A leaded glass barrier is installed to facilitate work in the hot lab. The used Xe^{133} + Mo^{99} generators are stored in the storage room behind 2 inch lead bricks.