AUG 6 1984

St. John's Hospital
Teton County Hospital District
ATTN: Charles S. Everts, M.D.
P.O. Box 428
Jackson, Wyoming 83001

Gentlemen:

Enclosed is Check 33048 ($150) and voucher which accompanied your recent application for renewal of Materials License 49-18276-01.

Section 170.11(a)(9) of Part 170, copy enclosed, provides that no fees will be required for "A license for possession and use of byproduct material, source material, or special nuclear material applied for by, or issued to an agency of a State or any political subdivision thereof." The St. John's Hospital is, therefore, exempt from payment of license fees.

Your application has been sent to the Licensing staff for processing.

Sincerely,

Original Signed By
Glenda Jackson

Glenda Jackson
License Fee Management Branch
Office of Administration

Enclosures:
1. Check 33048 ($150) and Voucher
2. 10 CFR 170

DISTRIBUTION:
Pending Fee File
Weekly Reading File
Materials Reading File

OFFICE	LFMB:ADM	LFMB:ADM				
SURNAME	FBrown:rej	GJackson				
DATE	8/6 /84	8/6 /84				

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

St. John's Hospital
Teton County Hospital District
Jackson, Wyoming 83001

TELEPHONE NO.: AREA CODE (307) 733 3636

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

Same

2. PERSON TO CONTACT REGARDING THIS APPLICATION

Charles S. Everts, M.D.

TELEPHONE NO.: AREA CODE (307) 733 3636

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

a. ☐ NEW LICENSE
b. ☐ AMENDMENT TO LICENSE NO. _____
c. ☒ RENEWAL OF LICENSE NO. 49-18276-01

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

Charles S. Everts, 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.)*

Charles S. Everts, M.D.
See Supplement A; Attached

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		AS NEEDED
10 CFR 35.100, SCHEDULE A, GROUP II	X	AS NEEDED
10 CFR 35.100, SCHEDULE A, GROUP III	X	2000
10 CFR 35.100, SCHEDULE A, GROUP IV		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	3000

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

RECEIVED BY LFMB
Date: 8/1/84
Log: Aug-III
By: d
Orig. To
Action Compl. 8/2/84

Applicant 33048 #150-EX
Check No. Check Rec'd
Amount/Fee Category 8/1/84
Type of Fee
Date Check Received
Received By: Jackson

'84 JUL 30 A11:10

17901

NRC FORM 313M (9-81)

FEE EXEMPT code 170.11(a)(9)/14

17901

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: Oct, 1980

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
X	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
X	Appendix D Procedures Followed for Dose Calibrator; or *(Check One)*
	Equivalent Procedures Attached
11. FACILITIES AND EQUIPMENT	
X	Description and Diagram Attached
12. PERSONNEL TRAINING PROGRAM	
X	Description of Training Attached
13. PROCEDURES FOR ORDERING AND RECEIVING RADIOACTIVE MATERIAL	
X	Detailed Information Attached
14. PROCEDURES FOR SAFELY OPENING PACKAGES CONTAINING RADIOACTIVE MATERIALS *(Check One)*	
	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
	Equivalent Procedures Attached
20. THERAPEUTIC USE OF SEALED SOURCES	
	Detailed Information Attached; and
	Appendix L Procedures Followed; or *(Check One)*
	Equivalent Procedures Attached
21. PROCEDURES AND PRECAUTIONS FOR USE OF RADIOACTIVE GASES (e.g., Xenon – 133)	
X	Detailed Information Attached
22. PROCEDURES AND PRECAUTIONS FOR USE OF RADIOACTIVE MATERIAL IN ANIMALS	
	Detailed Information Attached
23. PROCEDURES AND PRECAUTIONS FOR USE OF RADIOACTIVE MATERIAL SPECIFIED IN ITEM 6.b	
	Detailed Information Attached

24. PERSONNEL MONITORING DEVICES

TYPE (Check appropriate box)			SUPPLIER	EXCHANGE FREQUENCY
a. WHOLE BODY	X	FILM	Searle Diagnostics, Inc.	Monthly
		TLD	Health Physics Services	
		OTHER (Specify)	Box 1367 Des Plaines, IL 60018	
b. FINGER	X	FILM	Searle Diagnostics, Inc.	Monthly
		TLD	Health Physics Services	
		OTHER (Specify)	Box 1367 Des Plaines, IL 60018	
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

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 SS170.11 Part A Paragraph 9

(2) LICENSE FEE ENCLOSED: $ Exempt

b. APPLICANT OR CERTIFYING OFFICIAL *(Signature)*

(1) NAME *(Type of Print)*

(2) TITLE

c. DATE

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
Charles S. Everts, M.D.	Wyoming, Utah

3. CERTIFICATION

SPECIALTY BOARD A	CATEGORY B	MONTH AND YEAR CERTIFIED C
American Board of Radiology	Diagnostic Radiology	Board Eligible

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	1) University of Utah Medical Center, 1971-1974, Radiology Resident 2) Montana State University	90	20
b. RADIATION PROTECTION	1) University of Utah Medical Center, 1971-1974, Radiology Resident 2) Montana State University	20	
c. MATHEMATICS PERTAINING TO THE USE AND MEASUREMENT OF RADIOACTIVITY	1) University of Utah Medical Center, 1971-1974, Radiology Resident 2) Montana State University	20	
d. RADIATION BIOLOGY	1) University of Utah Medical Center, 1971-1974, Radiology Resident	30	
e. RADIOPHARMACEUTICAL CHEMISTRY	1) University of Utah Medical Center, 1971-1974, Radiology Resident	20	20

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

ISOTOPE	MAXIMUM AMOUNT	WHERE EXPERIENCE WAS GAINED	DURATION OF EXPERIENCE	TYPE OF USE

NRC FORM 313M SUPPLEMENT B
(9-81)

U. S. NUCLEAR REGULATORY COMMISSION

PRECEPTOR STATEMENT

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

1. APPLICANT PHYSICIAN'S NAME AND ADDRESS

FULL NAME

Charles S. Everts, M.D.

STREET ADDRESS

St. John's Hospital
Teton County Hospital District

CITY	STATE	ZIP CODE
Jackson	WY	83001

KEY TO COLUMN C

PERSONAL PARTICIPATION SHOULD CONSIST OF:

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

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

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

2. CLINICAL TRAINING AND EXPERIENCE OF ABOVE NAMED PHYSICIAN

ISOTOPE A	CONDITIONS DIAGNOSED OR TREATED B	NUMBER OF CASES INVOLVING PERSONAL PARTICIPATION C	COMMENTS *(Additional information or comments may be submitted in duplicate on separate sheets.)* D
I-131 or I-125	DIAGNOSIS OF THYROID FUNCTION		See previous license application License No.: 49-18276-01
	DETERMINATION OF BLOOD AND BLOOD PLASMA VOLUME		
	LIVER FUNCTION STUDIES		
	FAT ABSORPTION STUDIES		
	KIDNEY FUNCTION STUDIES		
	IN VITRO STUDIES		
OTHER			
I-125	DETECTION OF THROMBOSIS		
I-131	THYROID IMAGING		
P-32	EYE TUMOR LOCALIZATION		
Se-75	PANCREAS IMAGING		
Yb-169	CISTERNOGRAPHY		
Xe-133	BLOOD FLOW STUDIES AND PULMONARY FUNCTION STUDIES		
OTHER			
Tc-99m	BRAIN IMAGING		
	CARDIAC IMAGING		
	THYROID IMAGING		
	SALIVARY GLAND IMAGING		
	BLOOD POOL IMAGING		
	PLACENTA LOCALIZATION		
	LIVER AND SPLEEN IMAGING		
	LUNG IMAGING		
	BONE IMAGING		
OTHER			

PRECEPTOR STATEMENT *(Continued)*

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

ISOTOPE A	CONDITIONS DIAGNOSED OR TREATED B	NUMBER OF CASES INVOLVING PERSONAL PARTICIPATION C	COMMENTS *(Additional information or comments may be submitted in duplicate on separate sheets.)* D
P-32 *(Soluble)*	TREATMENT OF POLYCYTHEMIA VERA, LEUKEMIA, AND BONE METASTASES		
P-32 *(Colloidal)*	INTRACAVITARY TREATMENT		
I-131	TREATMENT OF THYROID CARCINOMA		
	TREATMENT OF HYPERTHYROIDISM		
Au-198	INTRACAVITARY TREATMENT		
Co-60 or Cs-137	INTERSTITIAL TREATMENT		
	INTRACAVITARY TREATMENT		
I-125 or Ir-192	INTERSTITIAL TREATMENT		
Co-60 or Cs-137	TELETHERAPY TREATMENT		
Sr-90	TREATMENT OF EYE DISEASE		
	RADIOPHARMACEUTICAL PREPARATION		
Mo-99/ Tc-99m	GENERATOR		
Sn-113/ In-113m	GENERATOR		
Tc-99m	REAGENT KITS		
Other			

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

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

a. NAME OF SUPERVISOR

b. NAME OF INSTITUTION

c. MAILING ADDRESS

d. CITY

5. MATERIALS LICENSE NUMBER(S)

6. PRECEPTOR'S SIGNATURE

7. PRECEPTOR'S NAME *(Please type or print)*

8. DATE

NRC FORM 313M SUPPLEMENT B
(9-81)

GPO 890-913

St. John's Hospital
P.O. BOX 428
JACKSON, WYOMING 83001
(307) 733-3636

Re: License 49-182-76-01-Renewal

NRC 313M

ADDENDUM

Additional experience and training of RSO-User Charles S. Everts, M.D.

Charles S. Everts, M.D. has received additional training and experience in use of diagnostic radioisotopes as follows: Above-mentioned is qualified for the MA Physician's Recognition Award in continuing medical education in diagnostic radiology. The following journals are received and read: (1) Seminars in Nuclear Medicine; (2) Clinical Nuclear Medicine; (3) American Journal of Roentgenology; (4) Radiology; (5) Journal, Canadian Association of Radiologists; (6) American College of Radiology Self-Evaluation Programs; (7) Saunders Monographs and Clinical Radiology; (8) Radiologic Clinics of North America.

AMERICAN MEDICAL ASSOCIATION

Physician's Recognition Award

CHARLES S EVERTS MD

has fulfilled the requirements for the
Physician's Recognition Award
in Continuing Medical Education

Valid until FEBRUARY 1, 1986

President

Executive Vice President

NRC - 313M

Section 7 MEDICAL ISOTOPES COMMITTEE

A. Committee Authority

The Medical Isotopes Committee is established by the authority of the Hospital Administrator and the Governing Body of Teton County Hospital District as the administrative body responsible for the safe use of radionuclides within the institution.

B. Committees, Duties and Responsibilities

1. Review and grant permission for, or disapprove, the use of byproduct material for all uses within the institution from the standpoint of radiological health and safety of patients or working personnel and other factors which the committee may wish to establish for medical use of byproduct materials prior to submission of an application to the Nuclear Regulatory Commission for licensing action.
2. Prescribe special conditions that will be required during a proposed use of byproduct material such as requirements for bioassays and physical examination of user, minimum level of training and experience of users.
3. Receive and review records and reports from the Radiation Safety Officer and other individuals delegated responsibility for health safety practices in the institution.
4. Recommend remedial action to correct safety infractions.
5. Formulate and review the institutional training programs for the safe use of radioisotopes.
6. Maintain written record of actions taken by the committee.
7. Inform the Nuclear Regulatory Commission of any changes in Committee Membership.
8. The committee shall, when appropriate:

   a. Review safety aspects to consider special cases or problems of the program.
   b. Review record keeping procedures of the committee.
   c. Review methods of record keeping and receipts, transfers and disposals of all radioactive materials within the institution.
   d. Review provisions for initiating corrective action as necessary to assure radiation safety.

NRC - 313M

Section 7 (Continued)

C. Meeting frequency annually, or more frequently as required.

D. Committee members include:

Charles S. Everts, M.D., Chairman and Radiation Safety Officer, Diagnostic Radiologist (see experience as listed in Supplement A).

William Fogarty, M.D., Pathologist

Robert Lippard, Administrator

Julie Huot, R.N., Nursing Service

Bruce Hayse, M.D., F.P.

NRC - 313M

Section 9 INSTRUMENTATION

A. Survey Instruments

1. Picker Geiger-Mueller Survey Meter, Model 655-186 with Beta, Gamma, Geiger Probe. Five ranges are available including 0-0.2, 0-2, 0-20, 0-200, and 0-2000 mR per hour.

   The Survey Meter capable of low level (0.1 mR per hour) and high level (1 R per hour) will be kept available, calibrated and operational at all times. Survey instruments will be calibrated to ±10% of full scale.

2. MiniMonitor 125 Contamination Monitor, Model 05-572 with thin-window G.M. detector. Three ranges are available including 0-500, 0-5000, and 0-50000 cpm (accuracy ±10% of full-scale). Sensitivity is approximately 5000 cpm per uCi of I-125 for a point source placed 5 mm from the detector window.

B. Dose Calibrator

1. Picker Digital Isotope Dose Calibrator Model 632-507 with energy range of 25 KeV to 3 MeV and activity levels from 1 uCi to 999 mCi, or an instrument to meet or exceed these specifications. (May be purchased in the future).

C. Diagnostic Instruments

1. General Electric Maxicamera 400A (1984 model)

2. Pulmonex Xenon System - xenon delivery system with built-in xenon gas trap (charcoal) for rebreathing, washout, perfusion, and single-breath studies. (May be purchased in the future).

NOTE:

Radioisotopes will be purchased on a unit dose basis from:

Nuclear Pharmacy, Inc.
1201 E. 17th Street
Denver, CO 80218

a. See attached protocol for alternative measurement of activity of radioisotope doses.

NRC - 313M

Section 10 CALIBRATION OF INSTRUMENTS

I. A. The following standards will be purchased as required for calibration and tests for dose calibrator:

1. Cesium-137 standard 200 uCi ±5%.

* 2. Cobalt-57 standard 5 mCi ±5%.

* 3. Barium-133 standard 250 uCi ±5%.

* Sources 2 and 3 will be purchased when generator and dose calibrator are used.

B. A standard source of 1 to 3 uCi ±5% of Cs-137 will be used as reference check source fot the survey meter.

II. Methods of Calibration

1. The survey meters will be calibrated as follows:

a. The survey meters will be checked daily or before each use with a check source. In addition, a battery check will be obtained daily or before each use. Daily constancy and reference check will be done with the Co-57 (5 mCi ±5%) source.

b. Once each year, the instruments will be calibrated to within ±10% of the values for each point checked by the manufacturer or by an outside contractor.

2. a. The methods used to monitor the dose calibrator will be those described in Section Two of Appendix D of NRC Regulatory Guide 10.8 (Revision 1, October, 1980).

b. The activity of the Tc-99m source used to perform linearity tests on the dose calibrator will be equivalent to the maximum activity that is assayed in clinical situations or maximum daily order of pertechnetate.

Section 10 (Continued)

3. The G.E. Maxicamera 400A will be subjected to quality control tests and loading procedures per enclosed materials.

4. Logs of each calibration or monitoring will be maintained.

NRC - 313M

Section 11 FACILITIES AND EQUIPMENT

A. The Nuclear Medicine Laboratory consists of one area located on the ground floor of the hospital. This floor plan will meet the requirements of exposure levels for the posted, restricted areas and unrestricted areas as set forth in 10 CFR 20.101 and 10 CFR 20.105 respectively.

B. Receipt and Storage of Radioactive Materials

1. All radioactive materials will be received and logged in the hot lab of the Nuclear Medicine Laboratory.
2. If purchased, a ^{99m}Tc generator will be shielded by a total of 7 cm of lead. An additional 5-cm thickness of lead (bricks) will be placed on the sides of the generator. A block of the shielding is removed in order to elute the generator. The additional shielding will remain around the generator until it is removed to the hot storage area which is located in a remote area in the emergency generator room of the hospital basement.
3. With the exception of th ^{99m}Tc generator, and standards described in Section 10, Part 1, all radioactive materials will be stored in the original shipping containers in a cave 5-cm thick in the refrigerator just below the cabinet where the generator is located. Standards 1-4 listed in Section 10 will be stored in a 1-inch thick lead container. Sufficient shielding will be placed around the 0.2 mCi Cs-137 source to reduce exposure to 2 mR/hr at 15 cm from the source.
4. Waste materials, old generators, needles and syringes and other contaminated items will be stored for decay in the hot storage area. The hot storage area is located such that only limited occupancy is likely. If needed, sufficient shielding will be installed to reduce exposure in the hot storage area to 2 mR/hr at the exterior walls. These items will remain in their shipping containers, in lead shielded boxes or in plastic-lined boxes until their disposal.
5. Posted areas including the scanner room, the hot lab, and hot storage area will be locked when not in use. Only informed, responsible persons will be permitted keys to these areas.

Section 11 (Continued)

C. Preparation and Handling of Radioactive Materials

The Nuclear Medicine Laboratory offers tile floors and formica-sufaced counter tops. Counter tops will be covered with polyethylene-backed absorbent paper. All radiopharmaceuticals for administration to patients will be prepared in the Nuclear Medicine hot lab areas as follows:

1. ^{99m}Tc generator will be eluted directly into a shielded vial.
2. Generator eluate and other bottled pharmaceuticals will be removed from shielding via 12-inch tongs for purposes of observation and/or vial assay. Transfer of radioactive materials will be ahieved via needle and syringe or pipette. If pipetting is required, only suction devices such as rubber bulbs or specifically-adapted disposable syringes or automated pipetting devices will be used.
3. Appropriate shielding will be employed by the radiation worker during handling of radioactive materials. This will be accomplished with the use of lead pigs (such as shipping containers), lead sheeting, lead shielded syringes and lead bricks. Manufacturer specifications for each pharmaceutical preparation will be followed to minimize exposure. Each radioactive materials preparation will be assayed via well ionization chamber.
4. Doses or radiopharmaceuticals will be withdrawn from shielded vials and placed in lead pigs until assay and/or administration. Technetium-99m preparations or any other radioactive materials will be routinely withdrawn and injected into shielded syringes. Each patient dose will be assayed via well ionization chamber or alternative method described herein.

D. Administration of Radioactive Materials and Patient Procedures

1. The Nuclear Medicine imaging area offers a tiled floor with sufficient area for administration of radiopharmaceuticals to patients. Patient examination via gamma camera will occur in this room.
2. Administration of radiopharmaceuticals to patients will occur only in the imaging room or

Section 11 (Continued)

in the patient's room in the hospital.

E. No in-vivo/in-vitro or radioimmunoassay procedures requiring pipetting of patient specimens, manipulation of specimens and counting of test tubes containing radioactive materials are to be instituted at this time.

NRC - 313M

Section 12 PERSONNEL TRAINING PROGRAM AND FREQUENCY

A. Radiation workers

1. Radiation workers will be provided with materials for continuing education in the form of books, journals, discussions or scientific meetings.
2. Discussions will include recent topics in journals relating to new or varied procedures, radiation safety review and radiopharmaceutical development.
3. Recent publications including the "Journal of Nuclear Medicine" will be provided.
4. Radiation workers will be instructed as to the terms and conditions of the NRC license and will be kept informed and required to read applicable NRC regulations.

B. Other personnel

1. All personnel potentially coming in contact with radioactive materials including nurses, housekeeping, and security personnel will be informed of the locations and potential hazards of radioactive materials stored in each location.
2. Nursing personnel will be informed of the proper procedures for handling radioactive patients.
3. Housekeeping will be informed of the areas which they may clean and refuse items which they may remove.
4. Security will be informed of the potential hazards in case of theft, fire and storm damage.
5. Individuals who work in or frequent any portion of a restricted area will receive instruction as specified in 10 CFR 19.12.

C. Information of the above described nature will be give through routine inservice education at the time of employment and annually thereafter.

NRC - 313M

Section 13 PROCEDURES FOR ORDERING AND RECEIPT OF RADIOACTIVE MATERIALS

A. Before ordering radioactive materials, the user will determine that the needed order will (when received and combined with on-hand materials) not exceed authorized possession limits.

B. The supplier of the radioactive materials will be instructed to deliver radioactive materials directly to the Nuclear Medicine Laboratory, or if after hours, to the Head Nurse of the Emergency Room area or security personnel, who will transfer the materials to the Nuclear Medicine hot lab area.

C. It is the responsibility of the Nuclear Medicine Technologist to assay the received radioactive materials, survey the shipping container for leakage and to record the amounts of materials received.

D. Survey of the shipping container will be achieved with the use of the Survey Meter.

E. Leakage or shipping container contamination will be reported to the supplier within 48 hours of discovery.

F. See Section 14 for procedures for safely opening packages containing radioactive material.

NRC - 313M

Section 14 PROCEDURES FOR SAFELY OPENING PACKAGES CONTAINING RADIOACTIVE MATERIAL

A. Receiving

1. Radioactive materials (RM) will normally be delivered directly to the Nuclear Medicine area during working hours.
2. Should the Nuclear Medicine area be closed, the materials will be delivered to the Head Nurse of the Emergency Room. The Emergency Room Nurse on duty will immediately deliver the materials to the Nuclear Medicine hot lab and immediately notify the Nuclear Medicine personnel of such action.
3. It will be the responsibility of the Radiation Safety Office and the Nuclear Medicine Technologist to arrange with the various delivering agencies the proper location for delivery of radioactive materials.

B. Package Manipulation (all packages of radioactive material).

1. All packages of radioactive material will be presumed contaminated. Rubber gloves will be worn by all personnel handling boxes of radioactive material including the Emergency Room Nurse on duty.
2. Only the Radiation Safety Officer or the Nuclear Medicine Technologist may open packaged radioactive materials.
3. The packaged radioactive material will be surveyed in the following manner within 3 hours of receipt during working hours or within 18 hours of receipt during weekends or holidays:

    a. Prior to opening, each package will be monitored with the survey meter and exposure rates recorded at: three (3) feet from the package surface; at the surface of the sides, top, and bottom of the package. Any reading greater than 10 mR/hr at 3 feet from the surface or 200 mR/hr at the package surface will be immediately reported to the final delivery agency, the supplier, and the Nuclear Regulatory Commission by telephone and telegraph. The address is:

Section 14 (Continued)

United States Nuclear Regulatory Commission
Office of Inspection and Enforcement,
Region IV
Suite 1000
611 Ryan Plaza Drive
Arlington, Texas 76012
Telephone (817) 860-8191

b. Step (a) above must be completed for each package of radioactive materials. If this condition required Nuclear Regulatory Commission notification, the package will not be opened. The intact package will be placed in a plastic bag and will not be opened until permission is obtained from the Nuclear Regulatory Commission. The package will be stored in the hot storage area located in the emergency generator room.

c. If Step (a) above did not require NRC notification, open the package and observe contents for damage or leakage. If no damage is observed, proceed with the unpacking, assay the material (where applicable) and proceed with the disposition of package contents.

Wipe external surface of final source container with moistened cotton swab or filter paper held with forceps, monitor, and record.

d. Survey packing material with the survey meter. If activity is found, determine the radiation level. Then notify the supplier as soon as possible. If no activity is found, remove or deface the radioactive material signs and dispose of the package.

4. Record in an appropriate log the following information:

Supplier
Transport group label
Nuclide and amount
Transportation index
Maximum reading at surface of package and at 3 feet (mR/hr).

Section 14 (Continued)

5. When radioactive material is administered to a patient, record the date, the patient's name, identifying number and activity of the dose administered.

NRC - 313M

Section 15 - GENERAL LABORATORY RULES FOR THE SAFE USE OF RADIOACTIVE MATERIALS

A. Personnel Safety Precautions

1. Age - Radiation workers will have had their 18th birthday prior to employment.

2. Monitoring:

a. Prior to employment, the user will obtain a medical record and occupational exposure record of potential employees. The potential employees' records will demonstrate compliance with 10 CFR 20.102 before they are permitted into restricted areas.

b. Radiation workers will wear film badges and finger film badges when handling radioactive materials, patients who have been injected with radioactive materials, or while working in areas where radioactive materials or patients may be.

c. Individuals whose monitored levels approaching those described in 10 CFR 20.101 will be assigned employment in non-radiation areas or terminated.

3. Protective clothing - Radiation workers will wear protective clothing including knee-length laboratory coats and disposable plastic gloves while working with radioactive materials or radioactive patients.

4. Transfer and shielding:

a. Transfer of all (liquid) radioactive materials from container to container will be achieved by needle and shielded syringe or by pipette. Whenever pipetting is required, only suction devices such as rubber bulbs or especially adapted disposable syringes or automated pipetting devices will be used.

b. Appropriate shielding will be employed for radiation workers handling radioactive materials. This will be accomplished with the use of lead pigs (such as shipping container), lead sheeting, lead bricks and a leaded glass work protective barrier (Picker Model 653-456).

Section 15 (Continued)

c. All radioactive materials withdrawn from shielded vials or preparation of radiopharmaceuticals for intravenous administration to patients will be withdrawn into shielded containers or shielded syringes. Syringe shields will routinely be used for administration of patient doses, the only exception will be pediatric patients where syringe shields would impede injection and would compromise the patient's well-being.

d. Capsules will be transferred to patient from shielded container, using tongs.

e. Survey generator, preparation and injection areas for contamination after each procedure or at the end of the day; decontaminate if necessary.

5. Ingestion of Radioactive Materials - Eating and drinking will not be allowed in posted areas except as prescribed by the user for patient being examined with radioactive materials. Smoking is prohibited without exception in all areas where radiopharmaceuticals are used or stored.

6. Radiation exposure to personnel during generator elution and handling of radioactive materials will be minimized by following the manufacturer's instructions exactly:

a. The generator column will be removed from its shield seven days after its calibration date and placed in the hot storage room behind lead bricks until 10 Mo-99 half lives have elapsed from the date of calibration.

b. Elution will be accomplished directly into a shielded vial.

c. 12 inch tongs will be used to remove the eluate vial from the shield for assay.

d. Eluate vials will remain in a lead shield during withdrawal of doses.

17901

Section 15(Continued)

B. Record keeping

1. The receipt and disposition of all radioactive materials will be recorded. These records include: Supplier, Nuclide, transport and group label, transportation index, exposure at 3 feet from package surface, chemical form, specific activity, concentration, activity as per label and well ionization chamber assay, date of calibration, lot number, date of receipt, expiration date, intended use, names, and identifying number of patients receiving portions of this material, date of administration, amount administered (volume and activities), amount of residue, date and method of disposal.

2. Records of radiation survey. These records are to include: Survey Meter readings of surveyed areas, background reading, counts per minute of wipe samples, background count, date, contamination if any, meter reading and counts per minute after decontamination.

3. Records of instrument calibration are to include: date of calibration, activity of source, reading of instrument, distance from source to detector and efficiency and full width at half maximum of energy peak if appropriate.

4. Records of film badge and film badge finger monitors will be maintained monthly on each radiation worker. These records are to include: type of monitor, dates of exposure, exposure level, reasons for excess reading (if any), action taken (if any).

C. Posting of restricted areas

1. The following areas will be posted as follows when room contents warrant: Conventional radiation symbol and words, "Caution, Radioactive Material". The Nuclear Medicine imaging room, hot laboratory, laboratory area and hot storage, 99mTc generator and rooms of patients hospitalized for 131-Iodine and other nuclide therapy.

Section 15(Continued)

2. A copy of the current regulations of 10 CFR 19, 20, 30 and 35, license application, the license, approved Nuclear Medicine procedure manual and a form AEC-3, "Notice to Employees" will be posted or available in the imaging room. Additional documents as required in 10 CFR 19 will be posted in the imaging room.

3. A copy of "Safety with Radioisotopes" will be posted in the imaging room, the hot laboratory, the laboratory and the hot storage areas.

NRC - 313M

Section 16 EMERGENCY PROCEDURES INCLUDING NAMES AND TELEPHONE NUMBERS OF PERSONNEL TO BE NOTIFIED

Unsealed radioactive liquids are handled routinely in the Nuclear Medicine Laboratory. The potential for spillage is always present. It is imperative that individuals handling radioactive materials respond properly to these spills so as to limit their radiation exposure and prevent the spread of contamination.

A. Minor Spills (tracer activities)

1. Notify persons in the immediate area that a spill has occurred.

2. Cover the spill with absorbent paper.

3. Limit access to the area to only those persons dealing with the spill.

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 (Survey Meter) potentially contaminated personnel before they disperse, and decontaminate as necessary.*

6. Notify the Radiation Safety Officer of the incident.

B. Major Spills (therapy activities)

1. Notify all persons not involved in the spill to vacate the room at once. Limit the movement of displaced persons to confine the spread of contamination.

2. Cover spill with absorbent paper.

3. Switch off all fans. Close windows.

4. Vacate room.

5. Close the door to the room. Prevent entry into the room.

6. If the spill is on the skin, flush thoroughly.

Section 16 (Continued)

7. If the spill is on clothing, discard outer or protective clothing at once.

8. Notify the Radiation Safety Officer immediately.

9. Survey (survey meter) personnel involved. immediately initiate decontamination of personnel as necessary, using mild soap and lukewarm water.*

C. A poster, "Safety with Radioisotopes", will be displayed in the hot laboratory, the imaging room, the laboratory and the hot storage area. This poster describes the procedures which are to be followed in the case of an emergency. In addition, this poster contains a description of what constitutes an emergency with regard to spillage of radionuclides. An emergency will be considered such if levels of activity in the contaminated area are found to be on the order of 3000 counts per minute or greater.

D. In the case of fire involving radioactive materials, the Fire Department is to be notified immediately, then the Radiation Safety Officer and the Hospital Administrator are to be notified. This poster will be displayed in both the laboratory and storage areas of the Nuclear Medicine facility.

E. In addition, at the time of employment, the Nuclear Medicine Technologist will be informed of these posters and the procedures to be followed.

* Refer to Radiologists Health Handbook, pp. 194-203 (reference list), for methods of personnel and area decontamination.

NRC - 313M

Section 17 AREA SURVEY PROCEDURES

A. Daily surveys of the floor, patient chairs, patient stretchers, linens, sink, counter top and injection areas of the Nuclear Medicine suite will be accomplished via the Survey Meter when the area is in use. Materials or areas found to be above room background will be respectively stored for decay or scrubbed to background. The minimum survey requirement is weekly intervals.

B. Before the Nuclear Medicine Technologist leaves the area where the Molybdenum-Technetium generator is eluted, radiopharmaceuticals prepared or patient doses prepared for administration to patients, he or she will survey hands, clothing and shoes for contamination. If activity is detected, the hands will be washed to remove such contamination. All clothing and contaminated objects of the person will be removed and stored for decay. Each survey will be recorded in an appropriate log.

C. Should accidental contamination occur, immediate survey and scrubbing procedures will begin.

D. Urine assays of each person handling millicurie amounts of radioactive material will be conducted on a weekly basis or more frequently if contamination is suspected.

E. Records of surveys, assays and wipe tests will be maintained including the identification of the person performing the survey.

F. Wipe tests: Routine weekly wipe tests will be done in areas where radiopharmaceuticals are used or stored.

G. The proposed separate storage area for radioactive wastes located in the basement level will, if used, be surveyed at least weekly. Detected contamination levels will be keyed to a location on a drawing.

NRC - 313M

Section 18 WASTE DISPOSAL PROCEDURES

A. Solid wastes and waste materials of ^{99m}Tc such as contaminated instruments, syringes, sealed containers or liquid will be sorted in the hot storage area until such time that when measured at surface by the Survey Meter do not produce a reading above background. When sufficiently decayed, radioactive labels will be removed and disposable wastes will be placed in the refuse collection system. Usable items will be thoroughly washed and returned to normal use.

B. Liquid wastes of Iodine-125, Iodine-131 labeled to human blood or serum will be dispersed into the sanitary sewerage in accordance with 10 CFR 20.303. The minimum water usage in St. John's Hospital is 26,500 gallons per month (July, 1979). This is equivalent to 3.23×10^7 ml of water per day. The maximum amount of radioactive materials in any room described above that could be dispersed into the sewer will not exceed:

1. ^{131}I - 6 x 10-5 uCi/ml

2. ^{99m}Tc - 2 x 10-1 uCi/ml

Other nuclides could be dispersed into the sewerage but the total quantity will not exceed those values set for 10 CFR 20 Appendix B, Table 1, Column 2.

C. A receptacle having a double liner and labeled, "Hot Trash - Do Not Empty", is provided in the Nuclear Medicine Department for contaminated material.

A decay bin will be placed in an area removed from the general public and hospital personnel, and shall be secured with a lock to prevent inadvertent entry. The area will be properly labeled with warning signs.

D. Generators will be returned to the manufacturer for disposal.

E. Records of each disposal, date, method, amount of activites involved, and initials of person discarding the material will be maintained.

* Note: An attempt will be made to dispose of all wastes by decay to background level.

NRC - 313M

Section 21 PROCEDURES AND PRECAUTIONS FOR USE OF RADIOACTIVE GASES (e.g. Xenon-133)

1. Quantities to be Used

It is anticipated that not more than two pulmonary ventilation studies requiring 20 mCi Xe-133 will be performed per week.

2. Use and Storage Areas

A Pulmonex Xenon System will be purchased and housed in the imaging room. Xenon-133 will be purchased as needed and stored until use behind lead bricks in the hot lab. Ventilation in this area is approximately 150 ft^3/min, with the exhaust vent located directly above the storage site. Ventilation rate in the area will be measured semi-annually to assure adequate air flow.

3. Procedures for Routine Use

A single vial of Xenon-133 (20-30 mCi) will be loaded into a Calidose gun and then into the Automatic Xenon Dispenser on the Pulmonex unit for delivery to the patient. The patient will inhale Xe-133 through a face mask and will wear a nose clamp to minimize the possibility of accidentally exhaling into the room. Upon expiration back into the face mask, the Xe-133 will be trapped in a charcoal filter built into the Pulmonex unit. This filter will be changed semi-annually to prevent the possibility of saturation with gas. Radioactive filters will be completely shielded with lead bricks on a four-wheeled cart and stored in the hot storage room for at least ten Xe-133 half lives. They will then be disposed of as ordinary trash.

4. Emergency Procedures

In the event of accidental release of Xe-133 into the imaging room, the room will be immediately evacuated until a survey (survey meter) of the room indicates a return to background radiation levels.

5. Air Concentrations of Xe-133 in Restricted Areas

From the ventilation rate in the imaging room, we estimate that even if the entire contents of two

Section 2

METHODS FOR CALIBRATION OF DOSE CALIBRATOR*

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

A. Test for the following:

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

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

C. Test for Instrument Constancy

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

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

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

E. Test of Instrument Linearity

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

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

---

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

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

Section 21 (Continued)

30-mCi vials (maximum number of studies per week) of Xe-133 were simultaneously opened to the atmosphere in the room, the allowed maximum permissible levels of Xe-133 listed in Regulatory Guide 10.8-53 (October, 1980) would not be exceeded. This event is extremely unlikely to occur.

6. Release of Exhaust to Outside of Hospital

Air from the ventilation system is exhausted through a stack on the roof of the hospital. The door leading to the roof will be locked at all times and posted with a sign displaying the conventional symbol and the words "Caution, Radioactive Materials." Personnel with access to the roof will be given specific instructions about radiation safety.

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

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

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

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

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

F. Test for Geometrical Variation

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

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

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

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

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

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

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

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

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

True Activity = Measured Activity x Correction Factor

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

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

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

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

G. Test for Instrument Accuracy

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

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

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

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

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

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

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

5. Keep a log of these calibration checks.

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

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

CALIBRATION OF DOSE CALIBRATOR

A. Sources Used for Linearity Test

(Check as appropriate)

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

or

_____ Other* (specify) _____

B. Sources Used for Instrument Accuracy and Constancy Tests

Radionuclide	Suggested Activity (mCi)	Activity (mCi)	Accuracy
Co-57	3-5	_____	_____
Ba-133	0.1-0.5	_____	_____
Cs-137	0.1-0.2	_____	_____
Ra-226	1-2	_____	_____
_____		_____	_____

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

or

_____ Equivalent procedures are attached.

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

APPENDIX O

MODEL PROGRAM FOR MAINTAINING OCCUPATIONAL RADIATION EXPOSURES AT MEDICAL INSTITUTIONS ALARA

(Licensee's Name)

(Date)

1. Management Commitment

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

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

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

d. In addition to maintaining doses to individuals as far below the limits as is reasonably achievable, the sum of the doses received by all exposed individuals will also be maintained at the lowest practicable level. It would not be desirable, for example, to hold the highest doses to individuals to some fraction of the applicable limit if this involved exposing additional people and significantly increasing the sum of radiation doses received by all involved individuals.

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

2. Radiation Safety Committee (RSC)[2]

a. Review of Proposed Users and Uses

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

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

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

b. Delegation of Authority

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

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

(2) The RSC will support the RSO in those instances where it is necessary for the RSO to assert his/her authority. Where the RSO has been overruled, the Committee will record the basis for its action in the minutes of the Committee's quarterly meeting.

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

c. Review of ALARA Program

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

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

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

3. Radiation Safety Officer (RSO)

a. Annual and Quarterly Review

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

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

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

b. Education Responsibilities for ALARA Program

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

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

c. Cooperative Efforts for Development of ALARA Procedures

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

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

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

d. Reviewing Instances of Deviation from Good ALARA Practices

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

4. Authorized Users

a. New Procedures Involving Potential Radiation Exposures

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

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

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

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

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

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

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

5. Persons Who Receive Occupational Radiation Exposure

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

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

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

This institution hereby establishes Investigational Levels for occupational external radiation exposure which, when exceeded, will initiate review or investigation by the RSC and/or the RSO. The Investigational Levels that we have adopted are listed in Table 0-1 below. These levels apply to the exposure of individual workers.

Table 0-1

	Investigational Levels (mrems per calendar quarter)	
	Level I	*Level II*
1. Whole body; head and trunk; active blood-forming organs; lens of eyes, or gonads	400	800
2. Hands and forearms, feet and ankles	5,000	10,000
3. Skin of whole body*	8,000	5,000

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

The Radiation Safety Officer will review and record on Form NRC-5, "Current Occupational External Radiation Exposures," or an equivalent form (e.g., dosimeter processor's report), results of personnel monitoring not less than once in any calendar quarter as required by §20.401 of 10 CFR Part 20. The following actions will be taken at the Investigational Levels as stated in Table 0-1.

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

Except when deemed appropriate by the RSO, no further action will be taken in those cases where an individual's exposure is less than Table 0-1 values for the Investigational Level I.

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

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

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

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

d. Reestablishment of an individual occupational worker's Investigational Level II to a level above that listed in Table 0-1.

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

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

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

7. Signature of Certifying Official[4]

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

Signature

Robert C. Offard

Name (print or type)

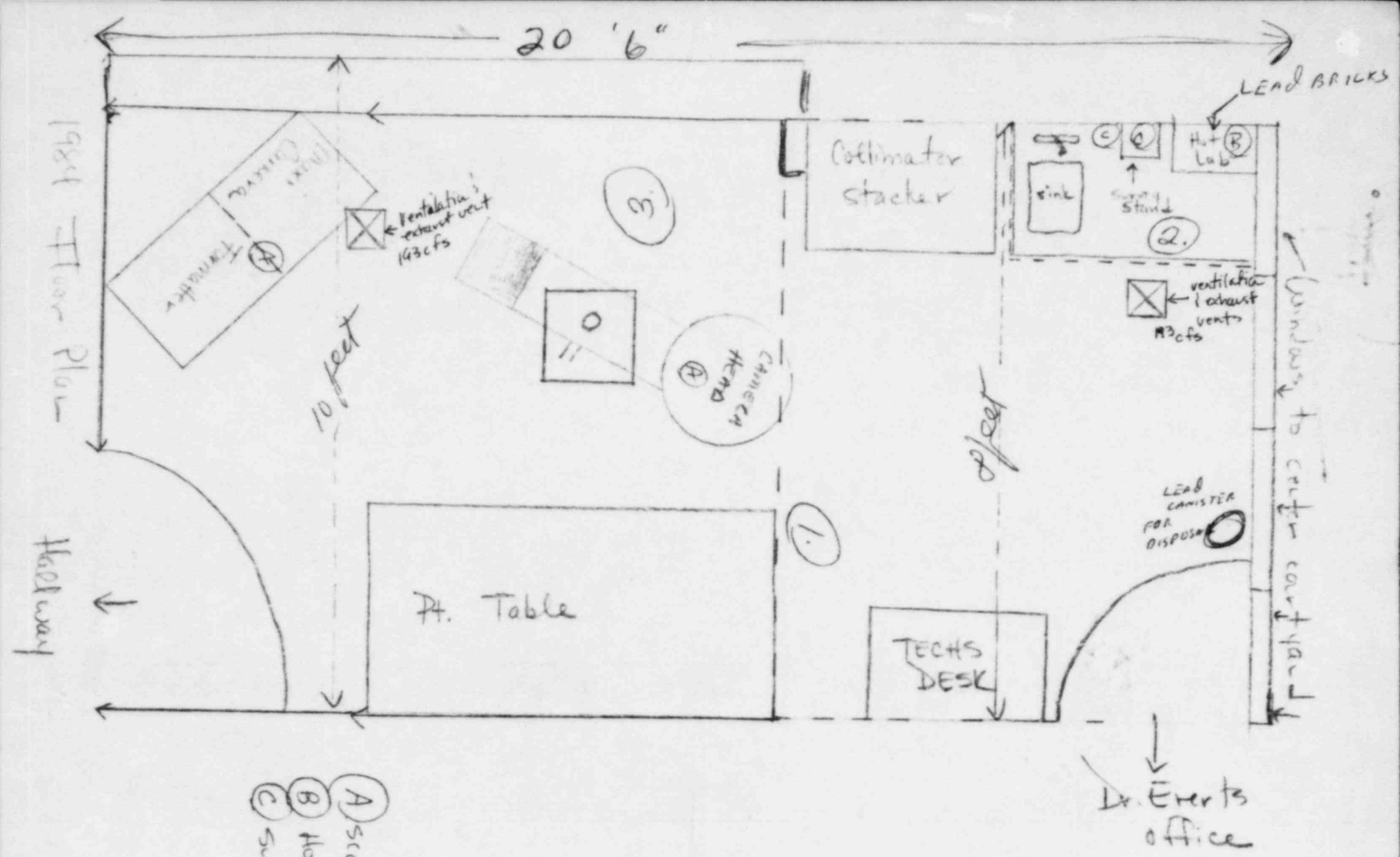
Administrator 2/13/87

Title

Institution (or Private Practice) Name and Address:

ST John's Hospital

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



room is 10' x 20.5' in some places

8' x 20.5' IN OTHERS

no wall betw. waiting area & camera

REN
49-18276-01
ST John's Hosp

Letter 3-22-

NRC - 313M

REFERENCE ITEMS 9, 10-B, 15-B

3. ALTERNATIVE METHOD OF DOSE CALIBRATION

A. The Geiger-Mueller Survey Meter will be calibrated each day or before each dose is given using a CO-57 source with accuracy ± 5%. The activity of the source will be 5 mC_i. Each patient dose will be assayed immediately before given. When multiple doses are received on the same day, each separate dose will be assayed using the Survey Meter.

B. The same geometry, i.e., distance and containers will be used each time when assaying doses.

C. The dose vial will be properly shielded in a cylindrical lead container. The same container will also expedite maintaining the same geometry from source to detector each time an assay is done.

D. Geiger-Mueller Survey Meter will be calibrated by the University of Utah, Salt Lake City, Utah, before initial use and thereafter on a yearly basis or if batteries are changed. The Geiger-Mueller Survey Meter will be calibrated for an energy spectrum to give readings for Technetium-99.

E. Measurements by the G-M Survey Meter to be used at St. John's Hospital will be taken for sources of known activity in the Laboratory of the University of Utah Radiopharmacy (the supplier.) These readings will be correlated and calibrated for doses of known activity given by their dose calibrator. A graphic chart will be made. Additionally, records will be kept correlating the activity determined at St. John's Hospital with that activity predetermined at the University of Utah Radiopharmacy.

F. The overall accuracy of this alternative system should be ± 10%.

NRC - 313M

APPLICABLE FORMULAS

1. $\text{mr/hr} = \frac{n \times I}{S^2}$

mr/hr = radiation intensity

n = activity in millicuries

I_2 = mr/hr/mC_i at 1 meter

S = distance from source in meters

2. $P_t = R_o \times e - \left[\frac{0.693}{T\ 1/2} \times t\right]$ for decay

3. mC_i dose = $\frac{\text{CPM dose} \times mC_i \text{ std}}{\text{CPM std}}$

LETTER 6-[illegible]-[illegible]

Proposed Method for Verification of
Technetium-99m Doses Prior to Administration

I. Initial Calibration of Survey Meter

A. St. John's Hospital will purchase a Geiger-Mueller survey instrument of suitable design and quality.

B. The GM survey instrument will be sent to the University of Utah, Radiological Health Department for calibration. The initial calibration will be performed using the 69 Curie Cesium-137 source operated under N.R.C. license 43-01864-13.

C. The instrument will be calibrated at two points on each sensitivity range, the points being approximately 1/3 and 2/3 of the full scale value on each range. The calibration controls will be adjusted to produce responses within ± 10% of the true dose rate at each calibration point.

D. When the instrument has been accurately calibrated, a response measurement will be made with a long-lived reference check source (e.g., Cesium-137) with the check source and the GM survey instrument positioned in the fixed geometric configuration noted in paragraph II A below. The observed response of the G.M. survey instrument will be recorded on the calibration certificate containing the data from the instrument calibration procedure described in paragraph C above.

II. Calibration for Technetium-99m.

A. Following the initial calibration procedures described above, the survey instrument will be positioned on a test stand shown in the attached sketch. The instrument probe will be 18 inches above the base of a ring stand upon which a lead shielded syringe holder, will be placed. The probe of the survey instrument will be held in place by a clamp to maintain a fixed, reproducible distance between the probe and the syringe holder.

B. A syringe containing a precisely measured quantity of fresh pertechnetate will be placed in the syringe holder. The dose rate in mR/hr. indicated by the survey meter will be recorded. The procedure will then be repeated using a series of syringes containing graduated quantities of pertechnetate.

C. The data acquired in the procedure described in paragraph B above will be used to plot a curve on a graph or nomagram which will indicate the observed dose rates in mR/hr. vs. quantities of pertechnetate in millicuries. All the data collected in the calibration procedures will be sent with the survey instrument and the reference check source to St. John's Hospital.

III. Recalibration and Response Checks.

A. The survey instrument will be recalibrated using the procedures described above:

1. At least annually.

2. After each maintenance and/or battery change.

3. Whenever the instrument response to the reference check source differs by more than 10% from the value given on the calibration certificate.

B. The response of the survey instrument to the reference check source will be checked before each use and at least daily. A record of each response check will be maintained.

IV. Verification of Technetium-99m Doses.

A. Prior to being administered to a patient, each prescribed dose of Technetium-99m will be checked to verify that it contains the correct activity. This will be done as follows:

1. The survey meter will be positioned as shown in the attached sketch.

2. The response of the instrument in the test configuration to the reference check source will be noted and recorded. This value must agree within ± 10% of the value given in the calibration certificate.

3. The reference check source will be removed and the syringe containing the Technetium-99m prepared for administration will be placed in the syringe holder. The response of the survey instrument in mR/hr. will be noted and recorded. The syringe will be removed to a shielded-holding area awaiting administration.

4. The activity of the material in the syringe will be determined by using the chart described in paragraph II C above. This value in millicuries will be recorded. If the activity level determined by this method varies from the prescribed activity level by greater than ± 10%, the material should not be administered to the patient, and the Director of the Nuclear Medicine Department should be notified.

Proposed Method for Verification of

Technetium-99m Doses Prior to Administration

I. Initial Calibration of Survey Meter

A. St. John's Hospital will purchase a Geiger-Mueller survey instrument of suitable design and quality.

B. The GM survey instrument will be sent to the University of Utah, Radiologic Health Department for calibration. The initial calibration will be performed using the 69 Curie Cesium-137 source operated under N.R.C. license 43-01884-13.

C. The instrument will be calibrated at two points on each sensitivity range, the points being approximately 1/3 and 2/3 of the full scale value on each range. The calibration controls will be adjusted to produce responses within ± 10% of the true dose rate at each calibration point.

D. When the instrument has been accurately calibrated, a response measurement will be made with a long-lived reference check source (e.g., Cesium-137) with the check source and the GM survey instrument positioned in the fixed geometric configuration noted in paragraph II A below. The observed response of the GM survey instrument will be recorded on the calibration certificate containing the data from the instrument calibration procedure described in paragraph C above.

II. Calibration for Technetium-99m

A. Following the initial calibration procedures described above, the survey instrument will be positioned on a test stand shown in the attached sketch. The instrument probe will be 18 inches above the top of the lead shielded syringe holder which is positioned on the ring stand base. The probe of the survey instrument will be held in place by a clamp to maintain a fixed, reproducible distance between the probe and the syringe holder.

B. A syringe containing a precisely measured quantity of fresh pertechnetate will be placed in the syringe holder. The dose rate in mR/hr indicated by the survey meter will be recorded. The procedure will then be repeated using a series of syringes containing graduated quantities of pertechnetate.

C. The data acquired in the procedure described in paragraph B above will be used to plot a curve on a graph or nomogram which will indicate the observed dose rates in mR/hr. vs. quantities of pertechnetate in millicuries. All the data collected in the calibration procedures will be sent with the survey instrument and the reference check source to St. John's Hospital.

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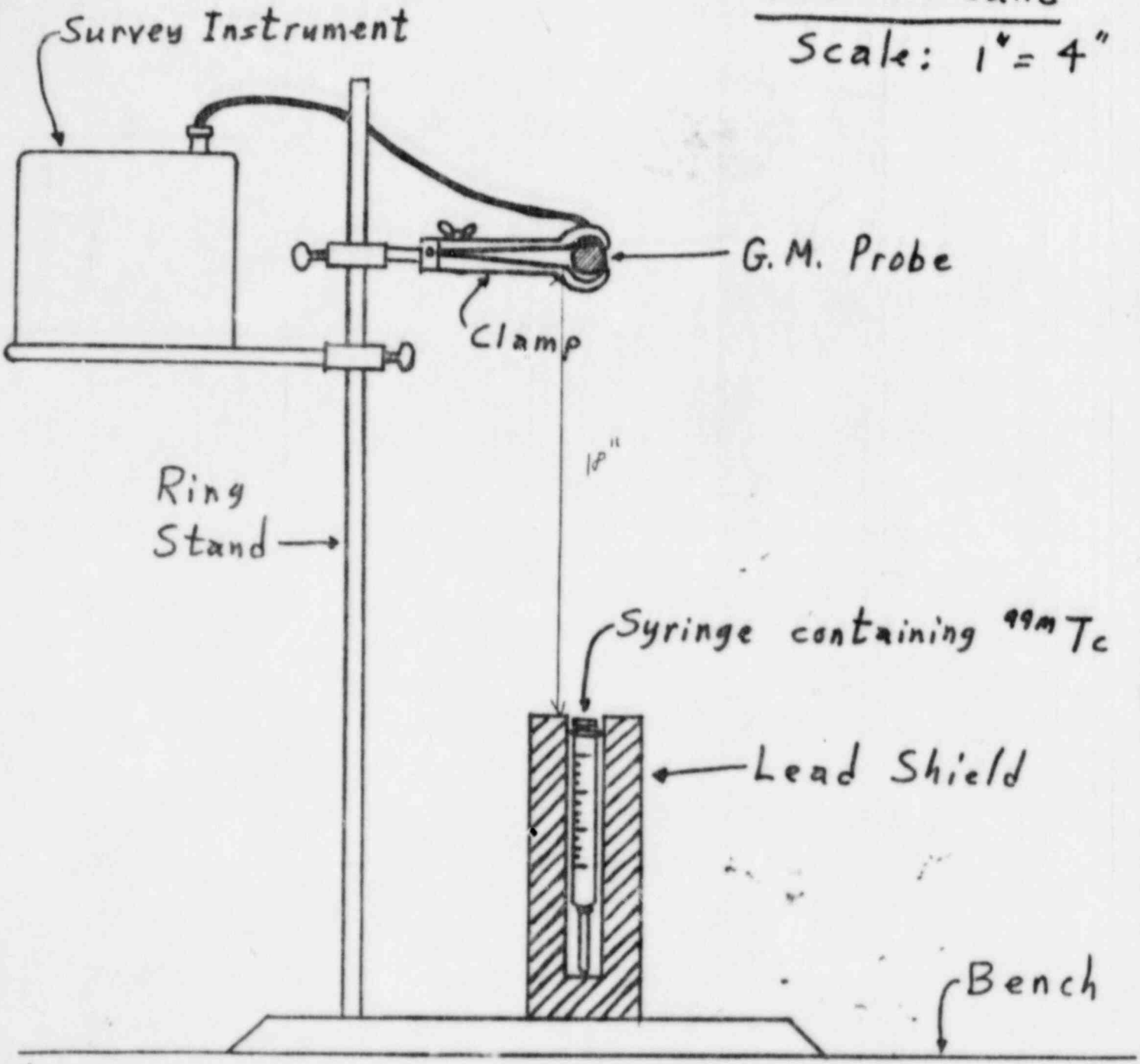
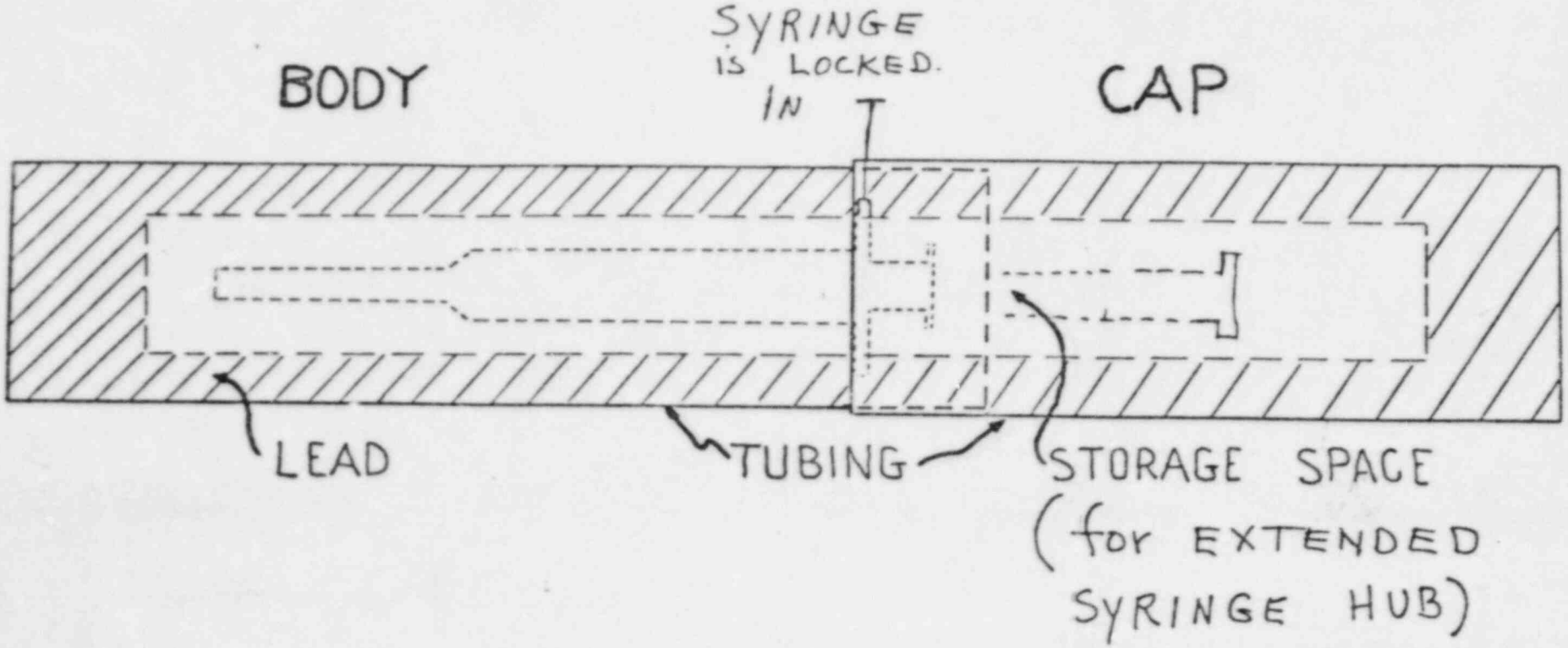
3. The reference check source will be removed and the syringe containing the Technetium-99m prepared for administration will be placed in the syringe holder. The response of the survey instrument in mR/hr. will be noted and recorded. The syringe will be removed to a shielded-holding area awaiting administration.

4. The activity of the material in the syringe will be determined by using the chart described in paragraph II C above. This value in millicuries will be recorded. If the activity level determined by this method varies from the prescribed activity level by greater than ± 10%, the material should not be administered to the patient, and the Director of the Nuclear Medicine Department should be notified.

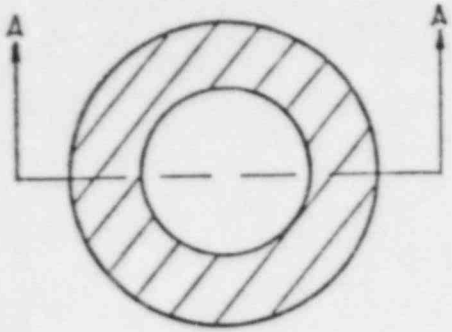
Calibration Test Stand

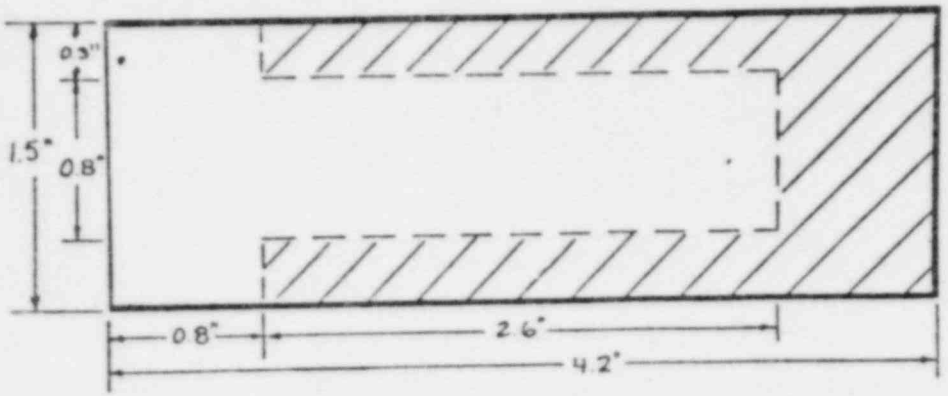
Scale: 1" = 4"



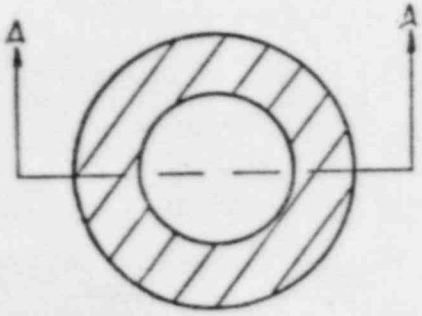

SYRINGE
IS LOCKED.
IN
BODY
CAP
LEAD
TUBING
STORAGE SPACE
(for EXTENDED
SYRINGE HUB)

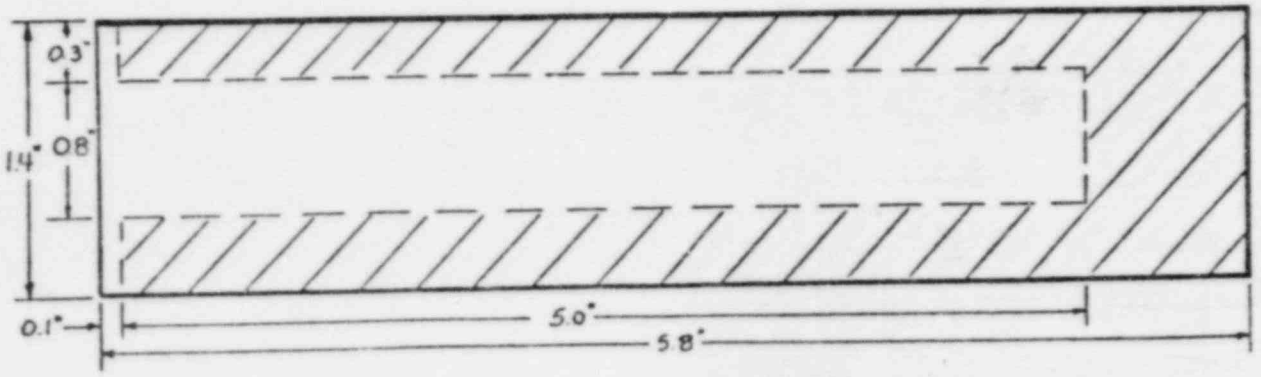
CAP





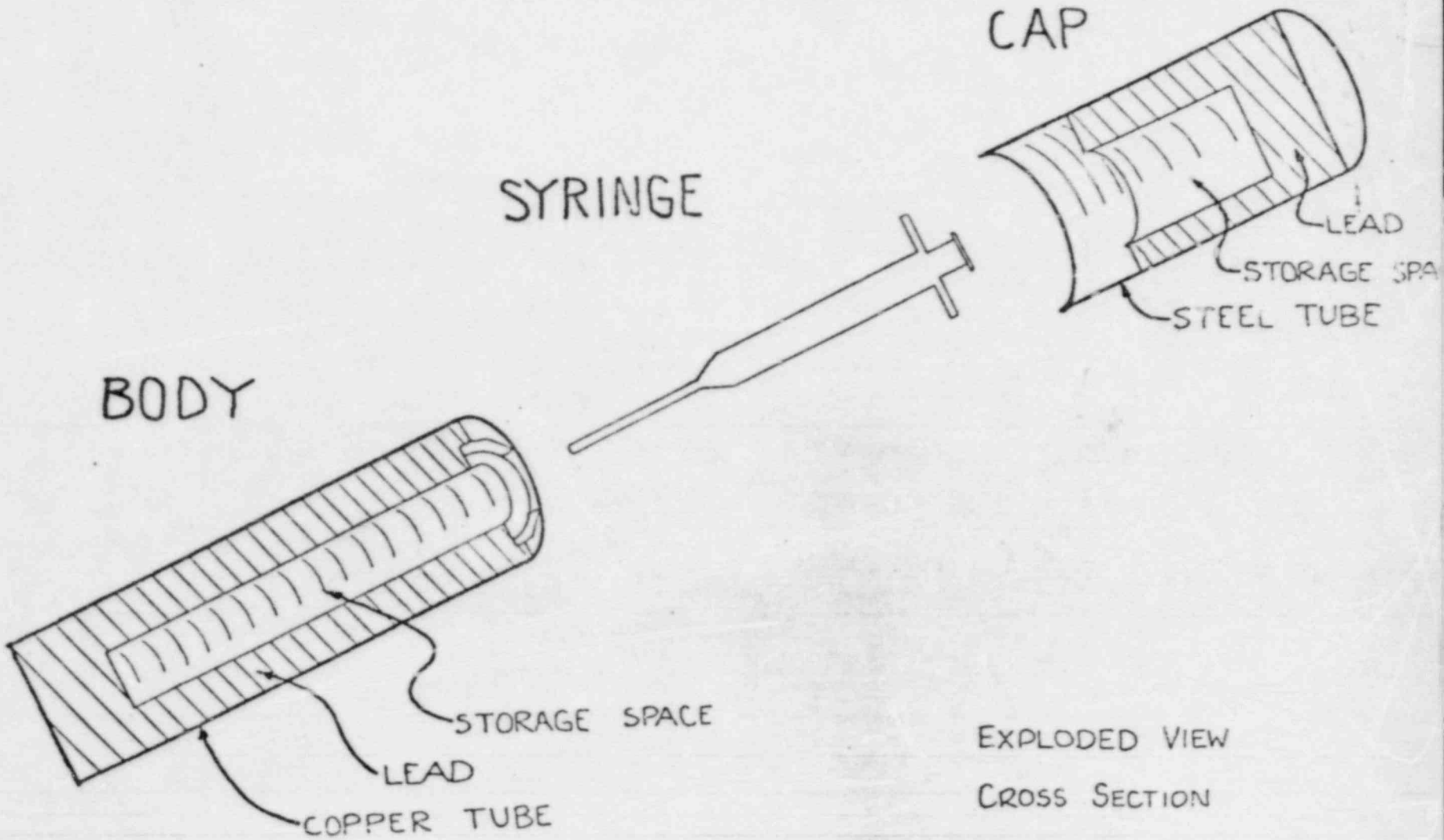
BODY





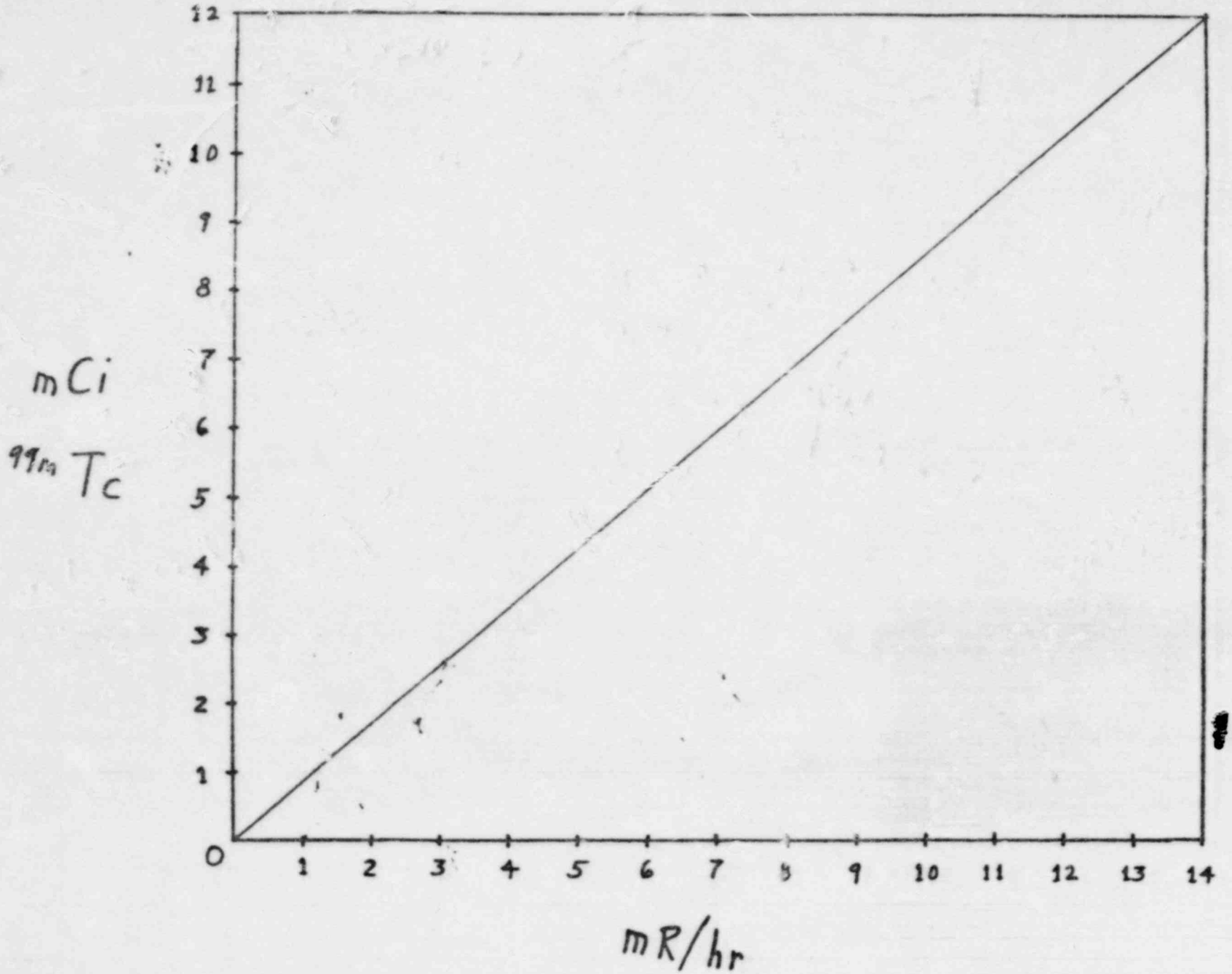
TOP VIEW

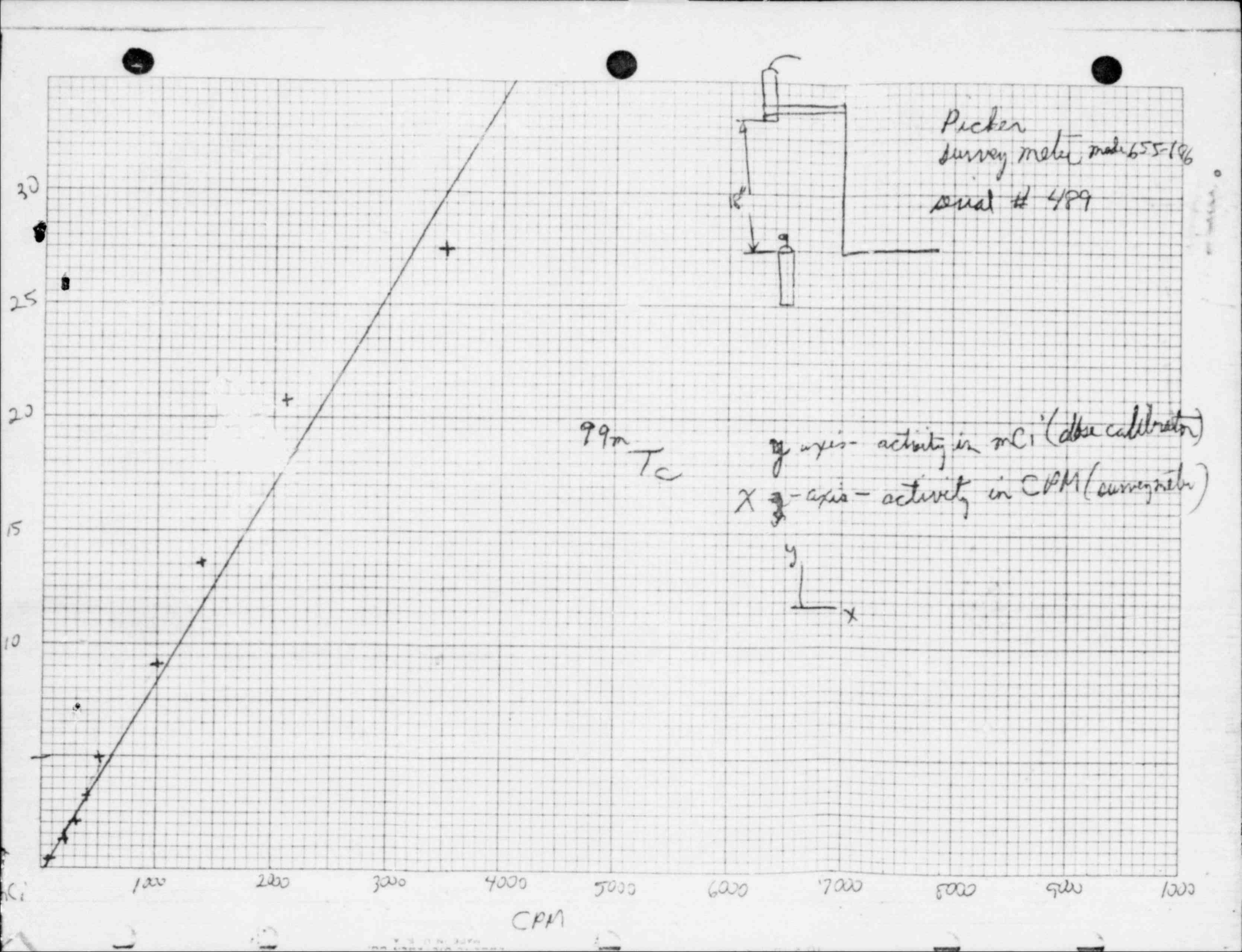
SIDE VIEW – CROSS SECTION

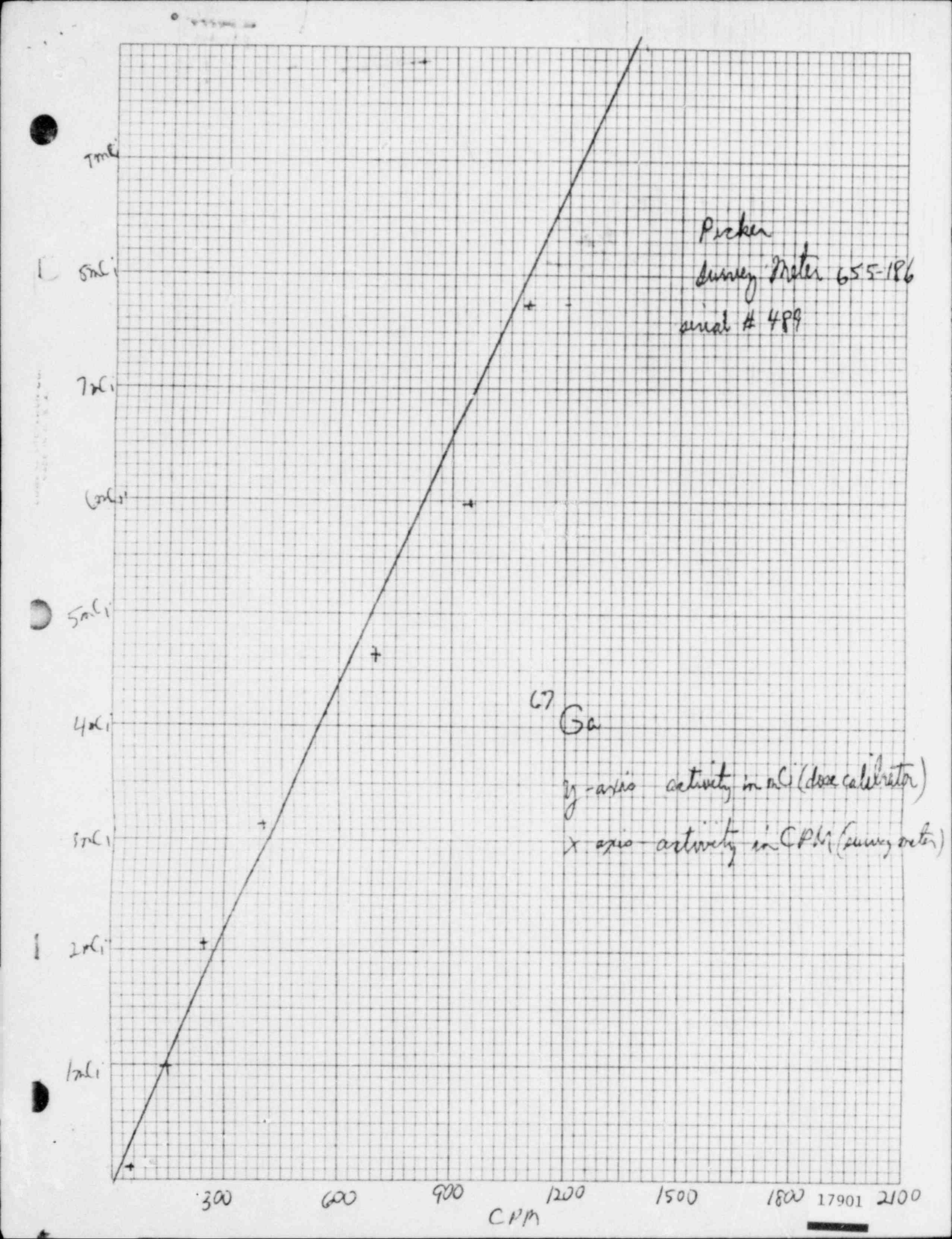


EXPLODED VIEW
CROSS SECTION

^{99m}Tc Dose Calibration




Picker
survey meter made 6-5-86
unit # 489
99m Tc
y axis - activity in mCi (dose calibrator)
x axis - activity in CPM (survey meter)
y
x
30
25
20
15
10
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
CPM


Picker
Survey Meter 655-186
serial # 489
67 Ga
y-axis activity in mCi (dose calibrator)
x axis activity in CPM (survey meter)
1mCi
5mCi
7mCi
5mCi
4mCi
3mCi
2mCi
1mCi
300
600
900
1200
1500
1800
2100
CPM
17901

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

St. John's Hospital
Teton County Hospital District
Jackson, Wyoming 83001

TELEPHONE NO.: AREA CODE (307) 733-3636

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

Same

2. PERSON TO CONTACT REGARDING THIS APPLICATION

Charles S. Everts, M.D.

TELEPHONE NO.: AREA CODE (307) 733-3636

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

a. ☐ NEW LICENSE
b. ☐ AMENDMENT TO LICENSE NO. _____
c. ☒ RENEWAL OF LICENSE NO. 49-18276-01

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

Charles S. Everts, 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.)*

Charles S. Everts, M.D.
See Supplement A; Attached

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		AS NEEDED
10 CFR 35.100, SCHEDULE A, GROUP II	X	AS NEEDED
10 CFR 35.100, SCHEDULE A, GROUP III	X	2000
10 CFR 35.100, SCHEDULE A, GROUP IV		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	3000

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

17901

17901

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: Oct., 1980

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
X	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
X	Appendix D Procedures Followed for Dose Calibrator; or *(Check One)*
	Equivalent Procedures Attached
11. FACILITIES AND EQUIPMENT	
X	Description and Diagram Attached
12. PERSONNEL TRAINING PROGRAM	
X	Description of Training Attached
13. PROCEDURES FOR ORDERING AND RECEIVING RADIOACTIVE MATERIAL	
X	Detailed Information Attached
14. PROCEDURES FOR SAFELY OPENING PACKAGES CONTAINING RADIOACTIVE MATERIALS *(Check One)*	
	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
	Equivalent Procedures Attached
20. THERAPEUTIC USE OF SEALED SOURCES	
	Detailed Information Attached; and
	Appendix L Procedures Followed; or *(Check One)*
	Equivalent Procedures Attached
21. PROCEDURES AND PRECAUTIONS FOR USE OF RADIOACTIVE GASES (e.g., Xenon – 133)	
X	Detailed Information Attached
22. PROCEDURES AND PRECAUTIONS FOR USE OF RADIOACTIVE MATERIAL IN ANIMALS	
	Detailed Information Attached
23. PROCEDURES AND PRECAUTIONS FOR USE OF RADIOACTIVE MATERIAL SPECIFIED IN ITEM 6.b	
	Detailed Information Attached

24. PERSONNEL MONITORING DEVICES

TYPE (Check appropriate box)			SUPPLIER	EXCHANGE FREQUENCY
a. WHOLE BODY	X	FILM	Searle Diagnostics, Inc.	Monthly
		TLD	Health Physics Services	
		OTHER (Specify)	Box 1367 Des Plaines, IL 60018	
b. FINGER	X	FILM	Searle Diagnostics, Inc.	Monthly
		TLD	Health Physics Services	
		OTHER (Specify)	Box 1367 Des Plaines, IL 60018	
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

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 SS170.11 Part A Paragraph 9

(2) LICENSE FEE ENCLOSED: $ Exempt

b. APPLICANT OR CERTIFYING OFFICIAL *(Signature)*

(1) NAME *(Type of Print)*

(2) TITLE

c. DATE

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
Charles S. Everts, M.D.	Wyoming, Utah

3. CERTIFICATION

SPECIALTY BOARD A	CATEGORY B	MONTH AND YEAR CERTIFIED C
American Board of Radiology	Diagnostic Radiology	Board Eligible

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	1) University of Utah Medical Center, 1971-1974, Radiology Resident 2) Montana State University	90	20
b. RADIATION PROTECTION	1) University of Utah Medical Center, 1971-1974, Radiology Resident 2) Montana State University	20	
c. MATHEMATICS PERTAINING TO THE USE AND MEASUREMENT OF RADIOACTIVITY	1) University of Utah Medical Center, 1971-1974, Radiology Resident 2) Montana State University	20	
d. RADIATION BIOLOGY	1) University of Utah Medical Center, 1971-1974, Radiology Resident	30	
e. RADIOPHARMACEUTICAL CHEMISTRY	1) University of Utah Medical Center, 1971-1974, Radiology Resident	20	20

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

ISOTOPE	MAXIMUM AMOUNT	WHERE EXPERIENCE WAS GAINED	DURATION OF EXPERIENCE	TYPE OF USE

NRC FORM 313M SUPPLEMENT B
(9-81)

U. S. NUCLEAR REGULATORY COMMISSION

PRECEPTOR STATEMENT

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

1. APPLICANT PHYSICIAN'S NAME AND ADDRESS

FULL NAME

Charles S. Everts, M.D.

STREET ADDRESS

St. John's Hospital
Teton County Hospital District

CITY	STATE	ZIP CODE
Jackson	WY	83001

KEY TO COLUMN C

PERSONAL PARTICIPATION SHOULD CONSIST OF:

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

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

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

2. CLINICAL TRAINING AND EXPERIENCE OF ABOVE NAMED PHYSICIAN

ISOTOPE A	CONDITIONS DIAGNOSED OR TREATED B	NUMBER OF CASES INVOLVING PERSONAL PARTICIPATION C	COMMENTS *(Additional information or comments may be submitted in duplicate on separate sheets.)* D
I-131 or I-125	DIAGNOSIS OF THYROID FUNCTION		See previous license application License No.: 49-18276-01
	DETERMINATION OF BLOOD AND BLOOD PLASMA VOLUME		
	LIVER FUNCTION STUDIES		
	FAT ABSORPTION STUDIES		
	KIDNEY FUNCTION STUDIES		
	IN VITRO STUDIES		
OTHER			
I-125	DETECTION OF THROMBOSIS		
I-131	THYROID IMAGING		
P-32	EYE TUMOR LOCALIZATION		
Se-75	PANCREAS IMAGING		
Yb-169	CISTERNOGRAPHY		
Xe-133	BLOOD FLOW STUDIES AND PULMONARY FUNCTION STUDIES		
OTHER			
Tc-99m	BRAIN IMAGING		
	CARDIAC IMAGING		
	THYROID IMAGING		
	SALIVARY GLAND IMAGING		
	BLOOD POOL IMAGING		
	PLACENTA LOCALIZATION		
	LIVER AND SPLEEN IMAGING		
	LUNG IMAGING		
	BONE IMAGING		
OTHER			

PRECEPTOR STATEMENT *(Continued)*

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

ISOTOPE A	CONDITIONS DIAGNOSED OR TREATED B	NUMBER OF CASES INVOLVING PERSONAL PARTICIPATION C	COMMENTS *(Additional information or comments may be submitted in duplicate on separate sheets.)* D
P-32 *(Soluble)*	TREATMENT OF POLYCYTHEMIA VERA, LEUKEMIA, AND BONE METASTASES		
P-32 *(Colloidal)*	INTRACAVITARY TREATMENT		
I-131	TREATMENT OF THYROID CARCINOMA		
	TREATMENT OF HYPERTHYROIDISM		
Au-198	INTRACAVITARY TREATMENT		
Co-60 or Cs-137	INTERSTITIAL TREATMENT		
	INTRACAVITARY TREATMENT		
I-125 or Ir-192	INTERSTITIAL TREATMENT		
Co-60 or Cs-137	TELETHERAPY TREATMENT		
Sr-90	TREATMENT OF EYE DISEASE		
	RADIOPHARMACEUTICAL PREPARATION		
Mo-99/ Tc-99m	GENERATOR		
Sn-113/ In-113m	GENERATOR		
Tc-99m	REAGENT KITS		
Other			

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

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

a. NAME OF SUPERVISOR

b. NAME OF INSTITUTION

c. MAILING ADDRESS

d. CITY

5. MATERIALS LICENSE NUMBER(S)

6. PRECEPTOR'S SIGNATURE

7. PRECEPTOR'S NAME *(Please type or print)*

8. DATE

NRC FORM 313M SUPPLEMENT B
(9-81)

GPO 890-913

AMERICAN MEDICAL ASSOCIATION

Physician's Recognition Award

CHARLES S EVERTS MD

has fulfilled the requirements for the
Physician's Recognition Award
in Continuing Medical Education

Valid until FEBRUARY 1, 1986

President

Executive Vice President

St. John's Hospital
P.O. BOX 428
JACKSON, WYOMING 83001
(307) 733-3636

Re: License 49-182-76-01-Renewal

NRC 313M

ADDENDUM

Additional experience and training of RSO-User Charles S. Everts, M.D.

Charles S. Everts, M.D. has received additional training and experience in use of diagnostic radioisotopes as follows: Above-mentioned is qualified for the MA Physician's Recognition Award in continuing medical education in diagnostic radiology. The following journals are received and read: (1) Seminars in Nuclear Medicine; (2) Clinical Nuclear Medicine; (3) American Journal of Roentgenology; (4) Radiology; (5) Journal, Canadian Association of Radiologists; (6) American College of Radiology Self-Evaluation Programs; (7) Saunders Monographs and Clinical Radiology; (8) Radiologic Clinics of North America.

NRC - 313M

Section 7 MEDICAL ISOTOPES COMMITTEE

A. Committee Authority

The Medical Isotopes Committee is established by the authority of the Hospital Administrator and the Governing Body of Teton County Hospital District as the administrative body responsible for the safe use of radionuclides within the institution.

B. Committees, Duties and Responsibilities

1. Review and grant permission for, or disapprove, the use of byproduct material for all uses within the institution from the standpoint of radiological health and safety of patients or working personnel and other factors which the committee may wish to establish for medical use of byproduct materials prior to submission of an application to the Nuclear Regulatory Commission for licensing action.
2. Prescribe special conditions that will be required during a proposed use of byproduct material such as requirements for bioassays and physical examination of user, minimum level of training and experience of users.
3. Receive and review records and reports from the Radiation Safety Officer and other individuals delegated responsibility for health safety practices in the institution.
4. Recommend remedial action to correct safety infractions.
5. Formulate and review the institutional training programs for the safe use of radioisotopes.
6. Maintain written record of actions taken by the committee.
7. Inform the Nuclear Regulatory Commission of any changes in Committee Membership.
8. The committee shall, when appropriate:

    a. Review safety aspects to consider special cases or problems of the program.
    b. Review record keeping procedures of the committee.
    c. Review methods of record keeping and receipts, transfers and disposals of all radioactive materials within the institution.
    d. Review provisions for initiating corrective action as necessary to assure radiation safety.

NRC - 313M

Section 7 (Continued)

C. Meeting frequency annually, or more frequently as required.

D. Committee members include:

Charles S. Everts, M.D., Chairman and Radiation Safety Officer, Diagnostic Radiologist (see experience as listed in Supplement A).

William Fogarty, M.D., Pathologist

Robert Lippard, Administrator

Julie Huot, R.N., Nursing Service

Bruce Hayse, M.D., F.P.

NRC - 313M

Section 9 INSTRUMENTATION

A. Survey Instruments

1. Picker Geiger-Mueller Survey Meter, Model 655-186 with Beta, Gamma, Geiger Probe. Five ranges are available including 0-0.2, 0-2, 0-20, 0-200, and 0-2000 mR per hour.

   The Survey Meter capable of low level (0.1 mR per hour) and high level (1 R per hour) will be kept available, calibrated and operational at all times. Survey instruments will be calibrated to ±10% of full scale.

2. MiniMonitor 125 Contamination Monitor, Model 05-572 with thin-window G.M. detector. Three ranges are available including 0-500, 0-5000, and 0-50000 cpm (accuracy ±10% of full-scale). Sensitivity is approximately 5000 cpm per uCi of I-125 for a point source placed 5 mm from the detector window.

B. Dose Calibrator

1. Picker Digital Isotope Dose Calibrator Model 632-507 with energy range of 25 KeV to 3 MeV and activity levels from 1 uCi to 999 mCi, or an instrument to meet or exceed these specifications. (May be purchased in the future).

C. Diagnostic Instruments

1. General Electric Maxicamera 400A (1984 model)

2. Pulmonex Xenon System - xenon delivery system with built-in xenon gas trap (charcoal) for rebreathing, washout, perfusion, and single-breath studies. (May be purchased in the future).

NOTE:

Radioisotopes will be purchased on a unit dose basis from:

Nuclear Pharmacy, Inc.
1201 E. 17th Street
Denver, CO 80218

a. See attached protocol for alternative measurement of activity of radioisotope doses.

NRC - 313M

Section 10 CALIBRATION OF INSTRUMENTS

I. A. The following standards will be purchased as required for calibration and tests for dose calibrator:

1. Cesium-137 standard 200 uCi ±5%.

* 2. Cobalt-57 standard 5 mCi ±5%.

* 3. Barium-133 standard 250 uCi ±5%.

* Sources 2 and 3 will be purchased when generator and dose calibrator are used.

B. A standard source of 1 to 3 uCi ±5% of Cs-137 will be used as reference check source fot the survey meter.

II. Methods of Calibration

1. The survey meters will be calibrated as follows:

a. The survey meters will be checked daily or before each use with a check source. In addition, a battery check will be obtained daily or before each use. Daily constancy and reference check will be done with the Co-57 (5 mCi ±5%) source.

b. Once each year, the instruments will be calibrated to within ±10% of the values for each point checked by the manufacturer or by an outside contractor.

2. a. The methods used to monitor the dose calibrator will be those described in Section Two of Appendix D of NRC Regulatory Guide 10.8 (Revision 1, October, 1980).

b. The activity of the Tc-99m source used to perform linearity tests on the dose calibrator will be equivalent to the maximum activity that is assayed in clinical situations or maximum daily order of pertechnetate.

Section 10 (Continued)

3. The G.E. Maxicamera 400A will be subjected to quality control tests and loading procedures per enclosed materials.

4. Logs of each calibration or monitoring will be maintained.

NRC - 313M

Section 11 FACILITIES AND EQUIPMENT

A. The Nuclear Medicine Laboratory consists of one area located on the ground floor of the hospital. This floor plan will meet the requirements of exposure levels for the posted, restricted areas and unrestricted areas as set forth in 10 CFR 20.101 and 10 CFR 20.105 respectively.

B. Receipt and Storage of Radioactive Materials

1. All radioactive materials will be received and logged in the hot lab of the Nuclear Medicine Laboratory.
2. If purchased, a ^{99m}Tc generator will be shielded by a total of 7 cm of lead. An additional 5-cm thickness of lead (bricks) will be placed on the sides of the generator. A block of the shielding is removed in order to elute the generator. The additional shielding will remain around the generator until it is removed to the hot storage area which is located in a remote area in the emergency generator room of the hospital basement.
3. With the exception of th ^{99m}Tc generator, and standards described in Section 10, Part 1, all radioactive materials will be stored in the original shipping containers in a cave 5-cm thick in the refrigerator just below the cabinet where the generator is located. Standards 1-4 listed in Section 10 will be stored in a 1-inch thick lead container. Sufficient shielding will be placed around the 0.2 mCi Cs-137 source to reduce exposure to 2 mR/hr at 15 cm from the source.
4. Waste materials, old generators, needles and syringes and other contaminated items will be stored for decay in the hot storage area. The hot storage area is located such that only limited occupancy is likely. If needed, sufficient shielding will be installed to reduce exposure in the hot storage area to 2 mR/hr at the exterior walls. These items will remain in their shipping containers, in lead shielded boxes or in plastic-lined boxes until their disposal.
5. Posted areas including the scanner room, the hot lab, and hot storage area will be locked when not in use. Only informed, responsible persons will be permitted keys to these areas.

Section 11 (Continued)

C. Preparation and Handling of Radioactive Materials

The Nuclear Medicine Laboratory offers tile floors and formica-sufaced counter tops. Counter tops will be covered with polyethylene-backed absorbent paper. All radiopharmaceuticals for administration to patients will be prepared in the Nuclear Medicine hot lab areas as follows:

1. ^{99m}Tc generator will be eluted directly into a shielded vial.
2. Generator eluate and other bottled pharmaceuticals will be removed from shielding via 12-inch tongs for purposes of observation and/or vial assay. Transfer of radioactive materials will be ahieved via needle and syringe or pipette. If pipetting is required, only suction devices such as rubber bulbs or specifically-adapted disposable syringes or automated pipetting devices will be used.
3. Appropriate shielding will be employed by the radiation worker during handling of radioactive materials. This will be accomplished with the use of lead pigs (such as shipping containers), lead sheeting, lead shielded syringes and lead bricks. Manufacturer specifications for each pharmaceutical preparation will be followed to minimize exposure. Each radioactive materials preparation will be assayed via well ionization chamber.
4. Doses or radiopharmaceuticals will be withdrawn from shielded vials and placed in lead pigs until assay and/or administration. Technetium-99m preparations or any other radioactive materials will be routinely withdrawn and injected into shielded syringes. Each patient dose will be assayed via well ionization chamber or alternative method described herein.

D. Administration of Radioactive Materials and Patient Procedures

1. The Nuclear Medicine imaging area offers a tiled floor with sufficient area for administration of radiopharmaceuticals to patients. Patient examination via gamma camera will occur in this room.
2. Administration of radiopharmaceuticals to patients will occur only in the imaging room or

Section 11 (Continued)

in the patient's room in the hospital.

E. No in-vivo/in-vitro or radioimmunoassay procedures requiring pipetting of patient specimens, manipulation of specimens and counting of test tubes containing radioactive materials are to be instituted at this time.

NRC - 313M

Section 12 PERSONNEL TRAINING PROGRAM AND FREQUENCY

A. Radiation workers

1. Radiation workers will be provided with materials for continuing education in the form of books, journals, discussions or scientific meetings.
2. Discussions will include recent topics in journals relating to new or varied procedures, radiation safety review and radiopharmaceutical development.
3. Recent publications including the "Journal of Nuclear Medicine" will be provided.
4. Radiation workers will be instructed as to the terms and conditions of the NRC license and will be kept informed and required to read applicable NRC regulations.

B. Other personnel

1. All personnel potentially coming in contact with radioactive materials including nurses, housekeeping, and security personnel will be informed of the locations and potential hazards of radioactive materials stored in each location.
2. Nursing personnel will be informed of the proper procedures for handling radioactive patients.
3. Housekeeping will be informed of the areas which they may clean and refuse items which they may remove.
4. Security will be informed of the potential hazards in case of theft, fire and storm damage.
5. Individuals who work in or frequent any portion of a restricted area will receive instruction as specified in 10 CFR 19.12.

C. Information of the above described nature will be give through routine inservice education at the time of employment and annually thereafter.

NRC - 313M

Section 13 PROCEDURES FOR ORDERING AND RECEIPT OF RADIOACTIVE MATERIALS

A. Before ordering radioactive materials, the user will determine that the needed order will (when received and combined with on-hand materials) not exceed authorized possession limits.

B. The supplier of the radioactive materials will be instructed to deliver radioactive materials directly to the Nuclear Medicine Laboratory, or if after hours, to the Head Nurse of the Emergency Room area or security personnel, who will transfer the materials to the Nuclear Medicine hot lab area.

C. It is the responsibility of the Nuclear Medicine Technologist to assay the received radioactive materials, survey the shipping container for leakage and to record the amounts of materials received.

D. Survey of the shipping container will be achieved with the use of the Survey Meter.

E. Leakage or shipping container contamination will be reported to the supplier within 48 hours of discovery.

F. See Section 14 for procedures for safely opening packages containing radioactive material.

NRC - 313M

Section 14 PROCEDURES FOR SAFELY OPENING PACKAGES CONTAINING RADIOACTIVE MATERIAL

A. Receiving

1. Radioactive materials (RM) will normally be delivered directly to the Nuclear Medicine area during working hours.
2. Should the Nuclear Medicine area be closed, the materials will be delivered to the Head Nurse of the Emergency Room. The Emergency Room Nurse on duty will immediately deliver the materials to the Nuclear Medicine hot lab and immediately notify the Nuclear Medicine personnel of such action.
3. It will be the responsibility of the Radiation Safety Office and the Nuclear Medicine Technologist to arrange with the various delivering agencies the proper location for delivery of radioactive materials.

B. Package Manipulation (all packages of radioactive material).

1. All packages of radioactive material will be presumed contaminated. Rubber gloves will be worn by all personnel handling boxes of radioactive material including the Emergency Room Nurse on duty.
2. Only the Radiation Safety Officer or the Nuclear Medicine Technologist may open packaged radioactive materials.
3. The packaged radioactive material will be surveyed in the following manner within 3 hours of receipt during working hours or within 18 hours of receipt during weekends or holidays:

   a. Prior to opening, each package will be monitored with the survey meter and exposure rates recorded at: three (3) feet from the package surface; at the surface of the sides, top, and bottom of the package. Any reading greater than 10 mR/hr at 3 feet from the surface or 200 mR/hr at the package surface will be immediately reported to the final delivery agency, the supplier, and the Nuclear Regulatory Commission by telephone and telegraph. The address is:

Section 14 (Continued)

United States Nuclear Regulatory Commission
Office of Inspection and Enforcement,
Region IV
Suite 1000
611 Ryan Plaza Drive
Arlington, Texas 76012
Telephone (817) 860-8191

b. Step (a) above must be completed for each package of radioactive materials. If this condition required Nuclear Regulatory Commission notification, the package will not be opened. The intact package will be placed in a plastic bag and will not be opened until permission is obtained from the Nuclear Regulatory Commission. The package will be stored in the hot storage area located in the emergency generator room.

c. If Step (a) above did not require NRC notification, open the package and observe contents for damage or leakage. If no damage is observed, proceed with the unpacking, assay the material (where applicable) and proceed with the disposition of package contents.

Wipe external surface of final source container with moistened cotton swab or filter paper held with forceps, monitor, and record.

d. Survey packing material with the survey meter. If activity is found, determine the radiation level. Then notify the supplier as soon as possible. If no activity is found, remove or deface the radioactive material signs and dispose of the package.

4. Record in an appropriate log the following information:

Supplier
Transport group label
Nuclide and amount
Transportation index
Maximum reading at surface of package and at 3 feet (mR/hr).

Section 14 (Continued)

5. When radioactive material is administered to a patient, record the date, the patient's name, identifying number and activity of the dose administered.

Section 15 - GENERAL LABORATORY RULES FOR THE SAFE USE OF RADIOACTIVE MATERIALS

A. Personnel Safety Precautions

1. Age - Radiation workers will have had their 18th birthday prior to employment.

2. Monitoring:

a. Prior to employment, the user will obtain a medical record and occupational exposure record of potential employees. The potential employees' records will demonstrate compliance with 10 CFR 20.102 before they are permitted into restricted areas.

b. Radiation workers will wear film badges and finger film badges when handling radioactive materials, patients who have been injected with radioactive materials, or while working in areas where radioactive materials or patients may be.

c. Individuals whose monitored levels approaching those described in 10 CFR 20.101 will be assigned employment in non-radiation areas or terminated.

3. Protective clothing - Radiation workers will wear protective clothing including knee-length laboratory coats and disposable plastic gloves while working with radioactive materials or radioactive patients.

4. Transfer and shielding:

a. Transfer of all (liquid) radioactive materials from container to container will be achieved by needle and shielded syringe or by pipette. Whenever pipetting is required, only suction devices such as rubber bulbs or especially adapted disposable syringes or automated pipetting devices will be used.

b. Appropriate shielding will be employed for radiation workers handling radioactive materials. This will be accomplished with the use of lead pigs (such as shipping container), lead sheeting, lead bricks and a leaded glass work protective barrier (Picker Model 653-456).

Section 15 (Continued)

c. All radioactive materials withdrawn from shielded vials or preparation of radiopharmaceuticals for intravenous administration to patients will be withdrawn into shielded containers or shielded syringes. Syringe shields will routinely be used for administration of patient doses, the only exception will be pediatric patients where syringe shields would impede injection and would compromise the patient's well-being.

d. Capsules will be transferred to patient from shielded container, using tongs.

e. Survey generator, preparation and injection areas for contamination after each procedure or at the end of the day; decontaminate if necessary.

5. Ingestion of Radioactive Materials - Eating and drinking will not be allowed in posted areas except as prescribed by the user for patient being examined with radioactive materials. Smoking is prohibited without exception in all areas where radiopharmaceuticals are used or stored.

6. Radiation exposure to personnel during generator elution and handling of radioactive materials will be minimized by following the manufacturer's instructions exactly:

a. The generator column will be removed from its shield seven days after its calibration date and placed in the hot storage room behind lead bricks until 10 Mo-99 half lives have elapsed from the date of calibration.

b. Elution will be accomplished directly into a shielded vial.

c. 12 inch tongs will be used to remove the eluate vial from the shield for assay.

d. Eluate vials will remain in a lead shield during withdrawal of doses.

17901

Section 15(Continued)

B. Record keeping

1. The receipt and disposition of all radioactive materials will be recorded. These records include: Supplier, Nuclide, transport and group label, transportation index, exposure at 3 feet from package surface, chemical form, specific activity, concentration, activity as per label and well ionization chamber assay, date of calibration, lot number, date of receipt, expiration date, intended use, names, and identifying number of patients receiving portions of this material, date of administration, amount administered (volume and activities), amount of residue, date and method of disposal.

2. Records of radiation survey. These records are to include: Survey Meter readings of surveyed areas, background reading, counts per minute of wipe samples, background count, date, contamination if any, meter reading and counts per minute after decontamination.

3. Records of instrument calibration are to include: date of calibration, activity of source, reading of instrument, distance from source to detector and efficiency and full width at half maximum of energy peak if appropriate.

4. Records of film badge and film badge finger monitors will be maintained monthly on each radiation worker. These records are to include: type of monitor, dates of exposure, exposure level, reasons for excess reading (if any), action taken (if any).

C. Posting of restricted areas

1. The following areas will be posted as follows when room contents warrant: Conventional radiation symbol and words, "Caution, Radioactive Material". The Nuclear Medicine imaging room, hot laboratory, laboratory area and hot storage, 99mTc generator and rooms of patients hospitalized for 131-Iodine and other nuclide therapy.

Section 15(Continued)

2. A copy of the current regulations of 10 CFR 19, 20, 30 and 35, license application, the license, approved Nuclear Medicine procedure manual and a form AEC-3, "Notice to Employees" will be posted or available in the imaging room. Additional documents as required in 10 CFR 19 will be posted in the imaging room.

3. A copy of "Safety with Radioisotopes" will be posted in the imaging room, the hot laboratory, the laboratory and the hot storage areas.

NRC - 313M

Section 16 EMERGENCY PROCEDURES INCLUDING NAMES AND TELEPHONE NUMBERS OF PERSONNEL TO BE NOTIFIED

Unsealed radioactive liquids are handled routinely in the Nuclear Medicine Laboratory. The potential for spillage is always present. It is imperative that individuals handling radioactive materials respond properly to these spills so as to limit their radiation exposure and prevent the spread of contamination.

A. Minor Spills (tracer activities)

1. Notify persons in the immediate area that a spill has occurred.

2. Cover the spill with absorbent paper.

3. Limit access to the area to only those persons dealing with the spill.

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 (Survey Meter) potentially contaminated personnel before they disperse, and decontaminate as necessary.*

6. Notify the Radiation Safety Officer of the incident.

B. Major Spills (therapy activities)

1. Notify all persons not involved in the spill to vacate the room at once. Limit the movement of displaced persons to confine the spread of contamination.

2. Cover spill with absorbent paper.

3. Switch off all fans. Close windows.

4. Vacate room.

5. Close the door to the room. Prevent entry into the room.

6. If the spill is on the skin, flush thoroughly.

Section 16 (Continued)

7. If the spill is on clothing, discard outer or protective clothing at once.

8. Notify the Radiation Safety Officer immediately.

9. Survey (survey meter) personnel involved. immediately initiate decontamination of personnel as necessary, using mild soap and lukewarm water.*

C. A poster, "Safety with Radioisotopes", will be displayed in the hot laboratory, the imaging room, the laboratory and the hot storage area. This poster describes the procedures which are to be followed in the case of an emergency. In addition, this poster contains a description of what constitutes an emergency with regard to spillage of radionuclides. An emergency will be considered such if levels of activity in the contaminated area are found to be on the order of 3000 counts per minute or greater.

D. In the case of fire involving radioactive materials, the Fire Department is to be notified immediately, then the Radiation Safety Officer and the Hospital Administrator are to be notified. This poster will be displayed in both the laboratory and storage areas of the Nuclear Medicine facility.

E. In addition, at the time of employment, the Nuclear Medicine Technologist will be informed of these posters and the procedures to be followed.

* Refer to Radiologists Health Handbook, pp. 194-203 (reference list), for methods of personnel and area decontamination.

NRC - 313M

Section 17 AREA SURVEY PROCEDURES

A. Daily surveys of the floor, patient chairs, patient stretchers, linens, sink, counter top and injection areas of the Nuclear Medicine suite will be accomplished via the Survey Meter when the area is in use. Materials or areas found to be above room background will be respectively stored for decay or scrubbed to background. The minimum survey requirement is weekly intervals.

B. Before the Nuclear Medicine Technologist leaves the area where the Molybdenum-Technetium generator is eluted, radiopharmaceuticals prepared or patient doses prepared for administration to patients, he or she will survey hands, clothing and shoes for contamination. If activity is detected, the hands will be washed to remove such contamination. All clothing and contaminated objects of the person will be removed and stored for decay. Each survey will be recorded in an appropriate log.

C. Should accidental contamination occur, immediate survey and scrubbing procedures will begin.

D. Urine assays of each person handling millicurie amounts of radioactive material will be conducted on a weekly basis or more frequently if contamination is suspected.

E. Records of surveys, assays and wipe tests will be maintained including the identification of the person performing the survey.

F. Wipe tests: Routine weekly wipe tests will be done in areas where radiopharmaceuticals are used or stored.

G. The proposed separate storage area for radioactive wastes located in the basement level will, if used, be surveyed at least weekly. Detected contamination levels will be keyed to a location on a drawing.

NRC - 313M

Section 18 WASTE DISPOSAL PROCEDURES

A. Solid wastes and waste materials of ^{99m}Tc such as contaminated instruments, syringes, sealed containers or liquid will be sorted in the hot storage area until such time that when measured at surface by the Survey Meter do not produce a reading above background. When sufficiently decayed, radioactive labels will be removed and disposable wastes will be placed in the refuse collection system. Usable items will be thoroughly washed and returned to normal use.

B. Liquid wastes of Iodine-125, Iodine-131 labeled to human blood or serum will be dispersed into the sanitary sewerage in accordance with 10 CFR 20.303. The minimum water usage in St. John's Hospital is 26,500 gallons per month (July, 1979). This is equivalent to 3.23×10^{7} ml of water per day. The maximum amount of radioactive materials in any room described above that could be dispersed into the sewer will not exceed:

1. ^{131}I - 6 x 10-5 uCi/ml

2. ^{99m}Tc - 2 x 10-1 uCi/ml

Other nuclides could be dispersed into the sewerage but the total quantity will not exceed those values set for 10 CFR 20 Appendix B, Table 1, Column 2.

C. A receptacle having a double liner and labeled, "Hot Trash - Do Not Empty", is provided in the Nuclear Medicine Department for contaminated material.

A decay bin will be placed in an area removed from the general public and hospital personnel, and shall be secured with a lock to prevent inadvertent entry. The area will be properly labeled with warning signs.

D. Generators will be returned to the manufacturer for disposal.

E. Records of each disposal, date, method, amount of activites involved, and initials of person discarding the material will be maintained.

* Note: An attempt will be made to dispose of all wastes by decay to background level.

NRC - 313M

Section 21 PROCEDURES AND PRECAUTIONS FOR USE OF RADIOACTIVE GASES (e.g. Xenon-133)

1. Quantities to be Used

   It is anticipated that not more than two pulmonary ventilation studies requiring 20 mCi Xe-133 will be performed per week.

2. Use and Storage Areas

   A Pulmonex Xenon System will be purchased and housed in the imaging room. Xenon-133 will be purchased as needed and stored until use behind lead bricks in the hot lab. Ventilation in this area is approximately 150 ft^3/min, with the exhaust vent located directly above the storage site. Ventilation rate in the area will be measured semi-annually to assure adequate air flow.

3. Procedures for Routine Use

   A single vial of Xenon-133 (20-30 mCi) will be loaded into a Calidose gun and then into the Automatic Xenon Dispenser on the Pulmonex unit for delivery to the patient. The patient will inhale Xe-133 through a face mask and will wear a nose clamp to minimize the possibility of accidentally exhaling into the room. Upon expiration back into the face mask, the Xe-133 will be trapped in a charcoal filter built into the Pulmonex unit. This filter will be changed semi-annually to prevent the possibility of saturation with gas. Radioactive filters will be completely shielded with lead bricks on a four-wheeled cart and stored in the hot storage room for at least ten Xe-133 half lives. They will then be disposed of as ordinary trash.

4. Emergency Procedures

   In the event of accidental release of Xe-133 into the imaging room, the room will be immediately evacuated until a survey (survey meter) of the room indicates a return to background radiation levels.

5. Air Concentrations of Xe-133 in Restricted Areas

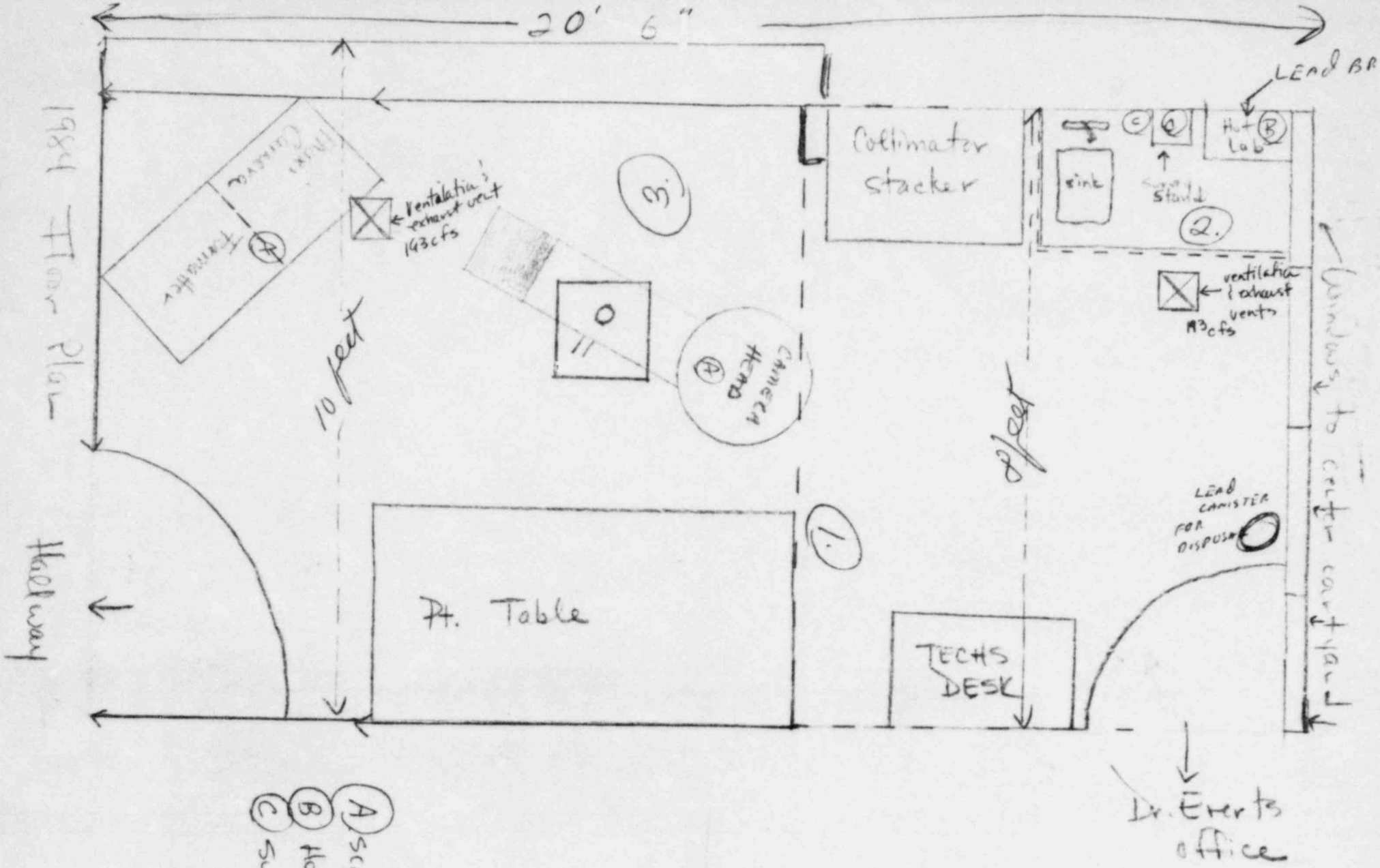
   From the ventilation rate in the imaging room, we estimate that even if the entire contents of two

Section 21 (Continued)

30-mCi vials (maximum number of studies per week) of Xe-133 were simultaneously opened to the atmosphere in the room, the allowed maximum permissible levels of Xe-133 listed in Regulatory Guide 10.8-53 (October, 1980) would not be exceeded. This event is extremely unlikely to occur.

6. Release of Exhaust to Outside of Hospital

Air from the ventilation system is exhausted through a stack on the roof of the hospital. The door leading to the roof will be locked at all times and posted with a sign displaying the conventional symbol and the words "Caution, Radioactive Materials." Personnel with access to the roof will be given specific instructions about radiation safety.


20' 6"
LEAD BRICKS
1984 Floor Plan
Collimator stacker
sink
stand
Hot Lab
ventilation exhaust vents 143 cfs
ventilation exhaust vents
83 cfs
10 feet
8 feet
Camera Head
LEAD CANISTER FOR DISPOSAL
windows to carrel area
Pt. Table
TECHS DESK
Hallway
Dr. Everts office
A scanner
B Hot lab
C survey meters
room is 10' x 20.5' in some places
10' x 20.5' IN OTHERS
no wall betw. wak area & campa

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Letter 2-22-79

NRC - 313M

REFERENCE ITEMS 9, 10-B, 15-B

3. ALTERNATIVE METHOD OF DOSE CALIBRATION

A. The Geiger-Mueller Survey Meter will be calibrated each day or before each dose is given using a CO-57 source with accuracy ± 5%. The activity of the source will be 5 mC_i. Each patient dose will be assayed immediately before given. When multiple doses are received on the same day, each separate dose will be assayed using the Survey Meter.

B. The same geometry, i.e., distance and containers will be used each time when assaying doses.

C. The dose vial will be properly shielded in a cylindrical lead container. The same container will also expedite maintaining the same geometry from source to detector each time an assay is done.

D. Geiger-Mueller Survey Meter will be calibrated by the University of Utah, Salt Lake City, Utah, before initial use and thereafter on a yearly basis or if batteries are changed. The Geiger-Mueller Survey Meter will be calibrated for an energy spectrum to give readings for Technetium-99.

E. Measurements by the G-M Survey Meter to be used at St. John's Hospital will be taken for sources of known activity in the Laboratory of the University of Utah Radiopharmacy (the supplier.) These readings will be correlated and calibrated for doses of known activity given by their dose calibrator. A graphic chart will be made. Additionally, records will be kept correlating the activity determined at St. John's Hospital with that activity predetermined at the University of Utah Radiopharmacy.

F. The overall accuracy of this alternative system should be ± 10%.

NRC - 313M

APPLICABLE FORMULAS

1. $mr/hr = \frac{n \times I}{S^2}$

mr/hr = radiation intensity

n = activity in millicuries

I_2 = $mr/hr/mC_i$ at 1 meter

S = distance from source in meters

2. $R_t = R_o \times e - \left[\frac{0.693}{T\ 1/2} \times t\right]$ for decay

3. mC_i dose = $\frac{\text{CPM dose} \times mC_i \text{ std}}{\text{CPM std}}$

Proposed Method for Verification of
Technetium-99m Doses Prior to Administration

I. Initial Calibration of Survey Meter

A. St. John's Hospital will purchase a Geiger-Mueller survey instrument of suitable design and quality.

B. The GM survey instrument will be sent to the University of Utah, Radiological Health Department for calibration. The initial calibration will be performed using the 69 Curie Cesium-137 source operated under N.R.C. license 43-01884-13.

C. The instrument will be calibrated at two points on each sensitivity range, the points being approximately 1/3 and 2/3 of the full scale value on each range. The calibration controls will be adjusted to produce responses within ± 10% of the true dose rate at each calibration point.

D. When the instrument has been accurately calibrated, a response measurement will be made with a long-lived reference check source (e.g., Cesium-137) with the check source and the GM survey instrument positioned in the fixed geometric configuration noted in paragraph II A below. The observed response of the G.M. survey instrument will be recorded on the calibration certificate containing the data from the instrument calibration procedure described in paragraph C above.

II. Calibration for Technetium-99m.

A. Following the initial calibration procedures described above, the survey instrument will be positioned on a test stand shown in the attached sketch. The instrument probe will be 18 inches above the base of a ring stand upon which a lead shielded syringe holder, will be placed. The probe of the survey instrument will be held in place by a clamp to maintain a fixed, reproducible distance between the probe and the syringe holder.

B. A syringe containing a precisely measured quantity of fresh pertechnetate will be placed in the syringe holder. The dose rate in mR/hr. indicated by the survey meter will be recorded. The procedure will then be repeated using a series of syringes containing graduated quantities of pertechnetate.

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C. The data acquired in the procedure described in paragraph B above will be used to plot a curve on a graph or nomogram which will indicate the observed dose rates in mR/hr. vs. quantities of pertechnetate in millicuries. All the data collected in the calibration procedures will be sent with the survey instrument and the reference check source to St. John's Hospital.

III. Recalibration and Response Checks.

A. The survey instrument will be recalibrated using the procedures described above:

1. At least annually.

2. After each maintenance and/or battery change.

3. Whenever the instrument response to the reference check source differs by more than 10% from the value given on the calibration certificate.

B. The response of the survey instrument to the reference check source will be checked before each use and at least daily. A record of each response check will be maintained.

IV. Verification of Technetium-99m Doses.

A. Prior to being administered to a patient, each prescribed dose of Technetium-99m will be checked to verify that it contains the correct activity. This will be done as follows:

1. The survey meter will be positioned as shown in the attached sketch.

2. The response of the instrument in the test configuration to the reference check source will be noted and recorded. This value must agree within ± 10% of the value given in the calibration certificate.

3. The reference check source will be removed and the syringe containing the Technetium-99m prepared for administration will be placed in the syringe holder. The response of the survey instrument in mR/hr. will be noted and recorded. The syringe will be removed to a shielded-holding area awaiting administration.

4. The activity of the material in the syringe will be determined by using the chart described in paragraph II C above. This value in millicuries will be recorded. If the activity level determined by this method varies from the prescribed activity level by greater than ± 10%, the material should not be administered to the patient, and the Director of the Nuclear Medicine Department should be notified.

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A. Following the initial calibration procedures described above, the survey instrument will be positioned on a test stand shown in the attached sketch. The instrument probe will be 18 inches above the top of the lead shielded syringe holder which is positioned on the ring stand base. The probe of the survey instrument will be held in place by a clamp to maintain a fixed, reproducible distance between the probe and the syringe holder.

B. A syringe containing a precisely measured quantity of fresh pertechnetate will be placed in the syringe holder. The dose rate in mR/hr indicated by the survey meter will be recorded. The procedure will then be repeated using a series of syringes containing graduated quantities of pertechnetate.

C. The data acquired in the procedure described in paragraph B above will be used to plot a curve on a graph or nomogram which will indicate the observed dose rates in mR/hr. vs. quantities of pertechnetate in millicuries. All the data collected in the calibration procedures will be sent with the survey instrument and the reference check source to St. John's Hospital.

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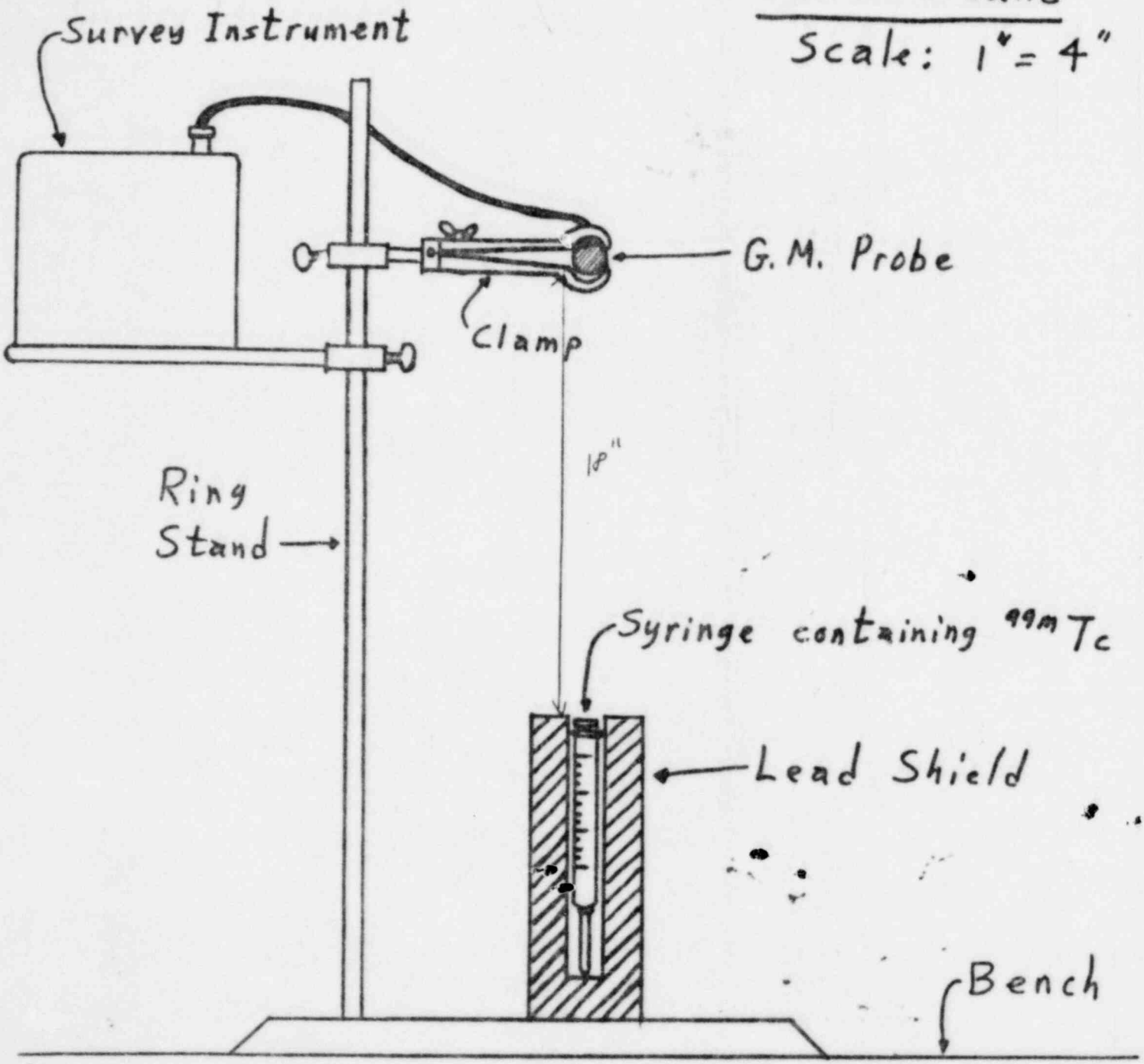
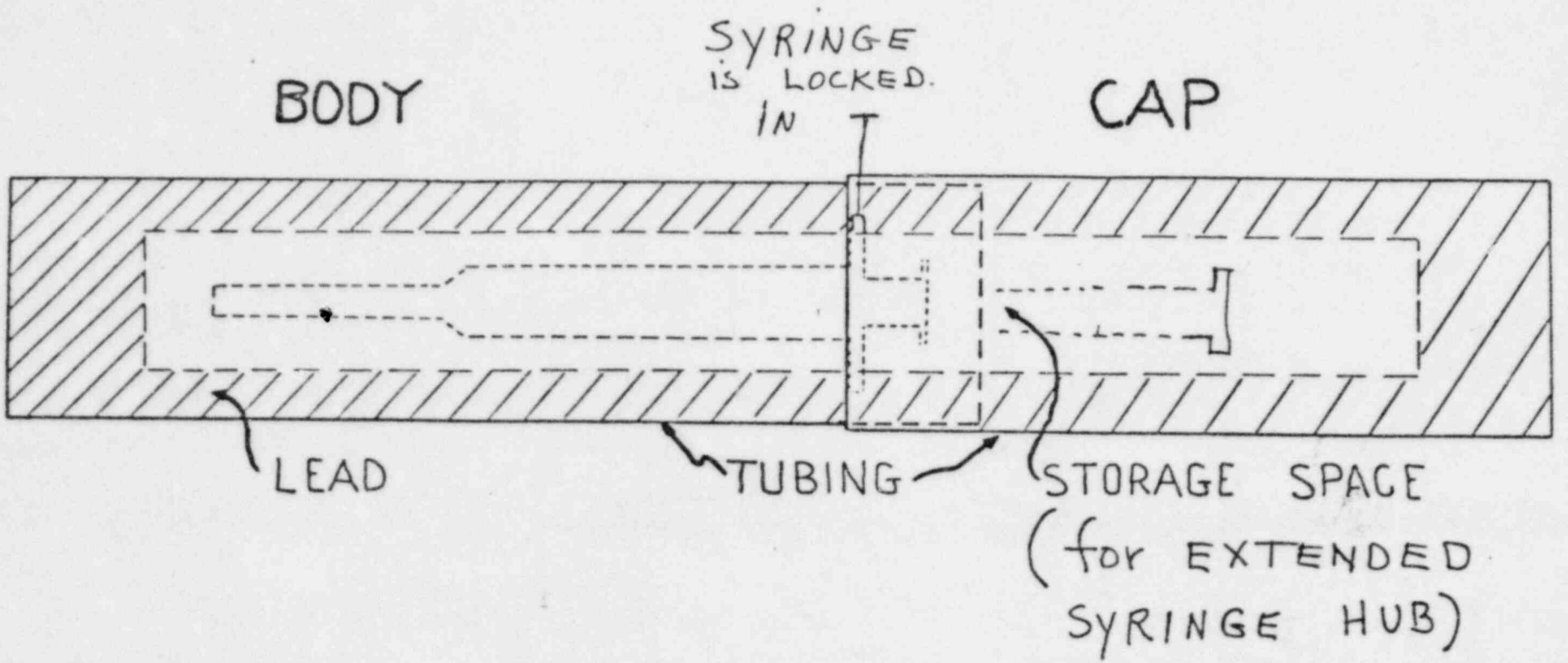
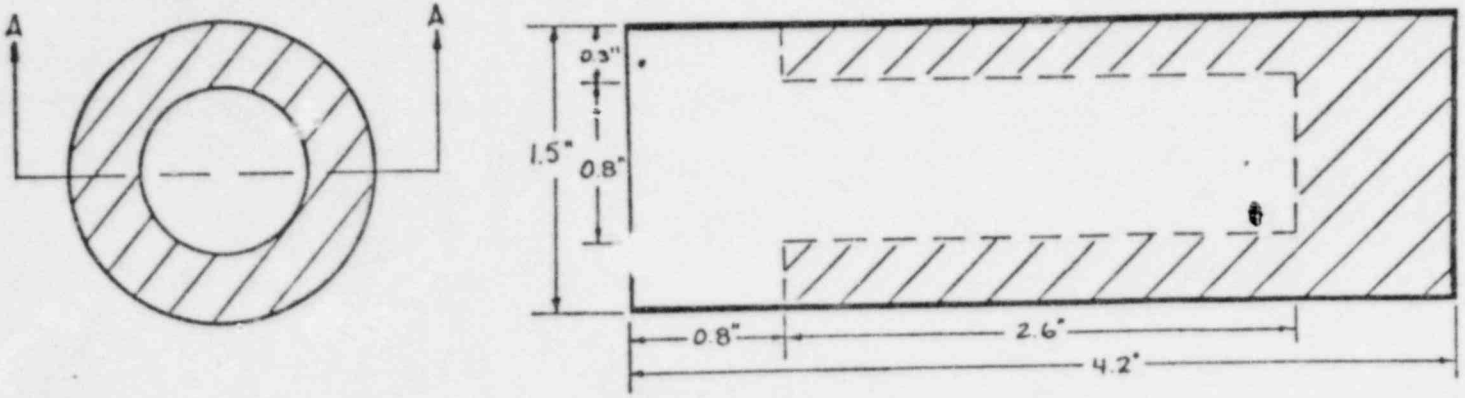
Calibration Test Stand

Scale: 1" = 4"




SYRINGE
IS LOCKED.
IN
BODY
CAP
LEAD
TUBING
STORAGE SPACE
(for EXTENDED
SYRINGE HUB)

CAP



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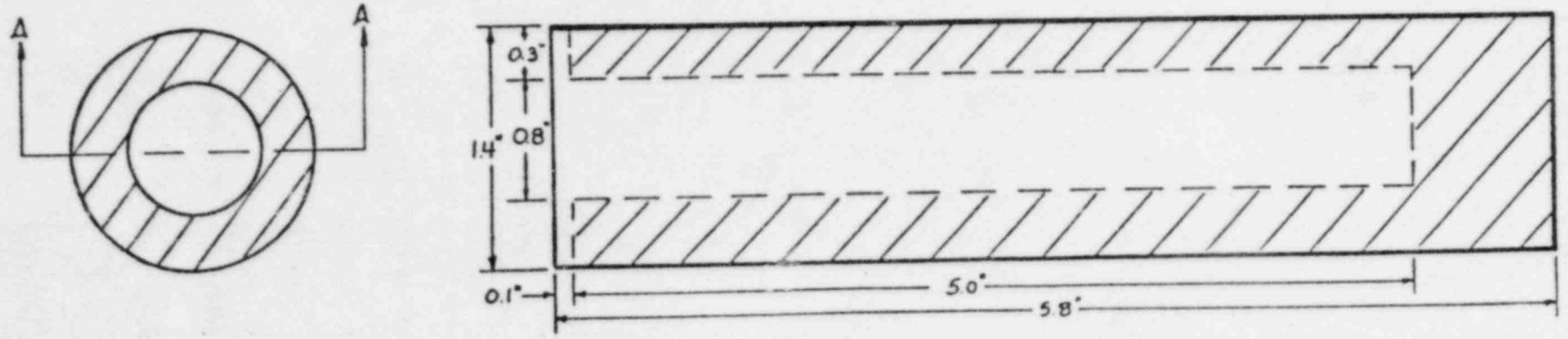
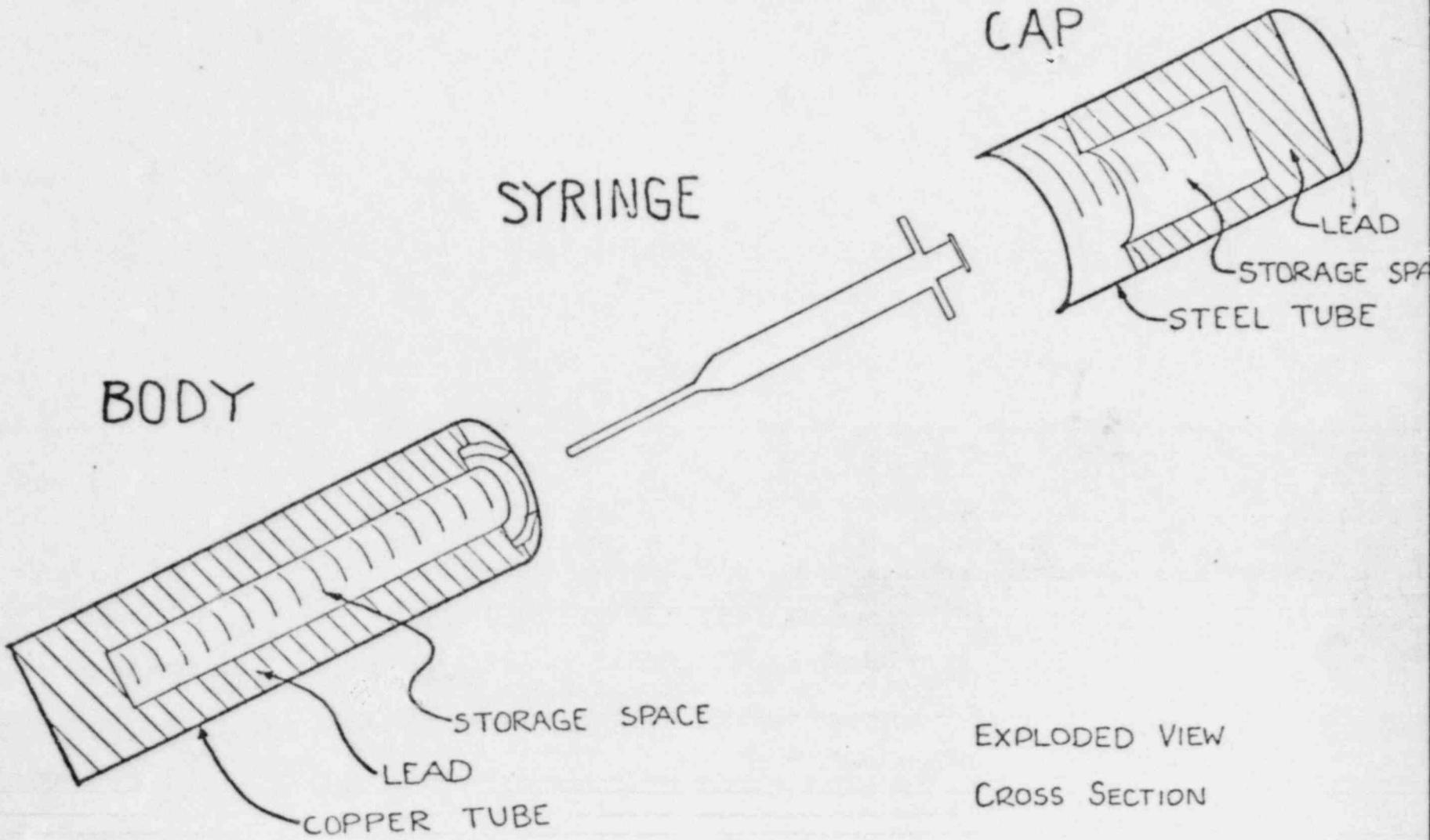


TOP VIEW

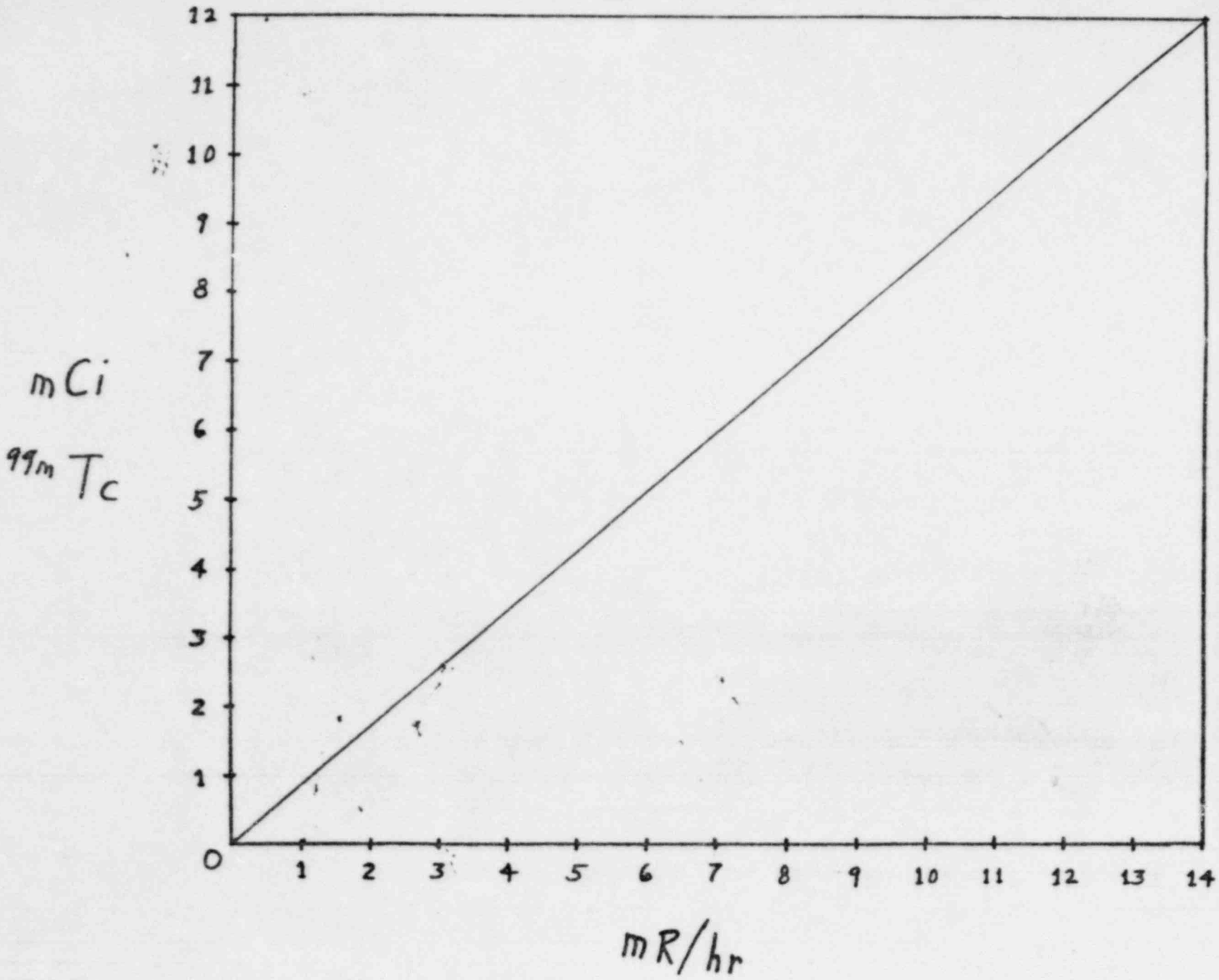
SIDE VIEW – CROSS SECTION

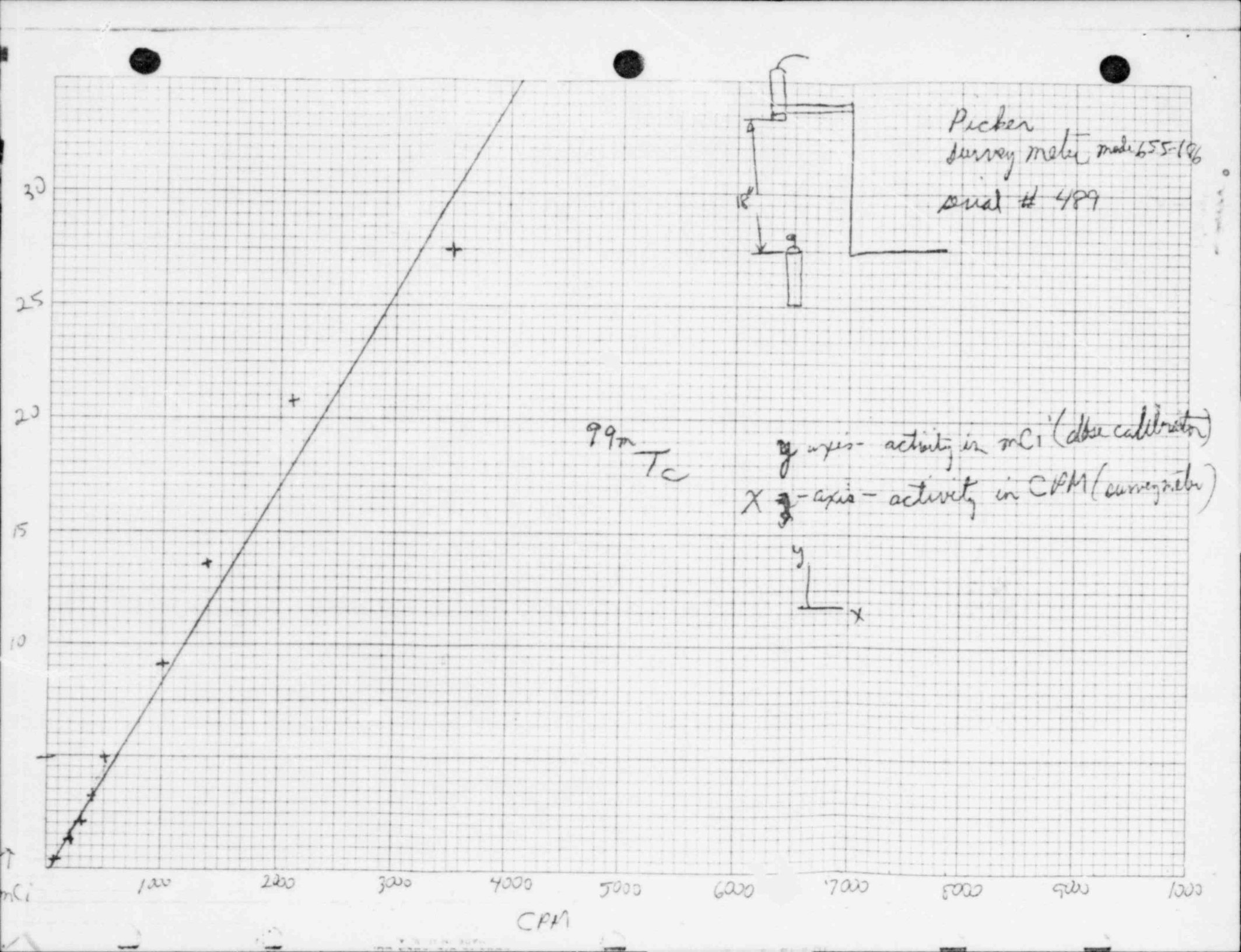


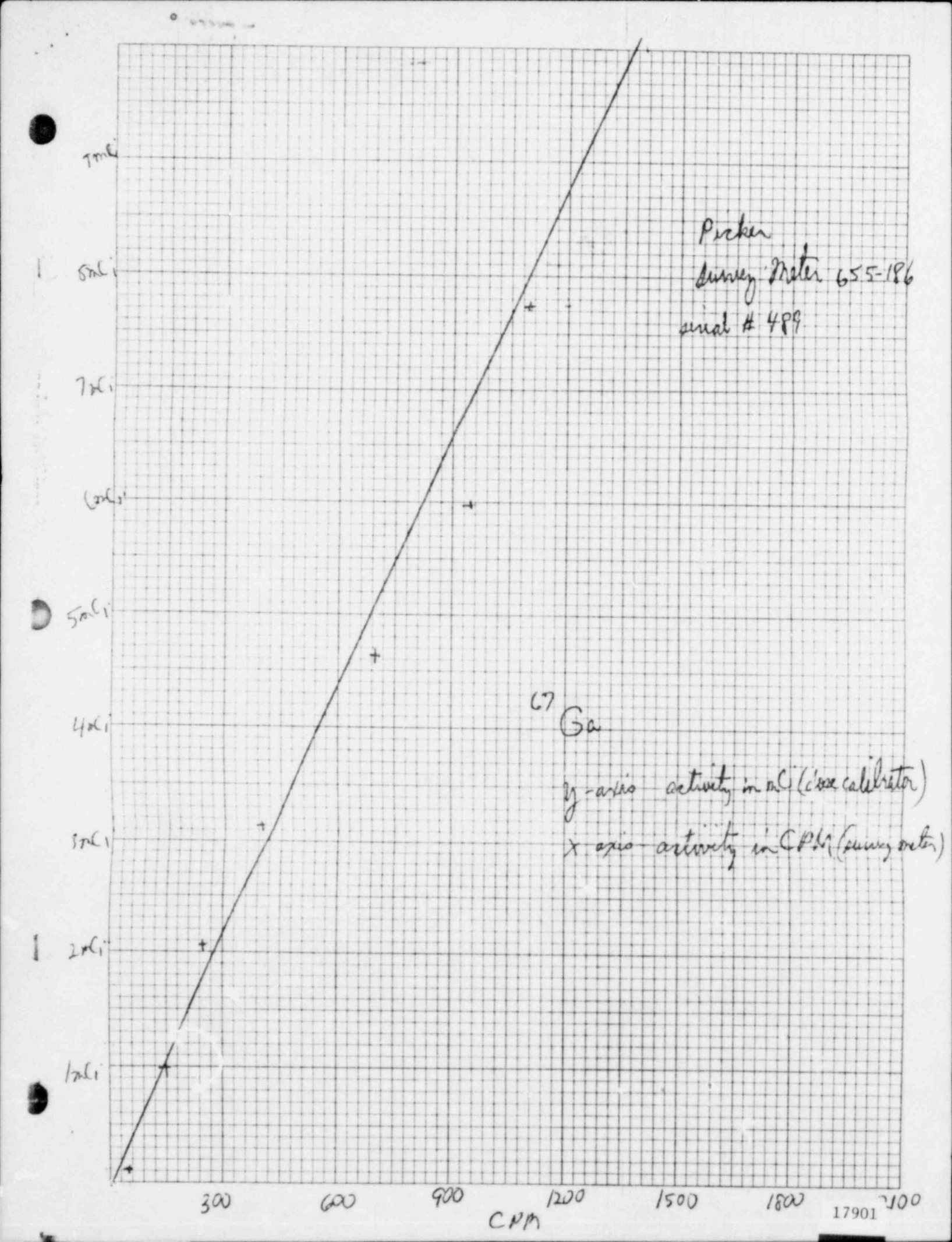
EXPLODED VIEW

CROSS SECTION

^{99m}Tc Dose Calibration




Picker
survey meter made 6-55-186
unit # 489
99m Tc
y axis - activity in mCi (dose calibrator)
x axis - activity in CPM (survey meter)
y
x
30
25
20
15
10
mCi
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
CPM


Picker
Survey Meter 655-186
serial # 489
67 Ga
y-axis activity in mCi (dose calibrator)
x axis activity in CPM (survey meter)
7mCi
5mCi
3mCi
2mCi
1mCi
300
600
900
1200
1500
1800
CPM
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