

## APPLICATION FOR MATERIALS LICENSE - MEDICAL

**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 License 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

Merrifield Research Laboratories, Inc.  
2723 B Merrilee Drive  
Fairfax, Virginia 22031

TELEPHONE NO.: AREA CODE ( 703 ) 560 - 1910

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 A. Bowles, Ph.D.

TELEPHONE NO.: AREA CODE ( ) same as above

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

a. ☒ NEW LICENSE

b. ☐ AMENDMENT TO LICENSE NO. \_\_\_\_\_

c. ☐ RENEWAL OF LICENSE NO. \_\_\_\_\_

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

Charles A. Bowles, Ph.D.  
Diana Linnekin

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 A. Bowles, Ph.D.

## 6.a. RADIOACTIVE MATERIAL FOR MEDICAL USE

RADIOACTIVE MATERIAL LISTED IN:	ITEMS DESIRED "X"	MAXIMUM POSSESSION LIMITS (In millicuries)	ADDITIONAL ITEMS:	MARK ITEMS DESIRED "X"	MAXIMUM POSSESSION LIMITS (In millicuries)
10 CFR 31.11 FOR IN VITRO STUDIES			IODINE-131 AS IODIDE FOR TREATMENT OF HYPERTHYROIDISM		
10 CFR 35.100, SCHEDULE A, GROUP I		AS NEEDED	PHOSPHORUS-32 AS SOLUBLE PHOSPHATE FOR TREATMENT OF POLYCYTHEMIA VERA, LEUKEMIA AND BONE METASTASES		
10 CFR 35.100, SCHEDULE A, GROUP II		AS NEEDED	PHOSPHORUS-32 AS COLLOIDAL CHROMIC PHOSPHATE FOR INTRACAVITARY TREATMENT OF MALIGNANT EFFUSIONS.		
10 CFR 35.100, SCHEDULE A, GROUP III			GOLD-198 AS COLLOID FOR INTRACAVITARY TREATMENT OF MALIGNANT EFFUSIONS.		
10 CFR 35.100, SCHEDULE A, GROUP IV		AS NEEDED	IODINE-131 AS IODIDE FOR TREATMENT OF THYROID CARCINOMA		
10 CFR 35.100, SCHEDULE A, GROUP V		AS NEEDED	XENON-133 AS GAS OR GAS IN SALINE FOR BLOOD FLOW STUDIES AND PULMONARY FUNCTION STUDIES.		
10 CFR 35.100, SCHEDULE A, GROUP VI					

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
Carbon-14	Any	50 mCi	Research and Biological studies
Hydrogen-3	Any	150 mCi	invitro only
Chromium-51	Any	20 mCi	same
Phosphorus-32	Any	30 mCi	same 204006

# **INFORMATION REQUIRED FOR ITEMS 7 THROUGH 23**

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

<b>7. MEDICAL ISOTOPES COMMITTEE</b>		<b>15. GENERAL RULES FOR THE SAFE USE OF RADIOACTIVE MATERIAL (Check One)</b>	
<input type="checkbox"/>	Names and Specialties Attached; and	<input type="checkbox"/>	Appendix G Rules Followed; or
<input type="checkbox"/>	Duties as in Appendix B; or _____ (Check One)	<input checked="" type="checkbox"/>	Equivalent Rules Attached
<input type="checkbox"/>	Equivalent Duties Attached	<b>16. EMERGENCY PROCEDURES (Check One)</b>	
<b>8. TRAINING AND EXPERIENCE</b> Refer to the attached		<input type="checkbox"/>	Appendix H Procedures Followed; or
<input type="checkbox"/>	Supplements A & B Attached for Each Individual User; and	<input checked="" type="checkbox"/>	Equivalent Procedures Attached
<input type="checkbox"/>	Supplement A Attached for RSO.	<b>17. AREA SURVEY PROCEDURES (Check One)</b>	
<b>9. INSTRUMENTATION (Check One)</b>		<input type="checkbox"/>	Appendix I Procedures Followed; or
<input type="checkbox"/>	Appendix C Form Attached; or	<input checked="" type="checkbox"/>	Equivalent Procedures Attached
<input checked="" type="checkbox"/>	List by Name and Model Number	<b>18. WASTE DISPOSAL (Check One)</b>	
<b>10. CALIBRATION OF INSTRUMENTS</b>		<input type="checkbox"/>	Appendix J Form Attached; or
<input type="checkbox"/>	Appendix D Procedures Followed for Survey Instruments; or _____ (Check One)	<input checked="" type="checkbox"/>	Equivalent Information Attached
<input checked="" type="checkbox"/>	Equivalent Procedures Attached; and	<b>19. THERAPEUTIC USE OF RADIOPHARMACEUTICALS (Check One)</b>	
<input type="checkbox"/>	Appendix D Procedures Followed for Dose Calibrator; or _____ (Check One)	<input type="checkbox"/>	Appendix K Procedures Followed; or
<input checked="" type="checkbox"/>	Equivalent Procedures Attached	<input type="checkbox"/>	Equivalent Procedures Attached
<b>11. FACILITIES AND EQUIPMENT</b>		<b>20. THERAPEUTIC USE OF SEALED SOURCES</b>	
<input checked="" type="checkbox"/>	Description and Diagram Attached	<input type="checkbox"/>	Detailed Information Attached; and
<b>12. PERSONNEL TRAINING PROGRAM</b>		<input type="checkbox"/>	Appendix L Procedures Followed; or _____ (Check One)
<input checked="" type="checkbox"/>	Description of Training Attached	<input type="checkbox"/>	Equivalent Procedures Attached
<b>13. PROCEDURES FOR ORDERING AND RECEIVING RADIOACTIVE MATERIAL</b>		<b>21. PROCEDURES AND PRECAUTIONS FOR USE OF RADIOACTIVE GASES (e.g., Xenon - 133)</b>	
<input checked="" type="checkbox"/>	Detailed Information Attached	<input type="checkbox"/>	Detailed Information Attached
<b>14. PROCEDURES FOR SAFELY OPENING PACKAGES CONTAINING RADIOACTIVE MATERIALS (Check One)</b>		<b>22. PROCEDURES AND PRECAUTIONS FOR USE OF RADIOACTIVE MATERIAL IN ANIMALS</b>	
<input type="checkbox"/>	Appendix F Procedures Followed; or	<input type="checkbox"/>	Detailed Information Attached
<input checked="" type="checkbox"/>	Equivalent Procedures Attached	<b>23. PROCEDURES AND PRECAUTIONS FOR USE OF RADIOACTIVE MATERIAL SPECIFIED IN ITEM 6.b</b>	
<input type="checkbox"/>		<input type="checkbox"/>	Detailed Information Attached

## 24. PERSONNEL MONITORING DEVICES

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

d. OTHER (Specify)

*July - 1 - II*  
 Application No. 1045-1090  
 Check No. 1045-1090  
 Amount/Fee Category (3m) \$580 + \$120  
 Type of Fee Application  
 Date Check Rec'd 7/15/85  
 Received By *Jacques* 18/5/85  
 3120x 20 450

## 25. FOR PRIVATE PRACTICE APPLICANTS ONLY

a. HOSPITAL AGREEING TO ACCEPT PATIENTS CONTAINING RADIOACTIVE MATERIAL NAME OF HOSPITAL <div style="text-align: center;">N/A</div> 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 <small>(See Section 170.31, 10 CFR 170)</small>  (1) LICENSE FEE CATEGORY:	b. APPLICANT OR CERTIFYING OFFICIAL (Signature)  (1) NAME (Type of Print)  (2) TITLE
(2) LICENSE FEE ENCLOSED: \$ 580.00	c. DATE

GUIDELINES FOR BIOASSAY  
REQUIREMENTS FOR TRITIUM

Nuclear Regulatory Commission  
Division of Fuel Cycle and Material Safety

## BIOASSAY REQUIREMENTS FOR TRITIUM

### I. Conditions Requiring Bioassay

- A. Routine Bioassay is required when quantities processed by an individual at any one time, or total amount processed per month, exceed those for the respective forms of tritium as shown in the attached Table 1.
- B. Above 0.1 of the levels in Table 1, routine bioassay is required unless a written justification is submitted for not performing bioassays.
- C. After protective devices, suits, hoods, or gloves are used to prevent exposure of a worker to concentrations of airborne tritium that would subject an unprotected worker to an intake of 6.3 mCi in one calendar quarter, bioassay is required.
- D. Bioassay is not required for process quantities less than 0.1 of those in Table 1.

### II. Who Should Participate

All workers involved in the processing of tritium, under conditions specified in I.A or I.B above, or sufficiently close that intake is possible, should participate.

### III. What Types of Bioassays Should be Performed

- A. Baseline, Pre-employment, or Pre-operational Urinalysis (not more than one month prior to beginning work with tritium requiring bioassay under Section I. above).
- B. Routine Urinalysis.

- C. Post-operational. Within one month of last possible exposure to tritium.
- D. Diagnostic. Within one week of any sample exceeding levels given as action points in Section V. below. See V.2.(d).

#### IV. How Often

##### A. Initial Routine Samples

Within 48 hours following entry of an individual into an area where operations require bioassay according to Section I. A. and B. above, and then every two weeks or more frequently thereafter as long as the individual is working with  $^3\text{H}$ .

##### B. After 3 Months

The sampling frequency selected in accordance with Section IV.A above may be changed to quarterly if, after 3 months, the following 3 conditions are met:

- (1) The average urinary tritium concentration from specimens obtained during the 3-month period does not exceed  $3 \mu\text{Ci/l}$ , and
- (2) The average concentration of tritium in air ( $\mu\text{Ci/ml}$ ), multiplied by the factor  $6.3 \times 10^8 \text{ ml}$ , does not exceed  $0.8 \text{ mCi}$ ; if the time ( $t$  hours/week) of exposure is not equal to 40 hours/week, the  $0.8\text{-mCi}$  criterion may be adjusted by the factor  $40/t$ ;
- (3) The working conditions during the 3-month period, with respect to the potential for tritium exposure, are representative of



working conditions during the period in which a quarterly urinalysis frequency is employed, and there is no reasonable expectation that the criteria given in (1) and (2) above will be exceeded.

V. Action Points and Corresponding Actions

A. Bi-Weekly or More Frequent Sampling

1. If urinary excretion rates exceed 5  $\mu\text{Ci/liter}$ , but are less than 50  $\mu\text{Ci/liter}$ , the following course of action should be taken:
  - (a) a survey of the operations involved, including air and area monitoring, should be carried out to determine the cause(s) of exposure and evaluate potential for further larger exposures.
  - (b) Implement any reasonable corrective actions indicated in the survey that may lower the potential for further exposures.
  - (c) A repeat urine sample should be taken within one week of the previous sample and should be evaluated within a week after collection.
  - (d) Any evidence from (a) or (b) indicating that further work in the area might result in an employee receiving a dose commitment in excess of the limits established in §20.101 for whole-body exposure should serve as cause to remove the

employee from work in this operation until the source of exposure is discovered and corrected.

2. If urinary excretion rates exceed 50  $\mu\text{Ci/liter}$ , the following course of action should be taken:
  - (a) Carry out all steps as in i.(a) to (d) above.
  - (b) If the projected body water dose commitment exceeds 5 rems, report the incident to the NRC in accordance with §20.403 of 10 CFR Part 20.
  - (c) Refer the case to appropriate medical/health physics consultation for recommendations regarding therapeutic procedures which may be carried out to accelerate removal of tritium from the body and reduce the dose to ALARA levels.
  - (d) Carry out repeated sampling (urine collections of at least 100 ml each) at approximately one-week intervals, at least until samples show an excretion rate less than 5  $\mu\text{Ci/liter}$ . If there is a possibility of long-term organic compartments of tritium that require evaluation, continue sampling as long as necessary to ensure that appreciable exposures to these other compartments do not go undetected.
  - (e) Provide, as a condition of the license, that written reports on any therapy, and dose commitment estimates prior to and following therapy, be provided to NRC. These reports should contain a description of the



processes and quantities of tritium involved that led to the exposure.

B. Quarterly Sampling

Carry out actions at levels as indicated under A. above, and, if the excretion rate continues to exceed 5  $\mu\text{Ci/liter}$ , also reinstitute biweekly (or more frequent) sampling for at least the next 6-month period, even when urinary excretion falls below 5  $\mu\text{Ci/liter}$ .

HEALTH PHYSICS ASPECTS OF THE USE  
OF RADIOACTIVE MATERIAL PHOSPHORUS-32

1. The vial containing Phosphorus-32 will not be opened until the time of use. Personnel will wear laboratory coats and rubber gloves when handling and opening this material.
2. Phosphorus-32 will be handled behind low Z number shielding, such as plexiglass, in order to keep bremsstrahlung radiation at a minimum.
3. Several smears of the use area will be taken to check for contamination.
4. Individuals involved with use of Phosphorus-32 will wash their hands thoroughly with soap and water and then carefully monitor their hands and clothing to detect any contamination.
5. Whole body and extremity monitoring devices will be worn by all personnel handling Phosphorus-32.
6. After using all of the material, the empty vial will be placed in a plastic bag, sealed, and returned to the storage area for decay and disposal.
7. Eye protection, i.e. plexiglass goggles, will be used for procedures involving 10 millicuries or more of Phosphorus-32.
8. A dry run will be performed prior to performance of unfamiliar procedures in order to preclude unexpected complication.

## RADIATION PROTECTION PROGRAM

The Radiation Safety Officer will be responsible for the radiation safety program and may use the services of Health Physics Services, Inc., Rockville, Maryland, to accomplish the following:

1. Maintaining the radioactive material license in a compliance status.
2. Providing training of personnel to insure that safe procedures in the laboratory are practiced.
3. Providing consultation to management and radiation workers on all matters relating to health physics.
4. Conducting the required health physics surveys and advising management of the findings and recommendations on routine matters on a monthly basis, or immediately when necessary.
5. Be available to respond to any radiation emergency.
6. Reviewing all personnel dosimetry reports monthly and advising management of the findings and recommendations.
7. Conducting calibrations of radiation survey meters as required.
8. Reviewing all proposed procedures or new experiments to insure that staff personnel will not become unnecessarily exposed to radiation. Additionally, he will insure that maximum permissible concentrations in air and water are within acceptable limits as outlined in 10 CFR, Part 20.
9. Insuring that the following documents are properly posted in each major area of radioactive material use:
  - a. NRC Form 3, "Notice to Employees"
  - b. License for radioactive materials and all supporting documents
  - c. Radiation safety procedures
  - d. Part 19 and 20, Code of Federal Regulations (NRC)
  - e. Any notices of licensee violations
10. Advise radiation workers of any unusual procedures which they must employ in order to reduce unnecessary exposure. Also, advise workers on the location of radioactive materials, proper use of survey meters, and their responsibilities with regard to the safe use of radioactive materials.

## RADIATION PROTECTION PROGRAM

11. The Radiation Safety Officer will prepare any requests for license amendments, with the assistance of management.
12. He will promulgate rules for the safe use of radioactive materials in the laboratory.

## HEALTH PHYSICS SURVEYS

On a weekly basis, the health physics staff will conduct a comprehensive radiation safety survey of all areas where radioactive material is used or stored. The survey will include the following:

1. Smears for spreadable contamination will be taken in all areas of probable contamination, such as bench tops, sinks, floors, door handles, control knobs, etc. Permissible contamination levels have been established at 200 dpm per 100 cm<sup>2</sup>. Contamination detected in excess of these levels will be immediately reports to the Radiation Safety Officer who will insure that appropriate decontamination is affected. Subsequently, the Radiation Safety Officer will take additional smears to insure that decontamination efforts have been completed.
2. Survey meter measurements will be taken in areas where radioactive materials are used or stored (other than low energy emitters) to insure adequate shielding.
3. Review radioactive material storage areas to insure that materials are properly labelled.
4. Review the bulletin board to insure that required documents are properly posted and current.
5. Review all personnel dosimetry reports.
6. Review the records of inventory, isotope receipt, isotope disposal, and other health physics records for completeness and accuracy.
7. Insure that areas where radioactive materials are used or stored are properly labelled in accordance with 10 CFR.
8. On a quarterly basis, survey all chemical fume hoods to insure flow rates are at least 100 fpm.
9. Observe the procedures of the technical staff to insure that safe working habits are practiced.

AUTHORIZED USERS

Charles A. Bowles, PH.D. - Previously authorized under Maryland License No. MD-31-134-01, Immuguest Laboratories, with the title of Radiation Safety Officer

Diana Linnekin - Previously authorized under Maryland License No. MD-31-134-01, under her married name of Diana McCartney

## RESPONSIBILITIES OF THE RADIATION SAFETY OFFICER

The specific duties of the Radiation Safety Officer include:

1. Establishing and maintaining operation procedures so that the radiation exposure of each worker is kept as far below the maximum permissible exposure as is practicable.
2. Instructing personnel in safe working practices and in the nature of injuries resulting from overexposure to radiation.
3. Assuring that personnel monitoring devices are used where indicated and that records are kept of the results of such monitoring.
4. Investigating any case of excessive or abnormal exposure to determine the cause and taking steps to prevent its recurrence.
5. Advise radiation workers of any unusual procedures which they must employ in order to reduce unnecessary exposure.
6. See that all license commitments and regulatory requirements have been met. To this end, Health Physics Services, Inc., Rockville, Maryland, will assist the Radiation Safety Officer in managing the overall radiation protection program.
7. Review all radiation survey reports, including those furnished by Health Physics Services, Inc. The surveys will include the following:
  - a. Smears for spreadable contamination
  - b. Survey meter measurements in those areas where radioactive materials are used or stored
  - c. A review of all personnel dosimetry reports
  - d. A review of the records of inventory, isotope receipt, isotope disposal, and other health physics records for completeness and accuracy
  - e. Required dose calibrator instrumentation tests (e.g. accuracy and linearity)
  - f. Sealed source leak testing
  - g. Survey meter calibration results
  - h. Any other health physics records pertinent to license compliance
8. Be available to respond to any radiation emergency.



## RADIATION DETECTION INSTRUMENTATION

Eberline E-120 with HP-210 probe

Ludlum Model 2 scintillation survey meter

Hewlett Packard liquid scintillation counter

METHOD, FREQUENCY, AND STANDARDS USED  
IN CALIBRATING INSTRUMENTATION

Calibrations of survey meters will be conducted on a quarterly basis by Health Physics Services, Inc., Rockville, Maryland, using Cesium-137 under Maryland License No. MD-31-035-01.

Source

Sealed Cesium-137 sources of approximately 500 mCi, authorized under Maryland License No. MD-31-035-01 will be used for calibration purposes. The exposure rate at discrete distances have been determined with NBS traceable ion chambers by a certified radiological physicist. These measurements will be re-certified annually.

Procedures

1. Turn on instrument to be calibrated and check batteries, etc. Replace as necessary.
2. Prepare calibration certificate in duplicate.
3. Unlock calibrator and remove source plug.
4. Compare instrument at two points on each scale (approximately 30% and 70% of scale) to known exposure level. If deviation from true exposure exceeds  $\pm 10\%$ , make appropriate adjustments in accordance with the instrument manual.
5. After appropriate adjustments, repeat Item 4 above. If deviation still exceeds  $\pm 10\%$ , forward for appropriate maintenance with customer's consent.
6. Complete calibration certificate and insure that true exposure and meter response is listed for two or more points on each scale.
7. Replace plug, lock calibrator, and sign certificate.
8. Insure that certificate accompanies instrument when returned to customer.
9. Affix calibration sticker, with date of calibration, on side of meter and pack for shipping.

NOTE: Instruments used to measure low energy range isotopes, i.e. I-125, Tc-99m, Xe-133, shall also be calibrated with a Co-57 source of approximately 10 mCi (ICN Model 77321 or equivalent) for relative response comparison.

Liquid scintillation counter will be calibrated in accordance with manufacturer's instructions.

**HEALTH PHYSICS SERVICES, INC.**

4 RESEARCH PLACE, SUITE 140  
ROCKVILLE, MARYLAND 20850  
(301) 670-1818 OR 800 - 638-8488

CALIBRATION CERTIFICATE

OWNER \_\_\_\_\_ CALIBRATION DATE \_\_\_\_\_ NEXT DUE \_\_\_\_\_

MANUFACTURER \_\_\_\_\_ MODEL NUMBER \_\_\_\_\_ SERIAL NUMBER \_\_\_\_\_

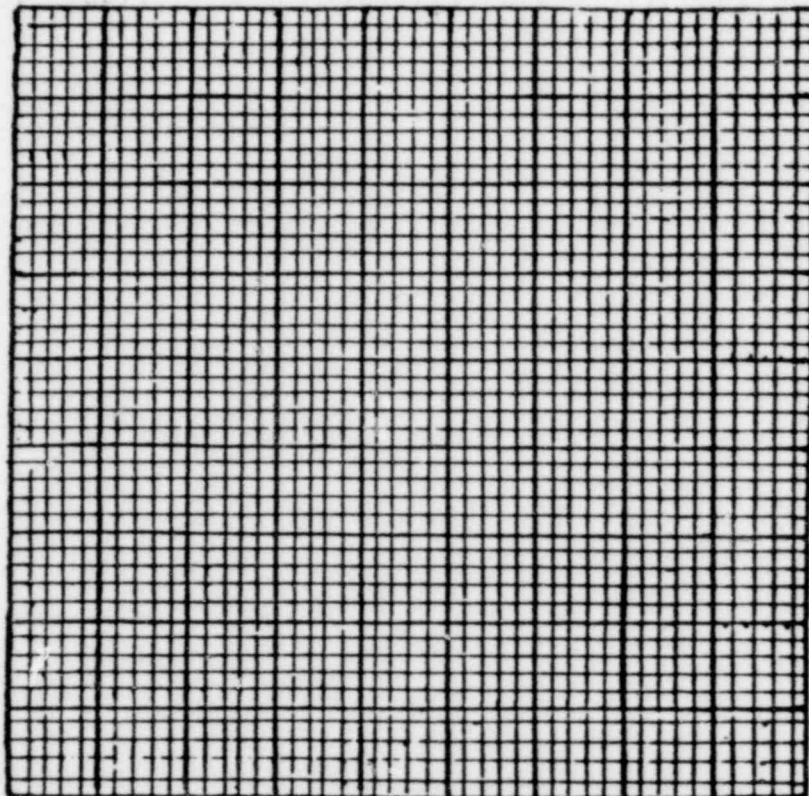
BATTERIES CHANGED: ☐ YES ☐ NO INTERNAL ADJUSTMENT: ☐ YES ☐ NO

The instrument was calibrated with the sensitive chamber positioned parallel/perpendicular to the radiation field.

METER RESPONSE (mR/hr)	SCALE	TRUE EXPOSURE (mR/hr)
---------------------------	-------	--------------------------

_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

METER RESPONSE (mR/hr)



TRUE EXPOSURE (mR/hr)

After calibration with Cesium-137, a Tc-99m factor was determined by measuring the response of this instrument to a calibrated source of Cobalt-57. The exposure rate at an arbitrary distance for the Cobalt-57 source is determined using the inverse square law and verified with a calibrated dose rate meter.

TRUE EXPOSUREMEASURED EXPOSURE

THIS CERTIFIES that the instrument described above was calibrated with Cesium-137. Exposure rates for this source have been verified with instrumentation whose calibration is traceable to the National Bureau of Standards.

\_\_\_\_\_  
Health Physics Technician

## RADIATION HANDLING EQUIPMENT

To enable personnel to work safely with unsealed radioactive material, the laboratory will have the proper radiation handling equipment. The following is a list of basic radiation handling equipment which is available:

### Shielding Equipment

Lead bricks, i.e. 2"x4"x6"

### Contamination Control

Laboratory coats or uniforms

Absorbent pads (absorbent layer backed by non-absorbent plastic material) for covering work surfaces

Disposable gloves

Decontaminating agents. Special agents are commercially available for decontaminating hands, utensils, work areas, etc.

Signs and labels indicating the presence of radioactive materials in areas or rooms where they are being used/stored.

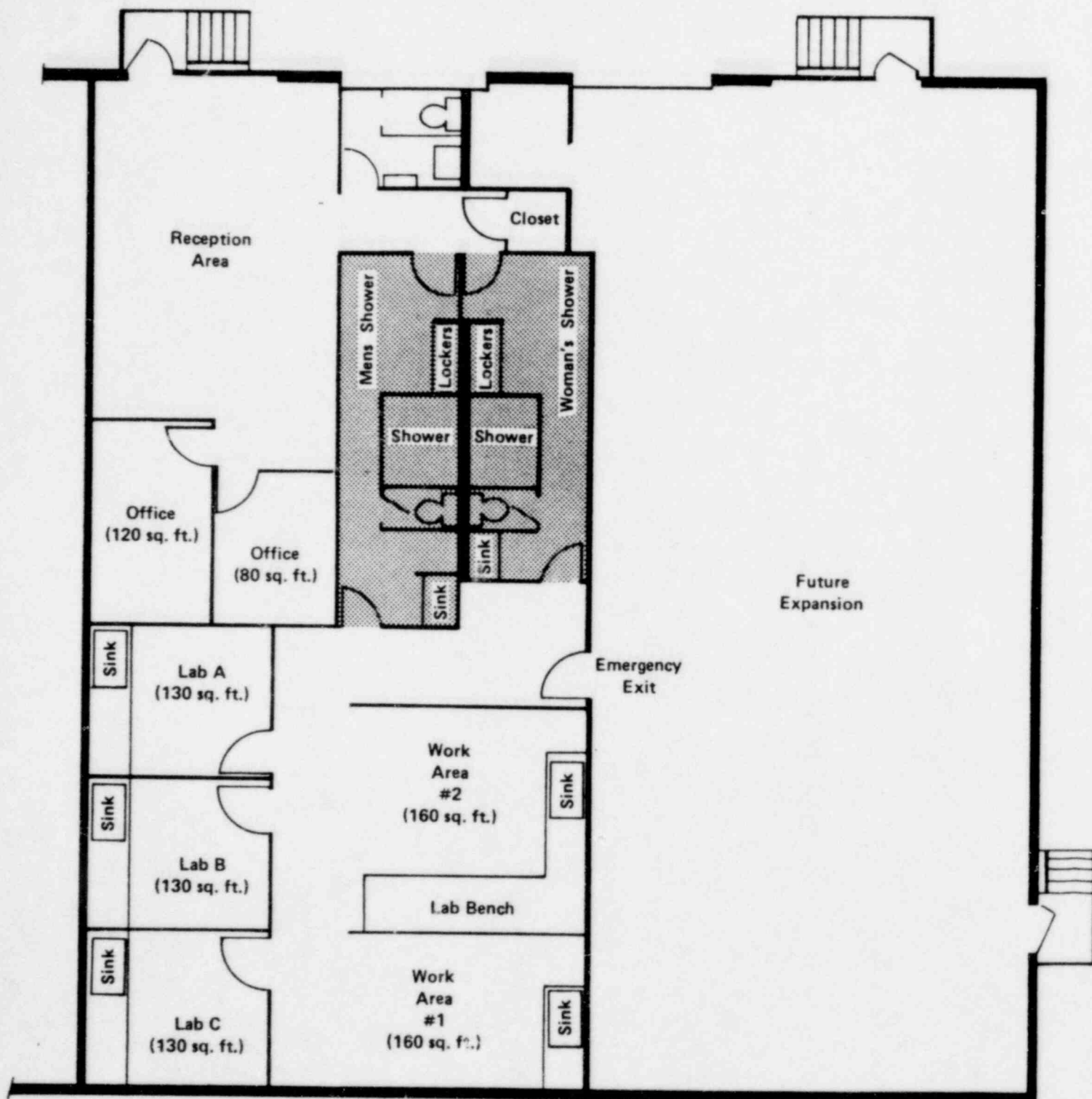
Labels on containers indicating radionuclide, activity, and date.

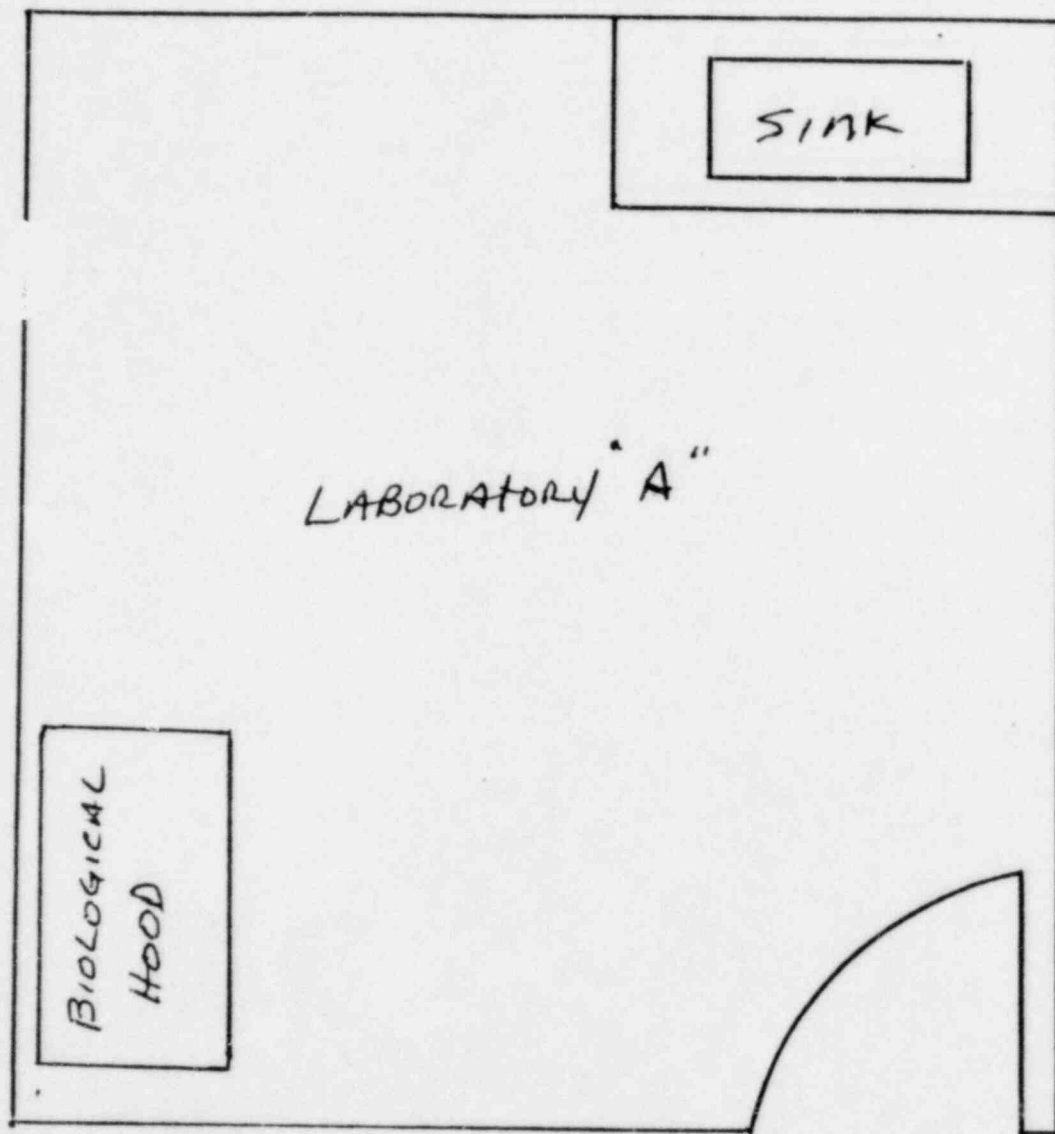
### Monitoring

Eberline Model E-120 with HP 210 detector

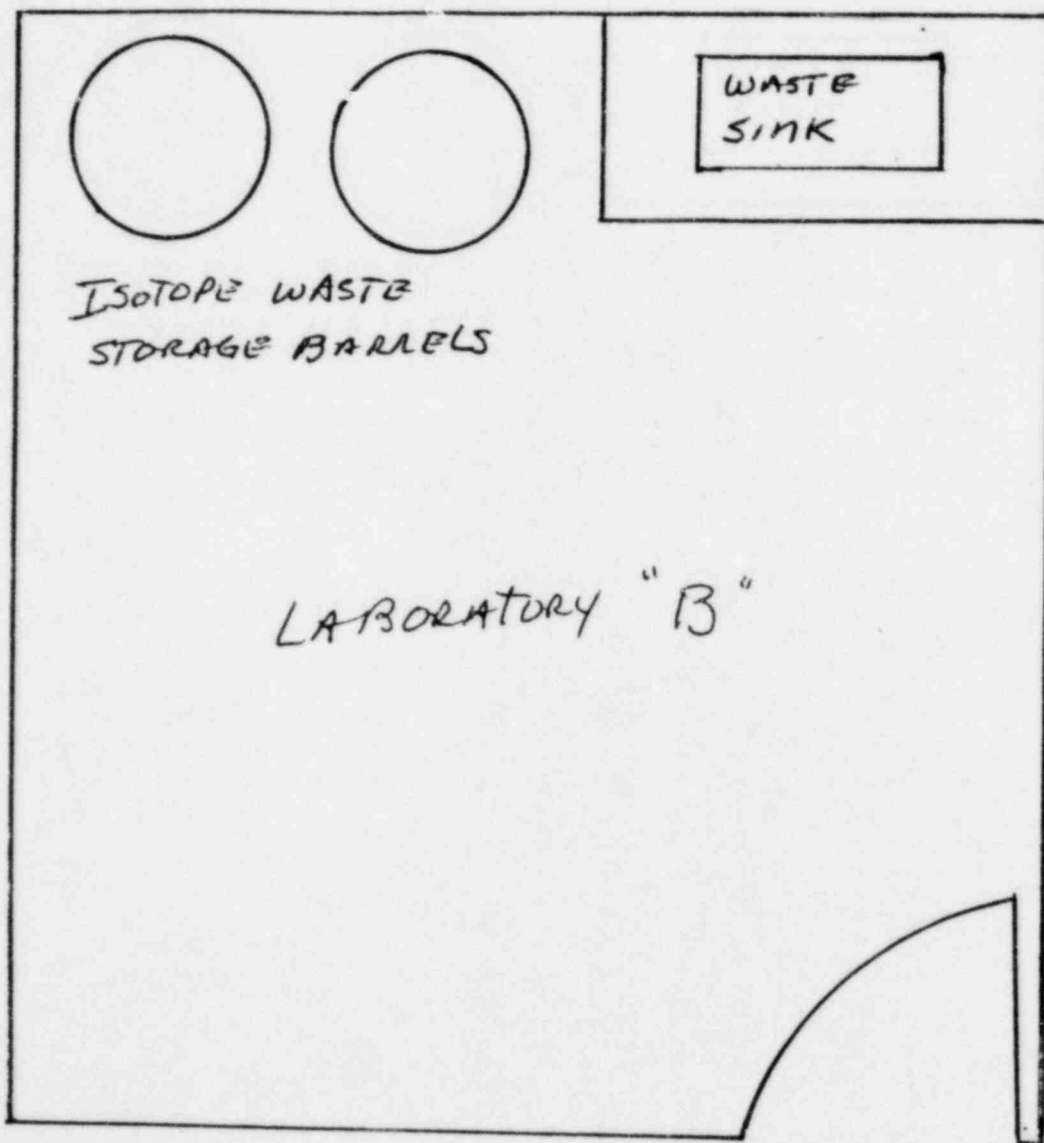
Ludlum Model 2 scintillation survey meter

**MERRIFIELD RESEARCH LABORATORIES, INC.**  
2723-B Merrilee Drive, Fairfax, Va. 22031

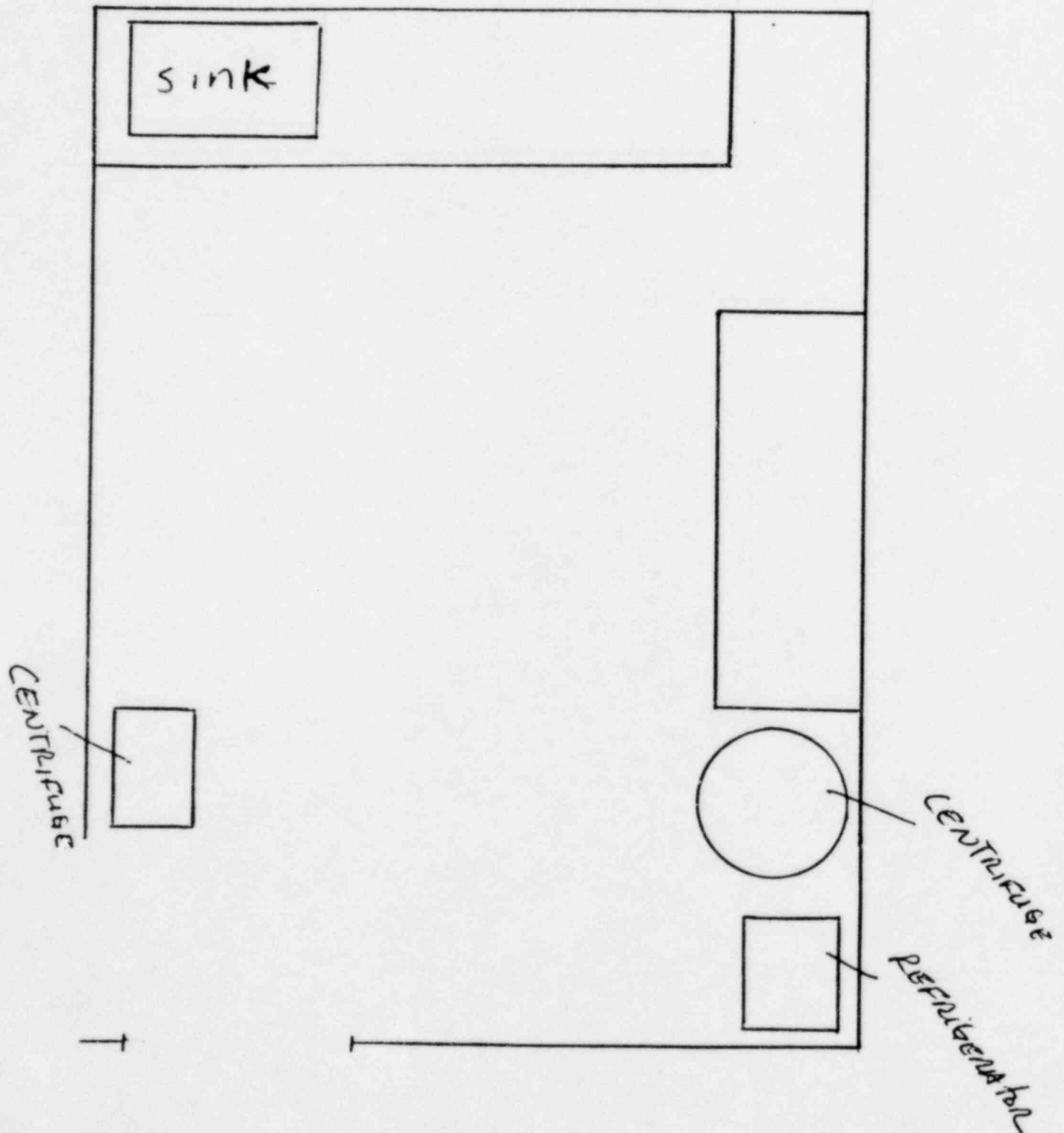




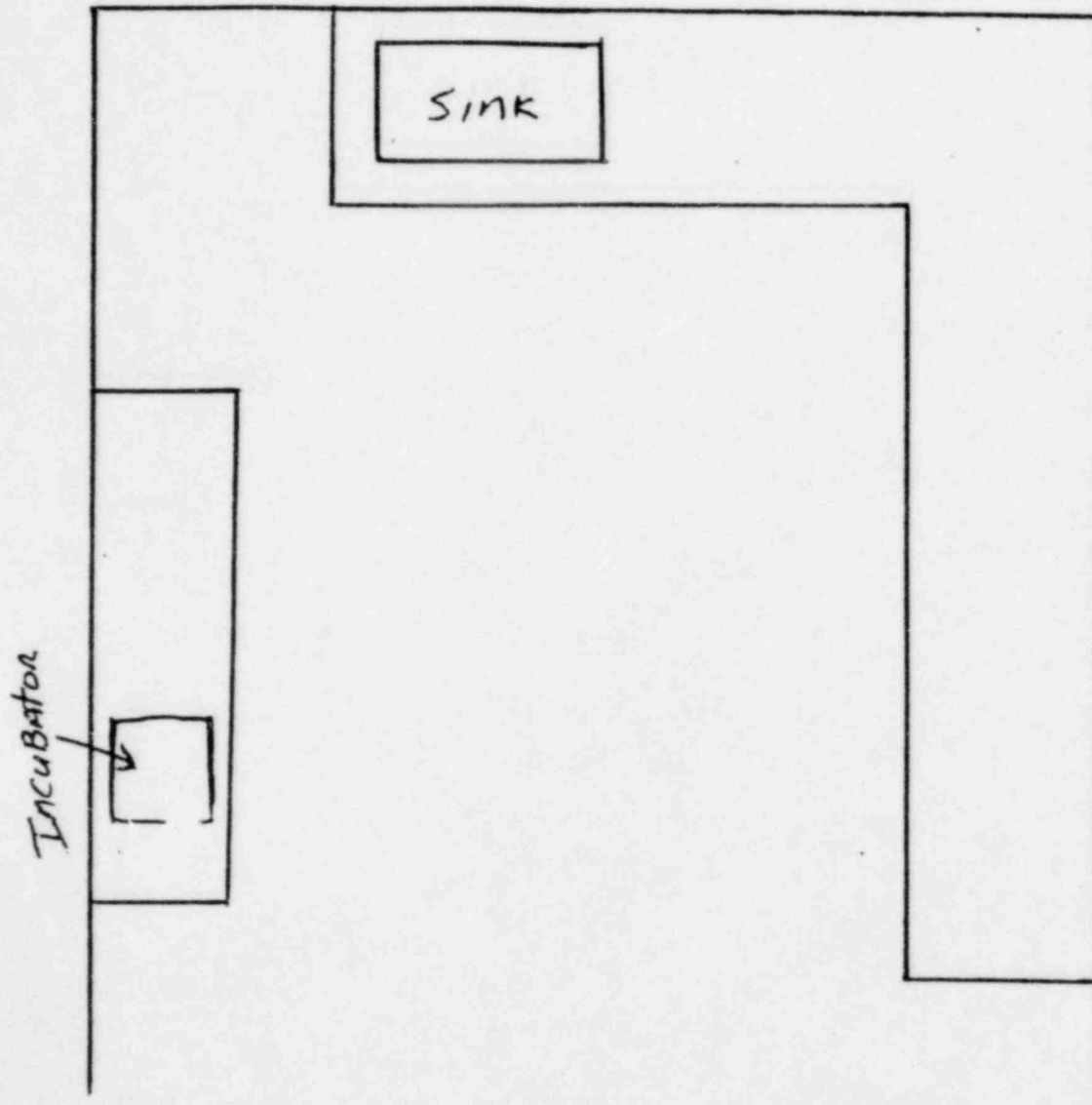




# WORK AREA #1



# WORK AREA #2



## RADIATION SAFETY TRAINING FOR RADIATION WORKERS

1. The principal user of radiation sources is responsible for insuring that all such sources under this jurisdiction are used only by individuals who have been properly trained to use them safely.
2. In addition to on-the-job training provided initially by supervisory personnel, all individuals who work with radiation sources (including maintenance and janitorial personnel) will receive periodic training at least annually in radiation safety. The health physics staff will conduct this training. The attached outline lists the topics to be included in the training. The depth of discussion will be based on the extent of applicability to the employees involved. This training will be documented and minimally will include:
  - a. Areas where radioactive material is used or stored
  - b. Potential hazards associates with radioactive material
  - c. Radiological safety procedures appropriate to their respective duties
  - d. Pertinent NRC regulations
  - e. Rules and regulations of the licensee
  - f. Pertinent terms of the license
  - g. Their obligation to report unsafe conditions
  - h. Appropriate response to emergencies or unsafe conditions
  - i. Their right to be informed of their radiation exposure and bioassay results
  - j. Locations where the licensee has posted or made available notices, copies of pertinent regulations, and copies of pertinent licenses and license conditions (including applications and applicable correspondence) as required by 10 CFR, Part 19.

## RADIATION SAFETY TRAINING

Presented To: Radiation Workers and Ancillary Personnel (as indicated)

Frequency of Instruction: Minimum of once a year and before assuming duties, or whenever there is a significant change in duties, regulations, or terms of the license

### Class Outline

#### 1. Introduction

a. Purpose: To familiarize personnel with the established standards for protection against unwarranted radiation exposure from radioactive materials.

b. References

10 CFR, Parts 19 and 20  
NBS Handbook No. 92  
NCRP Reports No. 39 and 48  
Terms and conditions of specific license and application

#### 2. Principles of Radiation Protection

- a. Philosophy of radiation exposure control
- b. Potential hazards and physical safeguards
- c. Federal Regulations and NCRP Recommendations

#### 3. Radiological Safety Procedures Described in the license

- a. General laboratory rules
- b. Isotope receipt and inspection, use, and storage
- c. Radiation caution signs and labels
- d. Anti-contamination procedures
- e. Radioactive waste disposal
- f. Personnel monitoring
- g. Radiation emergency procedures
- h. Applicable special procedures, i.e. gases, animal waste, etc.

#### 4. Health Physics Surveys

- a. Criteria and frequency
- b. Measurement of radiation levels
- c. Assessment of laboratory procedures
- d. Facility evaluation
- e. Records review

#### 5. Question and answer period

## PROCEDURES FOR ORDERING RADIOACTIVE MATERIALS

Radioactive materials will be ordered by the authorized users or their designees. Prior to placing an order, the inventory will be reviewed to insure possession limits will not be exceeded.

The Radiation Safety Officer will review these inventories and related procedures on a monthly basis.

All radioactive materials will be received ONLY during normal duty hours.



PROCEDURES FOR SAFELY OPENING PACKAGES  
CONTAINING RADIOACTIVE MATERIAL

For safely opening packages containing radioactive material, the technologist will:

1. Put on gloves to prevent hand contamination.
2. Visually inspect packages for any sign of damage (wetness, crushed, etc.). If damage is noted, the procedure will be stopped and the radiation safety officer notified.
3. Measure exposure rate at 3 feet from package surface and record. If greater than 10 mR per hour, the procedure will be stopped and the radiation safety officer notified.
4. Measure surface exposure rate and record. If greater than 200 mR per hour, the procedure will be stopped and the radiation safety officer notified.
5. Wipe external surface of shipping container and remove wipe to low background area. Assay the wipe and record amount of removable radioactivity (e.g., dpm/100 sq. cm., etc.). Check wipes with a thin end window GM survey meter. The procedure will be stopped if removable contamination is greater than 22,000 dpm/100 sq. cm. above background. The radiation safety officer and health physics consultant shall be notified to determine the "exempt" status of the package with respect to wipe testing. If the package is not exempt, then appropriate notification of regulatory offices will be made.
6. Open the package with the following precautionary steps:
  - A. Open the outer package following manufacturer's instructions, if supplied, and remove packing slip.
  - B. Open inner package and verify that contents agree with those on packing slip. Compare requisition, packing slip, and label on bottle.
  - C. Check integrity of final source container (i.e., inspect for breakage of seals or vials, loss of liquid, and discoloration of packaging material).
  - D. Check also that shipment does not exceed possession limits.
7. Wipe external surface of final source container and remove wipe to low background area. Assay the wipe and record amount of removable radioactivity (e.g., dpm/100 cu. cm., etc.). Check wipes with a well counter/scintillation detector or thin end window GM survey meter, and take precautions against the spread of contamination as necessary. The acceptable level of removable contamination will be 200 dpm/100 sq. cm. above background. The procedure will be stopped and the radiation safety officer notified if this level is exceeded.
8. Monitor the packing material and packages for contamination before discarding. If contaminated, treat as radioactive waste. If not contaminated, radiation labels will be obliterated before discarding in regular trash.

Records will be maintained of the results of checking each package (see following sample).

# RADIOACTIVE SHIPMENT RECEIPT REPORT

1. P. O. # \_\_\_\_\_ Survey Date \_\_\_\_\_ Time \_\_\_\_\_  
 (if applicable) Surveyor \_\_\_\_\_

2. CONDITION OF PACKAGE:  
 \_\_\_\_\_ O. K. \_\_\_\_\_ Punctured \_\_\_\_\_ Status \_\_\_\_\_ Wet  
 \_\_\_\_\_ Crushed \_\_\_\_\_ Other \_\_\_\_\_

## RADIOACTIVE MATERIAL PACKAGES LABEL CRITERIA (173.399) DOSE RATE LIMITS

LABEL	AT ANY POINT ON ACCESSIBLE SURFACE OF PACKAGE	AT THREE FEET FROM EXTERNAL SURFACE OF PACKAGE (TRANSPORT INDEX)
"RADIOACTIVE-WHITE I"	0.5mR/hr	0
"RADIOACTIVE-YELLOW II"	50 mR/hr	1.0 mR/hr
"RADIOACTIVE-YELLOW III"	200 mR/hr	10 mR/hr

3. Radiation Label number \_\_\_\_\_

### 4. MEASURED RADIATION LEVELS:

- a) Bkg = \_\_\_\_\_ mRem/hr.  
 b) Package surface \_\_\_\_\_ mRem/hr.  
 c) 3 feet or 1 meter from surface \_\_\_\_\_ mRem/hr.

5. Notification to the NRC or Agreement state is voluntary if mR/hr levels exceed those indicated for applicable Labels I & II. Notification of the RSO, health physics consultant, carrier, and NRC/Agreement state is mandatory if levels of exposure exceed either 10mR/hr at three feet or 200mR at the surface of the package.

### 6. DO PACKING SLIP AND VIAL CONTENTS AGREE?

- a. Radionuclide \_\_\_\_\_ yes \_\_\_\_\_ no, difference \_\_\_\_\_  
 b. Amount \_\_\_\_\_ yes \_\_\_\_\_ no, difference \_\_\_\_\_  
 c. Chem form \_\_\_\_\_ yes \_\_\_\_\_ no, difference \_\_\_\_\_

## 7. WIPE RESULTS

a. Bkg \_\_\_\_\_ CPM (Eff.= \_\_\_\_\_%)  $\rightarrow$   $\text{CPM} \times \frac{100}{\text{eff.}} =$  \_\_\_\_\_ bkg. DPM

b. Outer \_\_\_\_\_ CPM (Eff.= \_\_\_\_\_%)  $\rightarrow$   $\text{CPM} \times \frac{100}{\text{eff.}} =$  \_\_\_\_\_ DPM

c. Final source container \_\_\_\_\_ CPM (Eff.= \_\_\_\_\_%)

$\rightarrow$   $\text{CPM} \times \frac{100}{\text{eff.}} =$  \_\_\_\_\_ DPM

8. SURVEY RESULTS OF PACKING MATERIAL AND CARTONS \_\_\_\_\_ mRem/hr, CPM

9. DISPOSITION OF PACKAGE AFTER INSPECTION \_\_\_\_\_

10. IF NRC/CARRIER NOTIFICATION REQUIRED, GIVE TIME, DATE, AND PERSONS NOTIFIED.  
\_\_\_\_\_

## GENERAL RULES FOR LABORATORY SAFETY PROCEDURES

1. All work with radioactive materials will be performed utilizing protective clothing and gloves.
2. Work surfaces will be covered with absorbent paper where radioactive materials are being used.
3. Radioactive solutions will be confined in covered containers plainly identified and labelled with name of compound, radionuclide, date, activity, and radiation level, if applicable.
4. Mechanical devices only will be used in pipetting radioactive solutions (NOT BY MOUTH).
5. Eating, drinking, smoking, or the application of cosmetics will be prohibited in the radioisotope work areas. Failure to do so may lead to accidental ingestions of radioactive material.
6. Radioactive waste will be deposited in the designated waste container.
7. Confine work with gaseous, volatile, or dust-forming radioactive materials to fume hoods.
8. Before leaving the laboratory after working with uncontained radioactive materials, each person will wash his hands thoroughly and check them with a laboratory monitoring device for contamination.
9. Review pertinent safety practices frequently, especially before using a new radioactive compound.
10. Refrigerators containing radioisotopes will not be used for the storage of food and other consumable items.

## EMERGENCY PROCEDURES

### Minor Spills

1. All persons in the area will be notified when a spill has occurred.
2. The spill will be covered with absorbent paper to prevent its spread.
3. Disposable gloves and remote handling tongs will be used to clean up the spill. The absorbent paper and pad will be carefully folded, inserted into a plastic bag and disposed of in the radioactive waste container. All other contaminated materials such as disposable gloves will also be inserted into the plastic bag.
4. The survey will be conducted using a low-range, G-M survey meter. The area around the spill, hands, and clothing will be checked for contamination.
5. The incident will be reported to the radiation safety officer.

### Major Spills

1. All persons not involved in the spill will be notified to vacate the room.
2. The spill will be covered with absorbent pads, but no attempt to clean it up will be made. The movement of all personnel potentially contaminated will be confined to prevent the spread.
3. If possible, the spill will be shielded, but only if it can be done without further contamination or without significantly increasing your radiation exposure.
4. The room will be vacated, and the door(s) locked to prevent entry.
5. The radiation safety officer will be notified immediately.
6. Contaminated clothing will be removed and stored for further evaluation by the radiation safety officer. If the spill is on the skin, the area will be flushed thoroughly and washed with mild soap and lukewarm water.

RADIATION SAFETY OFFICER: Charles A. Bowles, Ph.D.

OFFICE PHONE: (703) 560-1910

HOME PHONE: (703) 938-0283

ALTERNATE NAMES AND TELEPHONE NUMBERS DESIGNATED BY RADIATION SAFETY OFFICER: \_\_\_\_\_



## AREA SURVEY PROCEDURES

The following area survey procedures will be conducted by the Radiation Safety Officer or his designee, in each area where radioactive material is used or stored:

1. All laboratory areas will be surveyed weekly.
2. The weekly survey will consist of:
  - A. A measurement of radiation levels with a survey meter sufficiently sensitive to detect 0.1 mRem per hour.
  - B. A series of wipe tests to measure contamination levels. The method for performing wipe tests will be sufficiently sensitive to detect 200 dpm per 100 sq. cm. for the contamination involved.
3. A permanent record will be kept of all survey results, including negative results. The record will include:
  - A. Location and date.
  - B. Name of person conducting the survey.
  - C. Measured exposure rates, keyed to locations (point out rates that require corrective action).
  - D. Detected contamination levels, keyed to locations.
  - E. Corrective action taken in the case of contamination or excessive exposure rates, reduced contamination levels or exposure rates after corrective action, and any appropriate comments.
4. The area will be cleaned if the contamination level exceeds 200 dpm per 100 sq. cm.

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



## WASTE DISPOSAL PROCEDURES

### Liquid Waste

Liquid radioactive waste will be disposed of through the sanitary sewerage system in accordance with 10 CFR, Part 20.303, Code of Federal Regulations. Documentation of radioactive material discharged through the sewerage system will be maintained in the laboratory and review by the Radiation Safety Officer.

### Solid Waste

Solid radioactive waste will be disposed of through a licensed commercial vendor or will be decayed on site for a minimum of 10 half lives. Prior to disposal as normal waste, all radioactive waste will be monitored with a low range, thin end window GM detector to determine that background levels of exposure have been reached. Records of such surveys and disposal will be maintained.