

<b>NRC Form 313 I</b> (12-81) 10 CFR 30		<b>U.S. NUCLEAR REGULATORY COMMISSION</b>		<b>1. APPLICATION FOR:</b> <i>(Check and/or complete as appropriate)</i>	
<b>APPLICATION FOR BYPRODUCT MATERIAL LICENSE INDUSTRIAL</b>				<input type="checkbox"/> a. NEW LICENSE	
<i>See attached instructions for details.</i>  Completed applications are filed in duplicate with the Division of Fuel Cycle and Material Safety, Office of Nuclear Material Safety, and Safeguards, U.S. Nuclear Regulatory Commission, Washington, DC 20555 or applications may be filed in person at the Commission's office at 1717 H Street, NW, Washington, D. C. or 7915 Eastern Avenue, Silver Spring, Maryland.				<input type="checkbox"/> b. AMENDMENT TO: LICENSE NUMBER	
				<input checked="" type="checkbox"/> c. RENEWAL OF: LICENSE NUMBER <b>37-08802-01</b>	
<b>2. APPLICANT'S NAME</b> <i>(Institution, firm, person, etc.)</i>  William H. Rorer, Inc. TELEPHONE NUMBER: AREA CODE - NUMBER EXTENSION (215) 628-6000			<b>3. NAME AND TITLE OF PERSON TO BE CONTACTED REGARDING THIS APPLICATION</b>  Andrew Polk, RSO TELEPHONE NUMBER: AREA CODE - NUMBER EXTENSION (215) 628-6588 or 6382		
<b>4. APPLICANT'S MAILING ADDRESS</b> <i>(Include Zip Code)</i> <i>(Address to which NRC correspondence, notices, bulletins, etc., should be sent.)</i>  500 Virginia Drive Fort Washington, PA 19034			<b>5. STREET ADDRESS WHERE LICENSED MATERIAL WILL BE USED</b> <i>(Include Zip Code)</i>  500 Virginia Drive Fort Washington, PA 19034		
(IF MORE SPACE IS NEEDED FOR ANY ITEM, USE ADDITIONAL PROPERLY KEYED PAGES.)					
<b>6. INDIVIDUAL(S) WHO WILL USE OR DIRECTLY SUPERVISE THE USE OF LICENSED MATERIAL</b> <i>(See Items 16 and 17 for required training and experience of each individual named below)</i>					
FULL NAME			TITLE		
a. Andrew Polk			Section Head, Met. Chemistry		
b. William L. Studt			Section Head, Med. Chemistry		
c. A.J. Visalli			Section Head, Anal. Chemistry		
<b>7. RADIATION PROTECTION OFFICER</b>  Andrew Polk			Attach a resume of person's training and experience as outlined in Items 16 and 17 and describe his responsibilities under Item 15.		
<b>8. LICENSED MATERIAL</b>					
L I N E  NO.	E L E M E N T  A	C H E M I C A L  B	N A M E  C	M A X I M U M  D	
	E L E M E N T  M A S S  N U M B E R	C H E M I C A L  A N D  O R  P H Y S I C A L  F O R M	N A M E  O F  M A N U F A C T U R E R  A N D  M O D E L  N U M B E R  <i>(If Sealed Source)</i>	M A X I M U M  N U M B E R  O F  M I L L I C U R I E S  A N D  O R  S E A L E D  S O U R C E S  A N D  M A X I M U M  A C T I V I T Y  P E R  S O U R C E  W H I C H  W I L L  B E  P O S S E S S E D  A T  A N Y  O N E  T I M E	
(1)	Iodine 131	Any		4 millicuries	
(2)	Iodine 125	Any		10 millicuries	
(3)	Phosphorus 32	Any		5 millicuries	
(4)	Carbon 14	Any		300 millicuries	
DESCRIBE USE OF LICENSED MATERIAL E					
(1)	1 through 9, also 11 & 12: Laboratory studies in lower animals and synthesis				
(3)	of tagged compounds for distribution to specifically licensed organizations.				
(4)	10: To be used in gas chromatography units for sample analysis.				

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9. STORAGE OF SEALED SOURCES			
LINE NO.	CONTAINER AND/OR DEVICE IN WHICH EACH SEALED SOURCE WILL BE STORED OR USED. A.	NAME OF MANUFACTURER B.	MODEL NUMBER C.
(1)	Gas Chromatograph (2 mCi)	Hewlett-Packard	7620A
(2)	Gas Chromatograph (10 mCi)	Perkin-Elmer	908B
(3)	Gas Chromatograph (15 mCi)	Perkin-Elmer	900
(4)			

10. RADIATION DETECTION INSTRUMENTS						
LINE NO.	TYPE OF INSTRUMENT A	MANUFACTURER'S NAME B	MODEL NUMBER C	NUMBER AVAILABLE D	RADIATION DETECTED (alpha, beta, gamma, neutron) E	SENSITIVITY RANGE (milliroentgens/hour or counts/minute) F
(1)	Cutie Pie	Victoreem	740F	1	Alpha, Beta Gamma	1 mr - 300R
(2)	GM Survey Meter	Baird-Atomic	420	1	Alpha, Beta Gamma	1 - 500 mr
(3)	Liquid Scint. Counter	Beckman	350	1	Beta, Gamma	15-999,999 cpm
(4)	Liquid Scint. Counter	Beckman	7000	1	Beta, Gamma	12-999,999 cpm

11. CALIBRATION OF INSTRUMENTS LISTED IN ITEM 10	
<input type="checkbox"/> a. CALIBRATED BY SERVICE COMPANY NAME, ADDRESS, AND FREQUENCY	<input checked="" type="checkbox"/> b. CALIBRATED BY APPLICANT <i>Attach a separate sheet describing method, frequency and standards used for calibrating instruments.</i>

12. PERSONNEL MONITORING DEVICES		
TYPE (Check and/or complete as appropriate.) A	SUPPLIER (Service Company) B	EXCHANGE FREQUENCY C
<input type="checkbox"/> (1) FILM BADGE  <input checked="" type="checkbox"/> (2) THERMOLUMINESCENCE DOSIMETER (TLD)  <input type="checkbox"/> (3) OTHER (Specify): _____  	Teledyne Isotopes 50 Van Buren Avenue Westwood, NJ 07675	<input type="checkbox"/> MONTHLY  <input checked="" type="checkbox"/> QUARTERLY  <input type="checkbox"/> OTHER (Specify): _____  

13. FACILITIES AND EQUIPMENT (Check where appropriate and attach annotated sketch(es) and description(s).)
<input checked="" type="checkbox"/> a. LABORATORY FACILITIES, PLANT FACILITIES, FUME HOODS (Include filtration, if any), ETC. <input checked="" type="checkbox"/> b. STORAGE FACILITIES, CONTAINERS, SPECIAL SHIELDING (fixed and/or temporary), ETC. <input checked="" type="checkbox"/> c. REMOTE HANDLING TOOLS OR EQUIPMENT, ETC. <input type="checkbox"/> d. RESPIRATORY PROTECTIVE EQUIPMENT, ETC.

14. WASTE DISPOSAL
a. NAME OF COMMERCIAL WASTE DISPOSAL SERVICE EMPLOYED <b>Teledyne Isotopes; US Ecology Inc.</b>
b. IF COMMERCIAL WASTE DISPOSAL SERVICE IS NOT EMPLOYED, SUBMIT A DETAILED DESCRIPTION OF METHODS WHICH WILL BE USED FOR DISPOSING OF RADIOACTIVE WASTES AND ESTIMATES OF THE TYPE AND AMOUNT OF ACTIVITY INVOLVED. IF THE APPLICATION IS FOR SEALED SOURCES AND DEVICES AND THEY WILL BE RETURNED TO THE MANUFACTURER, SO STATE.

### INFORMATION REQUIRED FOR ITEMS 15, 16 AND 17

Describe in detail the information required for Items 15, 16 and 17. Begin each item on a separate page and key to the application as follows:

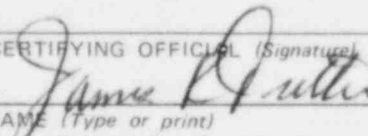
15. **RADIATION PROTECTION PROGRAM.** Describe the radiation protection program as appropriate for the material to be used including the duties and responsibilities of the Radiation Protection Officer, control measures, bioassay procedures (if needed), day-to-day general safety instruction to be followed, etc. If the application is for sealed source's also submit leak testing procedures, or if leak testing will be performed using a leak test kit, specify manufacturer and model number of the leak test kit.
  
16. **FORMAL TRAINING IN RADIATION SAFETY.** Attach a resume for each individual named in Items 6 and 7. Describe individual's formal training in the following areas where applicable. Include the name of person or institution providing the training, duration of training, when training was received, etc.
  - a. Principles and practices of radiation protection.
  - b. Radioactivity measurement standardization and monitoring techniques and instruments.
  - c. Mathematics and calculations basic to the use and measurement of radioactivity.
  - d. Biological effects of radiation.
  
17. **EXPERIENCE.** Attach a resume for each individual named in Items 6 and 7. Describe individual's work experience with radiation, including where experience was obtained. Work experience or on-the-job training should be commensurate with the proposed use. Include list of radioisotopes and maximum activity of each used.

### 18. CERTIFICATE

(This item must be completed by applicant)

*The applicant and any official executing this certificate on behalf of the applicant named in Item 2, certify that this application is prepared in conformity with Title 10, Code of Federal Regulations, Part 30, and that all information contained herein, including any supplements attached hereto, is true and correct to the best of our knowledge and belief.*

**WARNING.**—18 U.S.C., Section 1001; Act of June 25, 1948; 62 Stat. 749; makes it a criminal offense to make a willfully false statement or representation to any department or agency of the United States as to any matter within its jurisdiction.

a. LICENSE FEE REQUIRED <i>(See Section 170.31, 10 CFR 170)</i>	b. CERTIFYING OFFICIAL (Signature) 
	c. NAME (Type or print) Dr. James R. Tretter
(1) LICENSE FEE CATEGORY:      3A	d. TITLE Vice President, Research & Development
(2) LICENSE FEE ENCLOSED: \$      \$460.00	e. DATE Sept 19, 1983

Item 6. Individuals Who Will Use or Directly Supervise the Use  
of Licensed Material (continued)

FULL NAME

TITLE

Paul R. Darkes, Senior Organic Chemist

Ching T. Tsuei, Senior Organic Chemist

R. L. Procaccini, Assistant Director, Clinical Research



Item 8. Licensed Material (continued)

5. Sulfur 35	Any	20 millicuries
6. Chromium 51	Any	20 millicuries
7. Hydrogen 3	Any	500 millicuries
8. Iron 59	Any	2 millicuries
9. Calcium 47	Any	2 millicuries
10. Nickel 63	Sealed	42 millicuries-

Sources

- (a) Hewlett/Packard *(Model 2-6195)*  
#7620A (2 mci)
- (b) Perkin Elmer-908B *typo - should read Model 910*  
(10 mci)
- (c) Perkin Elmer 900  
(15 mci)

11. Zinc 65	Any	2 millicuries
12. Selenium 75	Any	2 millicuries

Item 10. Radiation Detection Instruments (continued)

5.	Gamma Counter	Micro- Medics	MS-588	1	Gamma	100 cpm - 999,999 cpm
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Item 11. Calibration of Instruments Listed in Item 10

1. "Cutie Pie": Factory calibration may be checked with any known radiation source every time it is being used.
2. CM Survey Meter: Calibration checked every time it is used by the 7000 cpm check source permanently attached to meter casing.
3. Beckman LS-350 Counter: Calibration checked at least once weekly and every time it is used, with Beckman sealed standards: 14-Carbon, 3-Hydrogen and Reference Background.
4. Beckman LS-7000 Counter: Calibration checked at least once weekly and every time it is used, with Beckman sealed standards: 14-Carbon, 3-Hydrogen and Reference Background. It is also checked annually by Beckman Instruments, 45 Belmont Drive, Somerset, N.J. 08873.
5. Gamma Counter: Calibration checked every time it is used, with ICN Calibration Standard Model R-35B (Simulated I-125 source).

### Item 13. Facilities and Equipment

#### Isotope Laboratory Facilities

- (a) Tiled Walls & Floors
- (b) Plastered Ceiling
- (c) Stainless Steel Hood with separate Filter System
- (d) Stainless Steel Benches and Sinks
- (e) Glove Box with Special Charcoal Filter
- (f) Special Waste Receptacles containing Plastic Bags
- (g) Protective Clothing Change Area within 80 feet of Isotope Laboratory
- (h) Protective Clothing, including disposal coats, foot coverings, gloves breathing masks (filters), head covering and lead apron
- (i) Storage Containers have 2 inch Lead Bricks: Isotopes are stored under lock and key at all times. Isotope Laboratory is kept locked during non-working hours
- (j) Waste Containers used for shipment of Radioactive Wastes are DOT-Approved - 55 Gal. Drum. The sealed drums are monitored and stored under lock and key.
- (k) One (1) 18 inch - Posi-Grip Tool with Interchangeable Jaws
- (l) Plastic-Backed Absorbent Paper
- (m) Rubber Pro-Pipets for Pipetting
- (n) Decontamination Kit: The Atomlab Decontamination Kit contains all the equipment to cope with a radioactive spill or routine decontamination problem in a laboratory. The drum serves as a container for the kit components and as a waste transfer/storage vessel. The kit contains:

<u>Quantity</u>	<u>Item</u>
1	13 gallon steel drum
2 pairs	Large overall
2 pairs	Shoe covers
2	Respirators
2 pairs	Gloves
1 gal.	Radiacwash
1 box	Radiacwash Toweletts
1 can	Radiacwash Spray Foam
10	Foly Bags
1	12" Niptong
1 each	Spong, mop, scrub brush, pail, rope, assorted signs

- (o) Lab #25 and Lab #28 each have a hood with an intake (when open) of 100 FPM.
- (p) Lab #26 (Isotope Lab) has a hood exhaust system with absolute filters.

## Item 14. Waste Disposal

### A. General

All activities in which radioactive materials are included shall be governed by the Rules and Regulations in Title 10, Chapter 1, Code of Federal Regulations - Energy. All personnel using radioactive materials must comply with these rules. Radioactive waste disposal methods must be governed by Part 20 - Standards for Protection Against Radiation Rules and regulations.

1. Aqueous Wastes are discharged into the sanitary sewerage system according to NRC Part 20.303 regulations.

- a. Plasma, urine, feces, aqueous solutions:

Carefully pour the contents into the stainless steel sink in the isotope laboratory, while the water faucet is turned to the half-way position. Continue running the water for at least one hour afterwards. Record the type of isotope, the number of microcuries, the total volume and the date in the Isotope Disposal Log kept in the Isotope Laboratory. The average concentrations must not exceed the limits specified in Appendix B, Table I, Column 2 of the above part 20.303.

- b. Dissolved Animal Carcasses:

Place the animal (rat, mouse, guinea pig: if dog or monkey draw and quarter the animal) in 20% potassium hydroxide solution and place the sealed container on a reciprocal shaker until solubilization is completed. Then proceed as detailed in above section for plasma, etc. If large quantities of animals make this procedure difficult, then use the procedure d. under this item (Disposal of Animal Carcasses).

Average flow of tap water in isotope sink = 115 gal/min (435 liters/min)

Average daily Rorer sewage output = 150,000 gal/day (567,750 liters/day)

Total amount of radioactivity discharged into sanitary sewerage system in 1982:

<sup>14</sup> Carbon - 14 millicuries  
<sup>3</sup> Hydrogen - 1 microcurie  
<sup>125</sup> Iodine - 10 microcuries



2. Liquid scintillation vials must be tightly capped and the cardboard tray placed in a Steel Drum and covered with absorbant material. Loose vials may be gently placed in this drum and covered with one to two inches of absorbant material. The amount of absorbant must be capable of absorbing twice the amount of liquid present. The absorbant must be an approved absorbant, such as Vermiculite - Industrial Grade 4 (Zonolite #4), Diatomaceous Earth (Medium Grade) or Super Fine (Diatomite).

The steel drum shall be monitored with the Baird-Atomic GM Survey Meter (Model 420) and the radiation reading (in millirems) shall be recorded on the drum. All drums shall be labeled (easily visible) with yellow tape or any other similar tape which includes the standard label for radiation and the following: RADIOACTIVE MATERIALS. In addition, each drum shall contain at least 2 White (1) radioactive labels which list the type of isotope and the approximate quantity (mCi) of each isotope contained in the radioactive waste shipment drum. After the drum is filled, it shall be sealed and transferred to the designated storage area until pickup by an authorized carrier.

Glassware that has contained radioactive material shall be first thoroughly rinsed with a suitable radioactive decontaminant before it is made available for routine washing.

c. Solid Wastes

All radioactive wastes (paper towels, gloves, plastic tubes, unusable radioactive chemicals and/or intermediates) shall be placed in the 55 gallon steel drum (DOT approved) reserved for radioactive solid wastes. Sufficient absorbent material (Vermiculite) shall be added to absorb any residual liquids adhering to plastic and glass containers.

When filled, the steel drum shall then be labeled, monitored, sealed and stored in the same manner as described for radioactive liquid scintillation vials.

- d. Disposal of Animal Carcasses - If it is not necessary to dissolve the carcasses for the measurement of body radioactivity as governed by a particular experiment, then the following procedure must be applied.

(1) Rats and Other Small Animals

The carcasses of all rats and other small laboratory animals that have received a radioactive compound shall be placed in 4% formaldehyde solution for at least 2 weeks or until the animal is preserved so that decomposition cannot occur. The abdomen must be slit open so that all parts of the carcass becomes saturated.

(2) Dogs and Larger Animals

The carcasses of all dogs and other large laboratory animals that have received a radioactive compound shall be drawn and quartered, then placed in a 4% formaldehyde solution until saturated.

(3) Placement in DOT Shipment Drums

Sufficient absorbent (3 to 5 inches of Vermiculite ) shall be first placed in the bottom of a 30 gallon DOT steel drum. The carcasses shall then be placed on this absorbent, with the use of tongs and the operator dressed in suitable protective clothing. The carcasses and all parts of the carcasses must be only in a single layer. The layer of carcasses is then covered with 2-3 inches of absorbent. This procedure is then repeated until the steel drum is almost full (3 to 4 inches from the top). The drum is then layered with absorbent until full and then sealed. The drum is monitored and labeled as to the amount and form of radioactivity and also the radioactivity present at the surface of the drum and at 3 feet with the appropriate radiation detector, i.e., "Cutie Pie". Radioactive labels, as required, are attached to the drum. The drum is then stored under lock and key, until picked up by a NRC licensed disposal facility. The attached shipment form (R-48) is used and a record is kept permanently.

e. Laundry Procedures

Laboratory coats and protective clothing will be monitored before being sent to the laundry. The maximum permissible contamination is 1 mr/hr - Ref: Handbook No. 48 - or approximately 1000 cpm with a thin window Geiger-Mueller Counter having a window area of 2 sq. in. Clothing which has become

contaminated above the permissible level is treated as solid waste and discarded as described above.

NOTE: When the 55-gallon drums are to be picked up by the authorized carrier, the Shipment Form for Radioactive Materials (Attachment to f.l.) must first be completed in duplicate. The carrier's representative will sign both copies. The original copy is kept on file in the Metabolic Chemistry Department and the duplicate copy is given to the carrier. In addition, signed copies of the carrier's required forms are also to be kept on file. The Radiation Safety Officer, or his designate, shall be responsible for completion of these forms.

f. Shipment of Isotopes

(1) To Outside Investigators and Laboratories

The shipment of radioactive materials to outside investigators and other laboratories, etc., shall conform to the regulations of CFR 10, Chapter I, Parts 71.1 to 71.64 and all subsequent regulations of the Nuclear Regulatory Commission.

The receiver of any shipment of radioactive materials shall possess a valid NRC License which allows the receiver to accept certain quantities of specific isotopes. The package, waybill and shipment form shall be according to NRC regulations. The packaging and air shipment of radioactive materials shall conform to the Civil Aeronautics Board regulations on Radioactive Materials (C.A.B. No. 82; Restricted Articles Tariff No. 6-D; Section IV).

The attached shipment forms must be completed in triplicate; the original WHR form R-48 must be retained by William H. Rorer, Inc. and a duplicate which has been signed by a authorized recipient returned to William H. Rorer, Inc. In addition, a special waybill is usually required to be completed for specific airlines.

SHIPMENT FORM FOR RADIOACTIVE MATERIALS

NAME \_\_\_\_\_ DATE \_\_\_\_\_

ADDRESS \_\_\_\_\_  
\_\_\_\_\_

NRC NO. \_\_\_\_\_

CARTON \_\_\_\_\_ OF \_\_\_\_\_ CARTONS

CONTENTS: RADIOACTIVE MATERIAL      TRANSPORT INDEX \_\_\_\_\_

LABEL REQUIRED:    ☐ WHITE I                      ☐ YELLOW II  
                         ☐ YELLOW III                      ☐ NO LABEL REQUIRED

<u>RADIONUCLIDE</u>	<u>CURIES</u>	<u>CHEMICAL/PHYSICAL FORM</u>	<u>TRANSPORT GROUP</u>
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

SHIPPER'S CERTIFICATION FOR RESTRICTED ARTICLES

This is to certify that the above named articles are properly classified, described, packaged, marked and labeled and are in proper condition for transportation according to the I.A.T.A. Restricted Articles Regulations and to the applicable regulations of the Department of Transportation and of the Administrator of the Federal Aviation Agency. This shipment is within the limitations prescribed for passenger-carrying aircraft.

William H. Rorer, Inc. (NRC #37-08802-01)  
500 Virginia Drive  
Fort Washington, Pennsylvania 19034

\_\_\_\_\_  
(Signature)

RECEIVED BY \_\_\_\_\_ DATE \_\_\_\_\_

During packing of isotopic material for shipment, the package is carefully monitored for possible contamination or radiation exposure hazard. After packaging is complete, the outside of the sealed container is monitored to insure compliance with indicated radioactive exposure hazard.

(2) Shipment of Radioactive Wastes

Copies of WHR form R-48 shall be completed in duplicate for each shipment of radioactive wastes. The original copy must be signed by the truck driver of the carrier or the carrier's authorized representative. In addition, the carrier's shipment form must be completed according to the carrier's instructions. A purchase order shall also be completed for each shipment by the Radiation Safety Officer or any authorized substitute in his absence.

(3) Persons Responsible for the Safe Transfer, Packaging, and Transport of Low-level Radioactive Material

A. Polk, RSO  
W. L. Studt  
T. Herczeg

Commercial Waste Disposal Service Employed

Teledyne Isotopes  
50 Van Buren Avenue  
Westwood, NJ 07675

(NRC #29-00055-141)

US Ecology, Inc.  
9200 Shelbyville Road, Suite 526  
P.O. Box 7246  
Louisville, Kentucky 40207

(NRC #16-NSF-1)



SHIPMENT FORM FOR RADIOACTIVE MATERIALS

NAME \_\_\_\_\_ DATE \_\_\_\_\_

ADDRESS \_\_\_\_\_  
\_\_\_\_\_

NRC NO. \_\_\_\_\_

CARTON \_\_\_\_\_ OF \_\_\_\_\_ CARTONS

CONTENTS: RADIOACTIVE MATERIAL

TRANSPORT INDEX \_\_\_\_\_

LABEL REQUIRED:

☐

WHITE I

☐

YELLOW II

☐

YELLOW III

☐

NO LABEL REQUIRED

RADIONUCLIDECURIESCHEMICAL/PHYSICAL FORMTRANSPORT  
GROUP

\_\_\_\_\_

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SHIPPER'S CERTIFICATION FOR RESTRICTED ARTICLES

This is to certify that the above named articles are properly classified, described, packaged, marked and labeled and are in proper condition for transportation according to the I.A.T.A. Restricted Articles Regulations and to the applicable regulations of the Department of Transportation and of the Administrator of the Federal Aviation Agency. This shipment is within the limitations prescribed for passenger-carrying aircraft.

William H. Rorer, Inc. (N.R.C. #37-08802-01)  
500 Virginia Drive  
Fort Washington, Pennsylvania 19034

\_\_\_\_\_  
(Signature)

RECEIVED BY \_\_\_\_\_ DATE \_\_\_\_\_

Carton No. \_\_\_\_\_ of \_\_\_\_\_ Waybill No. \_\_\_\_\_

Contents: Radioactive Material.

Transport Index ☐

Label Required:

☐ White I☐ Yellow II☐ Yellow III☐ No Label Required

Radionuclide	Curies	Chemical/Physical Form	Transport Group

## SHIPPER'S CERTIFICATION FOR RESTRICTED ARTICLES

This is to certify that the above named articles are properly classified, described, packaged, marked and labeled and are in proper condition for transportation according to the I.A.T.A. Restricted Articles Regulations and to the applicable regulations of the Department of Transportation and of the Administrator of the Federal Aviation Agency. This shipment is within the limitations prescribed for passenger-carrying aircraft.

William H. Rorer, Inc.  
500 Virginia Drive  
Ft. Washington, Pa. 19034

\_\_\_\_\_  
(Signature)

Carton No. \_\_\_\_\_ of \_\_\_\_\_ Waybill No. \_\_\_\_\_

Contents: Radioactive Material.

Transport Index ☐

Label Required:

☐ White I☐ Yellow II☐ Yellow III☐ No Label Required

Radionuclide	Curies	Chemical/Physical Form	Transport Group

## SHIPPER'S CERTIFICATION FOR RESTRICTED ARTICLES

This is to certify that the above named articles are properly classified, described, packaged, marked and labeled and are in proper condition for transportation according to the I.A.T.A. Restricted Articles Regulations and to the applicable regulations of the Department of Transportation and of the Administrator of the Federal Aviation Agency. This shipment is within the limitations prescribed for passenger-carrying aircraft. ✓

William H. Rorer, Inc.  
500 Virginia Drive  
Ft. Washington, Pa. 19034

\_\_\_\_\_  
(Signature)

I. a. Radiation Areas

The term "radiation area" shall be used to designate any area in which precautions against radiation exposure are required. Radiation areas shall be plainly marked and where personnel monitoring equipment is required; the marking shall include a statement to this effect.

All areas in which there is radiation shall be posted. Signs having the magenta Health Physics symbol, usually on a yellow background with purple letters, will be standard for radiation hazards. The symbol of the magenta color also will be used to distinguish source containers, contaminated waste cans, hot sinks, barriers, etc. Insofar as in practical, magenta will be restricted to such use just as red is restricted to use for fire equipment.

b. Equipment and Fixtures

Hoods, for work with substances presenting a radiological hazard, should have an air flow rate of 100-200 linear feet per minute across all parts of the hood opening, when wide open. Nonporous inert floors and walls or a suitable strippable lining are recommended for such hoods.

All work with radioisotopes shall be done over surfaces such as stainless steel, glass or tile which can be easily decontaminated, and over surfaces protected by trays, heavy kraft paper, blotting paper, stripable coatings or similar materials, which may be disposed of easily.

Covers of centrifuges handling active materials must be closed while motor is operating.

c. Protective Clothing

It shall be the responsibility of the individual and his supervisor to see that appropriate protective clothing is worn wherever contamination of personal clothing with radioactive materials is possible. Coveralls, laboratory coats or other protective garments used for radiation protection are not to be worn out of the locally designated areas in which their use is required.

Suitable gloves shall be worn in all work

involving alpha, beta or gamma emitters whenever hand contamination is likely. Rubber gloves are to be preferred for cases where liquid contamination may be present or where radioactive dust might filter through canvas gloves. Rubber gloves are to be washed with soap and water, dried and monitored before removal. If gloves are contaminated, above 1000 cpm, decontamination procedures (Handbook No. 48) are to be followed to reduce the contamination below this level. If the routine decontamination procedure does not reduce the activity, the gloves are to be discarded as solid waste. All rubber gloves are to be stored and handled so as to prevent contamination of the inside surfaces. After removal of the gloves, the hands shall be monitored and if contaminated, routine contamination procedures followed.

d. Monitoring of Laboratory Areas

Wipe tests of benchtops, hoods and sinks of the isotope laboratory and in all other laboratory areas where radioactive materials are present, or, have been used, shall be obtained every 7 to 14 days with an absorbent pad (Whatman No. 1 filter paper). A record of this will be maintained. If any wipe tests shows that radioactivity of more than twice the background is present, then these workbenches, etc. shall be washed with an appropriate decontamination spray and/or detergent. See attached form for procedure and areas to be monitored.

e. Atmospheric Monitoring

Atmospheric monitoring for beta radiation shall be done at least twice a year, during synthesis for  $^{14}\text{C}$  compounds, and, at such times as deemed necessary by the Radiation Safety Officer. Atmospheric monitoring for gamma radiation shall be done during I-125 labeling procedures, and, at such times as deemed necessary by the Radiation Safety Officer. This monitoring shall include Lab #25, Lab #26 (Isotope Laboratory), Lab #28 and the hallway outside Lab #26; also the exhaust outlets (on the roof of the Research Building) from Lab #25, Lab #26 and Lab #28. The monitoring shall be done with the Bantam Air Sampler (Model N. 19102) containing a charcoal filter (Interex #19-172) and a glass filter (Schleicher and Schuell #25) for 1 hour.

Filters from the Bendix Bantom Air Sampler and



## AREA RADIATION SURVEY RADIATION LEVELS (CPM)

Attachment to I.d.

DATE	B		Y		ISOTOPE LABORATORY (LAB #26)																S U R V E Y
					Benches										Hood		Sink #1		Sink #2		
					1		2		3		4		5		6		7		8		
	Bkg	Std	Bkg	Std	B	Y	B	Y	B	Y	B	Y	B	Y	B	Y	B	Y	B	Y	
	ISOTOPE LABORATORY (LAB #26)										END LABORATORY (LAB #25)										
	Floor (Front)		Floor (Back)		Storage Cabinet		Refrigerator Door		Floor (Doorway)		Benches				Floor		Oxidizer		Floor (Doorway)		
	9		10		11		12		13		14		15		16		17		18		
	B	Y	B	Y	B	Y					B	Y	B	Y	B	Y	B	Y	B	Y	
	MAIN LABORATORY (LAB #28)								SPECIAL EQUIPMENT LAB (#30)				COUNTING ROOM (#29)								
	Bench		Hood		Floor		Floor (Doorway)		Bench		Floor		Bench		Floor						
	19		20		21		22		23		24		25		26		27		28		
	B	Y	B	Y	B	Y	B	Y	B	Y	B	Y	B	Y	B	Y	B	Y	B	Y	

1. Samples of tabletops, hoods, floors, and sinks will be obtained every 2 to 4 weeks\*with an absorbent pad (Whatman No. 1 Paper - 42.5 mm). A 2 ft<sup>2</sup> area will be wiped with the filter paper and the paper placed in a vial with 15 ml of fluor-then counted in the Beckman LS-350 for B-radioactivity levels.
2. If  $\gamma$  (gamma) producing isotopes have been used, then the filter paper must be counted in the  $\gamma$  counter (dry) first.
3. All samples must be counted with appropriate blanks and standards.
4. If contaminating is present to an excess (greater than 3X blank), decontaminate the area and perform another wipe test.

\*or, at least every month.



[illegible]

Procedure: Use Bantam Air Sampler (Model No. 19102) containing a charcoal filter and a glass filter for 1 hour in each lab and the exhaust outlets on the roof from each lab. (Set air intake at 15 fpm.) After determining the gamma radiation, place the filters in 15 ml of Fluor and count for 10 to 100 minutes, along with the sealed standards and appropriate blanks.

•

Procedure: Use Bantam Air Sampler (Model No. 19102) containing a charcoal filter and a glass filter for 1 hour in each lab and the exhaust outlets on the roof from each lab. (Set air intake at 15 lpm.) Count the filters in the Micro Medics gamma counter for 10 minutes using the simulated I-125 standard (ICN #R-35B).

for 10 minutes using the simulated I-125 standard (ICN #R-35B).

wipe test taken to monitor bench tops, sinks and hoods with absorbant pads are counted for total radioactivity in either the Beckman 350 or 7000 Liquid Scintillation System using automatic quench correction (AQC). Calibration of instruments is checked weekly with Beckman sealed LSC standard set No. 566321 for  $^{14}\text{C}$  (27100 cpm) and H-3 (118,000 cpm).

The gamma radiation of the charcoal filter from the Bantam Air Sampler is determined in the Micromedics gamma counting system. The instrument is calibrated, every time it is used, with a simulated I-125 source (ICN Calibration Standard, Model R-35B).

The filters are counted in the gamma counter (when necessary) for at least 10 minutes, along with appropriate blanks and the simulated I-125 standard. The filters are then shaken in 15 ml of Hydrofluor (or PCS Fluor) and the beta radiation always determined in the Liquid Scintillation Counter for at least 100 minutes along with a sealed  $^{14}\text{C}$  standard and appropriate blanks.

A record of the atmospheric monitoring shall be kept (see attached forms).

f. Storing, Transporting and Handling of Radioactive Materials

All transfer of materials between hoods and storage devices must be done in such a manner as to avoid the possibility of spillage or breakage. Double containers to eliminate contamination and breakage danger must be used.

g. Eating and Drinking

Eating, storing, or preparation of food in a laboratory or rooms in a radiation area is forbidden. No edibles of any kind, including candy, or beverages, shall be brought into the area. Nor shall food be touched before removing all washable traces of radioisotopes from the hands.

The application of cosmetics in the laboratory is forbidden. Smoking is strictly forbidden.

h. Continuation Control and Emergency Measures

Experimental work involving hazardous levels of activity shall not be undertaken until suitable

protective measures have been agreed upon by the individuals responsible for the work in question and approved by the Radiation Safety Officer.

Loose contamination should not be tolerated on exposed surfaces such as bench tops and floors and shall be removed as soon as possible. Small amounts of fixed contamination will be unavoidable at times, but the degree of such contamination should be kept as low as practicable. Maximum limits of 1 mr/hr at 2 cm. of beta-gamma are recommended. Higher levels of contamination may be permitted for restricted surfaces, i.e., in areas where entry or access is controlled by procedure or special work instructions. The same standards of contamination control shall apply to tools and equipment. In all cases, signs and controls for contaminated surfaces, areas or equipment shall be instituted to such extent as may be necessary to prevent the occurrence of a health hazard or the spread of contamination.

All spills of radioactive material must be cleaned up promptly. Cleaning responsibility shall lie with the individuals working in the room or area involved, and they shall make a survey after cleaning to verify that the cleaning is thorough.

The supervisor shall be informed in all cases of spillage.

Each person in charge of a laboratory shall be responsible for making or having made surveys of all radiation hazards in the vicinity. It will be the responsibility of the person in charge of the laboratory to keep the Radiation Safety Officer informed of activities in the laboratory.

Effective safeguards against radiation hazards depend upon the intelligent cooperation of all who handle radioactive materials. Each must assume responsibility for acquiring adequate knowledge of the isotope with which he is working; the experimental results which are to be expected; methods for detecting and measuring radiation; tolerance limits; results of over-exposure; and rules for avoiding exposure of self or associates.

All persons working with radioactive materials where hand contamination is possible shall wash their hands thoroughly. Before leaving the laboratory, after washing, the Geiger-Mueller count rate meter shall be utilized to determine the absence of contamination. If the hands have



inadvertently become contaminated, routine decontamination procedures (Handbook No. 48) shall be followed until a level of at least 1 mr per hour (approximately 1000 cpm) average per 2 sq. in. surface area has been reached.

Extreme precautions must be taken to avoid cuts or puncture wounds. In the event that the skin is broken while working with radioactive substances, the wound shall be washed immediately with large volumes of running water. The edges of the wound shall be spread open to permit a flushing action of the water. Bleeding of the wound should be encouraged. The individual shall report to his immediate supervisor, who will monitor the wound after it has been thoroughly flushed. If the wound is contaminated, decontamination procedures shall be employed (Handbook No. 48). The individual shall then be referred to the dispensary for first-aid treatment.

If ingestion of radioactive materials should occur, the individual shall be immediately referred by the supervisor to the designated medical representative for appropriate action.

When hands, body surfaces, clothing or shoes become unavoidably contaminated, steps should be taken, as soon as possible, to remove loose contamination. Some degree of fixed contamination will be unavoidable in certain cases, the following maximum limit is suggested for hands, body surfaces, protective garments or personal clothing and shoes:

beta-gamma activity 0.1 mg/hr

In all cases protective clothing and shoes shall be decontaminated or discarded before they may become a health hazard or result in spread of contamination.

The pipetting by mouth of liquids containing radioactivity is forbidden. Any glassblowing done in these areas shall not involve introduction of glass into the mouth. Any person, who knowingly swallows, inhales or receives an injection of radioactive material, or who may have been grossly over-exposed to radiation from any source, shall report to his supervisor immediately. The case shall be referred to the Medical Director or his designate for further action.

Any work with materials susceptible to



atmospheric distribution (that is, dusting, vaporizing, effervescence of solutions, etc) shall be done in adequate hoods. Radioisotopes shall be securely covered during storage. All radioactive material not in immediate use shall be properly stored in the Isotope Cabinet in the Isotope Laboratory.

Upon receipt of radioactive material in Receiving, the appropriate individual is called and material is held until collected. The material shall be brought to the Isotope Laboratory promptly. The transport of I-131 is handled by placing the shipping container on a cart within a surrounding wall of lead bricks.

The transport of radioactive isotopes through the corridors of the building is to be accomplished in the same manner.

i. Ordering and Receiving Radioactive Material

All purchase orders for radioactive materials in the Research Division shall be placed through the Radiation Safety Officer (A. Polk) or, in his absence, the Section Head of Medicinal Chemistry (Dr. W. L. Studt).

Upon receipt of radioactive material, the Radiation Safety Officer, or a qualified designate, shall perform a wipe test on a 100 cm<sup>2</sup> area of the outside of the package. This shall be carried out by applying a detergent and wiping the area with No. 1 Whatman filter paper. The paper is then dried in the oven at 55°C, and the radioactivity, if any, determined either in the Micromedics Counter (gamma radiation) or the Beckman Liquid Scintillation Counter (gamma radiation).

- (1) (Gamma) Counting: Place the folded dried filter paper in a plastic tube and determine the radioactivity (10 minutes counting) on the Micromedics Gamma Counter. Appropriate blanks and standard must be included.
- (2) (Beta) Counting: Place the filter paper in 15 ml of Hydrofluor (or PCS Fluor) and determine the radioactivity (10 to 100 minutes counting) on the Liquid Scintillation Counter. Appropriate blanks and standards must be included.

## APPENDIX C

PROCEDURES FOR ORDERING AND RECEIVING RADIOACTIVE MATERIAL

1. The Radiation Safety Officer must place all orders for radioactive material and must ensure that the requested materials and quantities are authorized by the license and that possession limits are not exceeded.
2. During normal working hours, carriers must be instructed to deliver radioactive packages directly to the Biochemistry Department.
3. During off-duty hours, security personnel must accept delivery of radioactive packages in accordance with the procedures outlined in the memorandum below.

## MEMORANDUM

MEMORANDUM FOR: Security Personnel

FROM: Mr. D. L. Cole

SUBJECT: RECEIPT OF PACKAGES CONTAINING RADIOACTIVE MATERIAL

Any packages containing radioactive material that arrive between 4:30 p.m. and 8:00 a.m. or on Saturday, Sundays or holidays shall be signed for by the Security guard on duty and taken immediately to the Isotope Lab in the Biochemistry Department. Unlock the door, place the package on top of the counter immediately to the right of the door and relock the door. The Isotope Lab key is #6 (green key) and is stored in the key box above the wall telephone in Lab #28 (first door).

If the package is wet or appears to be damaged, immediately contact the Radiation Safety Officer. Ask the carrier to remain at the Guard House until it can be determined that neither he nor the delivery vehicle is contaminated.

RADIATION SAFETY OFFICER: ANDREW POLK

OFFICE TELEPHONE: 628-6588

HOME TELEPHONE: 215 - 566-6307

Alternate: Dr. William L. Studt

Office Telephone: 628-6412

Home Telephone: 256-6226

## RADIOACTIVE SHIPMENT RECEIPT REPORT

1. P.O. # \_\_\_\_\_ Survey Date \_\_\_\_\_ Time \_\_\_\_\_  
Surveyor \_\_\_\_\_
2. CONDITION OF PACKAGE:  
\_\_\_\_\_ O.K. \_\_\_\_\_ Punctured \_\_\_\_\_ Status \_\_\_\_\_ Wet  
\_\_\_\_\_ Crushed \_\_\_\_\_ Other \_\_\_\_\_
3. RADIATION UNITS OF LABEL: \_\_\_\_\_ Units (mRem/hr)
4. MEASURED RADIATION LEVELS:  
a. Package surface \_\_\_\_\_ mRem/hr  
b. 3 feet or 1 meter from surface \_\_\_\_\_ mRem/hr
5. DO PACKING SLIP AND VIAL CONTENTS AGREE?  
a. Radionuclide \_\_\_\_\_ yes \_\_\_\_\_ no, difference \_\_\_\_\_  
b. Amount \_\_\_\_\_ yes \_\_\_\_\_ no, difference \_\_\_\_\_  
c. Chem Form \_\_\_\_\_ yes \_\_\_\_\_ no, difference \_\_\_\_\_
6. WIPE RESULTS FROM:  
a. Outer \_\_\_\_\_ CPM = \_\_\_\_\_ DPM  
eff = (    )  
b. Final source container \_\_\_\_\_ CPM = \_\_\_\_\_ DPM  
eff = (    )
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.

\_\_\_\_\_  
Signature\_\_\_\_\_  
Date

Attachment to I.i.

[illegible]

RADIOISOTOPE INVENTORY FORM

Compound \_\_\_\_\_

Isotope \_\_\_\_\_ Rorer Isotope No. \_\_\_\_\_

Half Life \_\_\_\_\_ Activity: Specific \_\_\_\_\_ Total \_\_\_\_\_

If purchased:

Source \_\_\_\_\_ Purchase Order No. \_\_\_\_\_

Lot No. \_\_\_\_\_

If synthesized:

Starting material \_\_\_\_\_ Rorer Isotope No. \_\_\_\_\_

Chemist \_\_\_\_\_ Notebook No. \_\_\_\_\_

Requested by \_\_\_\_\_ Date of arrival or synthesis \_\_\_\_\_

Date of Depletion \_\_\_\_\_

Record of Use

Date	Quantity	Purpose	Notebook No.

Method of Disposal

Date	Means of Disposal	Disposer



See attached form "Monitoring of Incoming Packages" for recording of appropriate information. It is not necessary to perform any wipe tests on packages containing exempt quantities.

j. Emergency Procedure

- (1) In case of spills of low specific activity, the investigator must use the Decontamination Kit to clean the area and dispose of the waste into the Radioactive Waste Shipment steel drums. The area is then monitored with the "Cutie Pie".
- (2) In case of spills of large quantities of radioactive material, or in case of fire, the Radiation Safety Officer (or his alternate - Dr. W. L. Studt) should be notified immediately. With appropriate protective clothing, and use of the Decontamination Kit, the area must be thoroughly cleaned until monitoring with the "Cutie Pie" and/or G-M survey meter show little or no radioactivity. The area must be continuously monitored before, during and following the essential decontamination procedures.
- (3) Contamination of Personnel

In case of contamination of personnel, the investigator must immediately remove all suspect contaminated clothing, shower immediately and notify the Radiation Safety Officer or his alternate.

If open wounds are present the Medical Director, (J.F. Vance, M.D., ext. 6761), or any of the following: the Director - Clinical Research (B. Rofman, M.D., ext. 6523); the Associate Director - Clinical Research (K.D. Lamon, M.D., ext. 6134); the Associate Director - Marketed Products (J.C. Maerz, M.D., ext. 6296), must be notified and appropriate therapeutic measures be exercised. The nurse on duty in the Dispensary (ext. 6581) must also be notified. In addition, blood, urine and/or fecal samples must be taken until there is evidence of no radioactivity in the injured investigator.

- (4) In case of a major fire or serious explosion, the above procedures j-1 through 3 must be followed and the NRC Regional Office at King of Prussia must be notified. In addition, the contaminated area must be sealed off and the affected lab must be locked until decontaminated.
- (5) In case of loss of radioactive material, all reasonable attempts at recovering as much as possible must be exhausted. The Radiation Safety Officer must be notified and the NRC Regional Office at King of Prussia must be notified of the quantity and type of radioactive material involved.

k. Sewage Monitoring

1. Sewerage samples shall be taken from the Sewerage Sampling Station in the Research building twice a year or when deemed necessary by the Radiation Safety Officer.
2. At least 1.0 ml of the sample shall be counted in duplicate in 15 ml of Fluor, along with the appropriate standards and blanks, in the LS-350 counter. If gamma emitting materials are being used, then samples will be counted in the gamma counter (See attached form).

l. Personnel Monitoring

1. Physical Examination

All personnel in radiation work shall have a complete physical examination once a year. The examination shall include PF Chest X-ray, a complete blood analysis (CBC, Sedimentation rate, SMA-12, RPR, lipid profile), urinalysis and a resting EKG for those personnel over 40 years old.

2. Personnel Monitoring

A TLD badge shall be worn by all persons working in a radiation area. In the case of persons to whom a TLD badge is assigned for more than one day, the wearing of a pocket ionization chamber, in addition to the TLD badge, may be required in certain cases where the conditions of work make a day-to-day indication of exposure desirable.

TLD badges will be issued to all



personnel working in the radiation area by the Radiation Safety Officer. Pocket ionization chambers and TLD badges are intended primarily for monitoring the individual to whom they are issued and are not to be tampered with in any way.

Personnel monitoring records shall be maintained by the Radiation Safety Officer in a Personnel Record Book provided for this purpose. Pocket ionization chamber readings, hand monitoring values (cpm) and results from their survey instruments shall be recorded daily insofar as they have been used. These records are checked by the supervisor.

TLD badges will be collected quarterly and sent to Tele-Dyne for determination of individual exposure for that interval. TLD badge readings for the individual shall be recorded in the Personnel Record Book by the Radiation Safety Officer when reported by Tele-Dyne. After recording the value, these reports will be kept in Metabolic Chemistry and Central Files. Whenever values are reported in excess of 100 millirem, the individual concerned shall be notified by his supervisor and appropriate action to prevent a recurrence shall be taken.

### 3. Bioassay Procedures

Any investigator that has handled 100 millicuries (or more) of tritium ( $^3\text{H}$ ) shall obtain a urine sample at least 24 hours later and submit this urine sample to the Radiation Safety Officer (or the Head of the Metabolic Chemistry Department) to aid in the determination of an individual's exposure to concentrations of radioactive material.

Samples of the urine (0.1 ml, 0.5 ml) shall be counted in Hydrofluor in duplicate. Additional samples of this urine shall be mixed with known quantities of  $^3\text{H}_2\text{O}$  standards and counted. These bio-assay results shall be made available, when requested, to the Nuclear Regulatory Commission, according to the instructions of the NRC Inspector (October 4, 1976).

### 4. Thyroid Uptake Procedure

Any investigator who has used Iodine-125

131  
during I-125 labeling procedures must have a thyroid I-125 uptake test 24 to 36 hours after an iodination procedure.

## II. Monthly Inspection, Retraining and Audit

- a. Inspection of all labs (#25, #26, #28 and #30) and all facilities pertaining to the use of radioactive materials shall be carried out at least once a month by the Radiation Safety Officer or a designated alternate. See attached form.
- b. Re-training of personnel shall be part of the safety program carried out monthly by the Radiation Safety Program. The personnel that require re-training shall be left to the discretion of the Radiation Safety Officer. See attached Safety Officer. See attached General Precautions, used as a supplement.
- c. A semi-annual audit of activities associated with radioactive materials shall be carried out by the Administrative Manager, Research Division. See attachments.

## III. Summary of Responsibilities

### a. Individuals

Each individual who has any contact with radioactive materials or radiation is responsible for:

1. Keeping his daily exposure to radiation as low as possible specifically below 100 mrem per week except where necessary to utilize the approved longer averaging time. Medical treatment is specifically excepted from inclusion in dosage determination.
2. Wearing prescribed monitoring equipment in radiation areas.
3. Making hand counts and removing contamination before leaving the job.
4. Wearing appropriate protective clothing whenever clothing contamination is possible and not wearing such clothing out of the laboratory area or to eating places.
5. Using gloves, hoods and respirators where necessary.



NRC Compliance Procedures \_\_\_\_\_

Date \_\_\_\_\_

Monthly Inspection and Retraining

1. Inspection: the following areas were inspected:
  - a. Isotope Lab (#26)
    - (1) Storage cabinet and refrigerator/freezer (sewage disposal record also checked)
  - b. End Lab (#25)
  - c. Main Lab (#28)
  - d. Walk-in freezer
  - e. Lab (#30)
  - f. LS counters
  - g. G.M. detectors
  - h. Notice on Bulletin Board
  - i. Radioactive Waste Storage
  - j. NRC Regulations and Rorer Radiation Safety Manual
  - k. Update of NRC regulations
2. Monthly Swipe Tests were done today. •
3. Retraining

# SOME GENERAL PRECAUTIONS FOR RADIOACTIVE WORK

## RE-TRAINING SESSION ON WORKING WITH RADIOACTIVE MATERIALS

ANDREW POLK, RSO

1. Always keep active and inactive work separated as far as possible, preferably by maintaining rooms used solely for radioactive work.

2. Always work over a spill tray and in a ventilated enclosure (except with small ( $< 1 \text{ mCi}$ ) quantities of  $^3\text{H}$ ,  $^{35}\text{S}$  or  $^{14}\text{C}$  compounds in a nonvolatile form in solution).

3. Always use the minimum quantity of radioactivity compatible with the objectives of the experiment.

4. Always wear protective clothing, safety glasses and gloves when handling radioactivity.

5. Always wash your hands and monitor yourself before leaving an active area.

6. Always work carefully and monitor the working area regularly to avoid ruining experiments by accidental contamination.

7. Always label containers of radioactive material clearly, indicating nuclide, total activity, compound, specific activity, date and the level of radiation at the surface of the container.

8. Never eat, drink, smoke or apply cosmetics in an area where unsealed radioactivity is handled.

9. Never use ordinary handkerchiefs; use paper tissues and dispose of them as active waste.

10. Never work with cuts or breaks in the skin unprotected, particularly on the hands or forearms.

11. Never pipette radioactive solutions by mouth.

12. In the event of a spill it is essential to minimize the spread of contamination:

a) Cordon off the suspected area of contamination.  
b) Ascertain, if possible, the type of contamination, i.e. the nuclide(s) involved (as it may be necessary to use breathing apparatus, protective clothing or other equipment).

c) Determine the area of contamination by monitoring after taking the necessary precautions.

d) Starting from the outer edge, decontaminate the area in convenient sectors by wiping and scrubbing.

e) Before moving on insure that a sector is clean by monitoring.

13. Dispose of all radioactive waste according to statutory requirements. Short-lived radionuclides, for example,  $^{32}\text{P}$ , may be stored with suitable shielding and left to decay. After 4 half-lives less than 10% of the original activity remains, after 7 half-lives  $< 1\%$ , after 10 half-lives  $< 0.1\%$ .

For longer-lived radionuclides, for example,  $^3\text{H}$ , this is impracticable and alternative disposal arrangements should be made.

14. Film badges should be worn for all radioactive work except with  $\mu\text{Ci}$  quantities of the low energy,  $\beta$ -emitting radionuclides  $^3\text{H}$ ,  $^{14}\text{C}$  and  $^{35}\text{S}$ .

15. The International Commission on Radiological Protection (ICRP) recommends that occupational exposure should not exceed 5rem/year to the whole body. The exposure of the general public should not exceed 10% of the occupational exposure levels.

16. To minimize the dose to the extremities, tongs or other remote handling equipment should be used where appropriate.

SIGNATURE

DATE

SEMI-ANNUAL AUDIT OF ACTIVITIES ASSOCIATED  
WITH RADIOACTIVE MATERIALS

Performed by: \_\_\_\_\_, \_\_\_\_\_ Title

Date: \_\_\_\_\_

1. Current Set of DOT & NRC Regulations Yes \_\_\_\_\_; No \_\_\_\_\_
2. Requirements of Waste Burial Firm Yes \_\_\_\_\_; No \_\_\_\_\_
3. List of People Responsible for Safe Transfer Yes \_\_\_\_\_; No \_\_\_\_\_
4. Detailed Instructions for Transfer, Controls, etc. Yes \_\_\_\_\_; No \_\_\_\_\_
5. Record of Training and Periodic Retraining Yes \_\_\_\_\_; No \_\_\_\_\_
6. Training and Retraining for Processing Waste Yes \_\_\_\_\_; No \_\_\_\_\_

N.B. See attachment for details of items 1 to 6.

**Action To Be Taken By Licensees:**

To assure the safe transfer, packaging, and transport of low-level radioactive waste, each licensee is expected to:

1. Maintain a current set of DOT and NRC regulations concerning the transfer, packaging and transport of low-level radioactive waste material.
2. Maintain a current set of requirements (license) placed on the waste burial firm by the Agreement State of Nevada, South Carolina, or Washington before packaging low-level radioactive waste material for transfer and shipment to the Agreement State licensee. If a waste collection contractor is used, obtain the appropriate requirements from the contractor.
3. Designate, in writing, people in your organization who are responsible for the safe transfer, packaging and transport of low-level radioactive material.
4. Provide management-approved, detailed instructions and operating procedures to all personnel involved in the transfer, packaging and transport of low-level radioactive material. Special attention should be given to controls on the chemical and physical form of the low-level radioactive material and on the containment integrity of the packaging.
5. Provide training and periodic retraining in the DOT and NRC regulatory requirements, the waste burial license requirements, and in your instructions and operating procedures for all personnel involved in the transfer, packaging and transport of radioactive material. Maintain a record of training dates, attendees, and subject material for future inspections by NRC personnel.
6. Provide training and periodic retraining to those employees who operate the processes which generate waste to assure that the volume of low-level radioactive waste is minimized and that such waste is processed into acceptable chemical and physical form for transfer and shipment to a low-level radioactive waste burial facility.

6. Using proper techniques and facilities in operations involving radioactive material.
7. Observing the prescribed procedures in regard to eating and smoking.
8. Reporting puncture wounds and ingestion accidents promptly to his supervisor.
9. Posting warning signs and otherwise controlling special hazards for which he is responsible.
10. Cleaning up contamination for which he is responsible.
11. Survey and decontamination when vacating an area.
12. Proper storage and handling of radioactive materials for which he is responsible.
13. Informing supervisor before removing radioactive material or equipment from the Isotope Laboratory.

b. Supervisors

Supervisors are responsible for insuring that the above individual responsibilities are discharged by those under their control and are further responsible for:

1. Instructing those employees for whom they are responsible in the use of safe techniques and in the application of the approved radiation safety practices.
2. Forwarding copies of special rules and experimental conditions to the Radiation Safety Officer for approval.
3. Maintaining such inspection and monitoring procedures as shall be necessary to insure that persons working with radioactive materials are complying with designated safety regulations.
4. Informing the Radiation Safety Officer of requests for new isotopes and additional radioactive material for new uses.

c. Radiation Safety Officer

The Radiation Safety Officer is responsible for:

1. Furnishing consulting services on all aspects of radiation protection.



2. Assisting individuals and supervisors in discharging their responsibilities.
3. General surveillance of all radiological activities.
4. Designating the personnel who shall have the entire responsibility for receipt, handling, labeling, storage, issue, disposal and records of all radioactive materials received.
5. Reviewing, amending and approving of precautionary and safety measures.
6. Designating the proper persons to be notified in event of an emergency, e.g., spills, bodily injury, fire, etc.
7. Preparation of NRC license applications.
8. Approval of all isotopes orders before order is placed.
9. Maintenance of safety records as required by Title 10 Code of Federal Regulations, Part 20 (20,202 and 20,401).
10. Submitting to appropriate personnel the results of isotope and chemical, including sterility, if required, analyses, prior to shipment of radioactive material to authorized investigators for human use.
11. Notification of NRC in case of accident or theft of radioactive materials.
12. Monthly inspections and retraining of personnel handling radioactive material.
13. TLD (Personnel Monitoring) Badge service.
14. Semi-annual Audit Records.

#### IV. Sealed-Source Leak-Test Procedure

- a. Each chromatograph detector containing Nickel 63 shall be tested for leakage and/or contamination at intervals not to exceed six months. In the absence of a certificate from a transferor indicating that a test has been made within six months prior to the transfer, the detector shall not be put into use until tested.

- b. The test shall be capable of detecting the presence of 0.005 microcurie of radioactive material on the test sample. The test sample shall be taken from the surfaces of the device in which the foil is mounted or stored on which one might expect contamination to accumulate. Records of leak test results shall be kept in units of microcuries and maintained for inspection by the Commission.
- c. If the test reveals the presence of 0.005 microcuries or more of removable contamination, the licensee shall immediately withdraw the foil from use and shall cause it to be decontaminated and repaired or to be disposed of in accordance with Commission regulations. A report shall be filed within five days of the test with the Director, Division Materials Licensing, U.S. Nuclear Regulator Commission, Washington, D.C. 20545, describing the equipment involved, the test results, and the corrective action taken. A copy of each report shall also be sent to the Directorate of Regulatory Operations, Region I, U.S.N.R.C., 631 Park Avenue, King of Prussia, PA 19406.
- d. Tests for leakage and/or contamination shall be performed by the licensee or by other persons specifically authorized by the Commission or an Agreement State to perform such services.

NICKEL 63 ELECTRON CAPTURE DETECTOR  
LEAK (WIPE) TEST INSTRUCTIONS

A. GENERAL

Performing a contamination wipe test every six months is part of the licensing requirement to possess an Electron Detector which contains a Nickel 63 radioactive foil. It is essential that the test be performed to insure retention of the N.R.C. license. The first due date is six months after the date stamped on the Nickel 63 Detector (see location in Figure 1).

This note is applicable to any instrument which has an Electron Capture Detector, factory or field installed.

B. PERFORMING THE LEAK (WIPE) TEST

The test should be performed as follows:

- (1) Select three information cards and fill out completely.
- (2) Select three pieces of filter paper and label them with a pencil as follows:  

Sample 1 - Det. Entrance Fitting  
Sample 2 - Det. Housing  
Sample 3 - Det. Exit
- (3) Disconnect the column from the EC Cell (Figure 1, No.1).
- (4) Wipe the detector entrance fitting, (Figure 1, No. 3) with a piece of filter paper labelled "Det. Entrance Fitting Sample:", and immediately insert it and a filled-out information card into one plastic bag. Wipe both the inside and outside of the fitting.
- (5) Wipe the detector housing (Figure 1, No. 4) with the filter paper labelled "Det. Housing Sample 2", and insert it and filled-out information card into a second plastic bag.
- (6) Disconnect the teflon exit fitting (Figure 1, No.2) from the detector cathode by unscrewing. Wipe the threaded metal detector exit fitting and the inside of the teflon tube exit fitting with the filter paper labelled "Det. Exit Sample 3", and insert it and a filled-out information card into a third plastic container.
- (7) Send plastic containers in special envelope to:

Teledyne Isotopes (NRC #29-00055-06)  
50 Van Buren Avenue  
Westwood, New Jersey 07675

1. Column
2. Det. Exit Tube
3. Det. Entrance Fitting
4. Det. Housing
5. Cathode
6. Cell Date

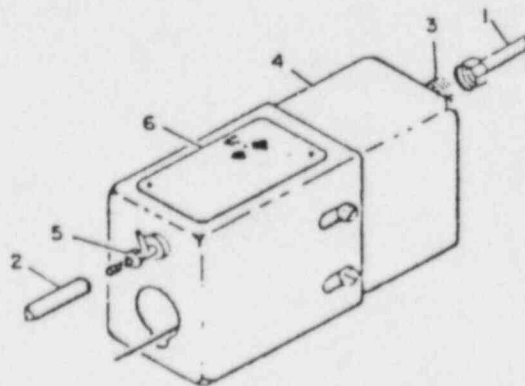


FIGURE 1. LEAK (WIPE) TEST POINTS

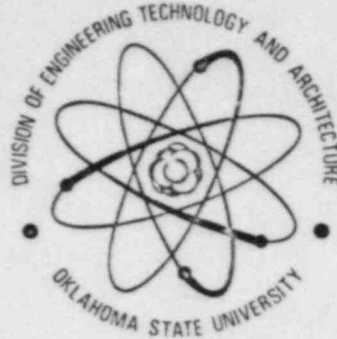
Items 16 and 17 (continued)

ANDREW POLK, B.Sc., Section Head, Metabolic Chemistry

TRAINING AND EXPERIENCE OF EACH INDIVIDUAL NAMED IN ITEM 4 (Use supplemental sheets if necessary)				
8. TYPE OF TRAINING		WHERE TRAINED	DURATION OF TRAINING	ON THE JOB (Circle answer) FORMAL COURSE (Circle answer)
a. Principles and practices of radiation protection		Hahnemann Medical College	4 mos.	Yes <input checked="" type="radio"/> No <input type="radio"/> Yes <input type="radio"/> No <input checked="" type="radio"/>
b. Radioactivity measurement standardization and monitoring techniques and instruments		Hahnemann Medical College	4 mos.	Yes <input checked="" type="radio"/> No <input type="radio"/> Yes <input type="radio"/> No <input checked="" type="radio"/>
c. Mathematics and calculations basic to the use and measurement of radioactivity		Hahnemann Medical College	4 mos.	Yes <input checked="" type="radio"/> No <input type="radio"/> Yes <input type="radio"/> No <input checked="" type="radio"/>
d. Biological effects of radiation		Hahnemann Medical College	4 mos.	Yes <input checked="" type="radio"/> No <input type="radio"/> Yes <input type="radio"/> No <input checked="" type="radio"/>
9. EXPERIENCE WITH RADIATION. (Actual use of radioisotopes or equivalent experience.)				
ISOTOPE	MAXIMUM AMOUNT	WHERE EXPERIENCE WAS GAINED	DURATION OF EXPERIENCE	TYPE OF USE
Carbon 14	10 mc	Smith Kline and French Laboratories	5 years	Metabolism of Carbon 14 labelled drugs
" "	60 mc	W. H. Rorer, Inc.	16 years	in humans, lower animals

Additional Training: "Radiation Safety Specialist Training" Course - see attached details of course.

# Oklahoma State University



*This is to certify that*

ANDREW POLK

*Has successfully completed the*

RADIATION SAFETY SPECIALIST TRAINING

*conducted by Oklahoma State University*

*and in recognition thereof is hereby awarded this certificate.*

*Given at* Oklahoma City, *Oklahoma this* 13th *day of* March  
*in the year of* 1981.



Howard M. Johnson  
Howard M. Johnson, Ph.D., Instructor

Robert B. Weaver  
Robert Weaver, Program Coordinator





# Oklahoma State University

TECHNOLOGY EXTENSION

STILLWATER, OKLAHOMA 74078  
313 CRUTCHFIELD  
(405) 624-5714

March 27, 1981

## TO WHOM IT MAY CONCERN:

Andrew Polk has successfully completed the thirty-two (32) hour Radiation Safety Specialist Training Program and has passed the four (4) hour comprehensive examination given upon completion. This course was conducted by Oklahoma State University in Oklahoma City, Oklahoma, March 9-13, 1981, and consisted of the following topics:

- 1) Atomic and Nuclear Structure
  - a) Nuclear Notation
  - b) Nuclear Stability
  - c) Isotopes
- 2) Radioactive Decay
  - a) Decay Schemes
  - b) Half-Life
  - c) Chart of the Nuclides
- 3) Types of Radiation and Interaction
  - a) X and gamma
  - b) Alpha and Beta
  - c) Neutrons
  - d) Bremsstrahlung
- 4) Radiation Dosimetry
  - a) Absorbed dose: rad
  - b) Exposure dose: roentgen
  - c) Dose equivalent
  - d) Quality factor
- 5) Biological Effects of Radiation
  - a) Acute and chronic effects
  - b) Radiation and protection guides
  - c) Dose limits
- 6) External Radiation Protection
  - a) Time
  - b) Distance
  - c) Shielding
- 7) Internal Radiation Protection
  - a) Internal radiation hazards
  - b) Control of contamination
  - c) Waste disposal
- 8) Radiation Safety Instrumentation
  - a) Survey meters
  - b) Radiation scalers
  - c) Personnel dosimeters
- 9) Regulatory Control
  - a) Licensing procedures
  - b) Agreement and nonagreement states
  - c) Code of Federal Regulations
- 10) Compliance
  - a) Establishing and posting radiation areas
  - b) Surveying and wipe testing work areas
  - c) Leak testing sealed sources
  - d) Counting statistics
  - e) Transportation of radioactive materials

Successful completion of the above training and examination has demonstrated that Andrew Polk is competent to perform the following tasks which are expected of a Radiation Safety Specialist:

- 1) Use the Radiological Health Handbook and the Chart of the Nuclides.
- 2) Determine decay characteristics of a radionuclide from the Radiological Health Handbook and the Chart of the Nuclides.
- 3) Use standard calibration sources and perform DPM-Curie conversions.
- 4) Perform radioactive decay corrections.
- 5) Apply statistics to the counting of radioactive sample and express in correct form.
- 6) Use of the following instruments to perform area surveys and express reading correct units:
  - a) Geiger-Muller survey meter
  - b) Cutie Pie survey meter
  - c) Neutron survey meter
  - d) Alpha survey meter
- 7) Use of film badges, thermoluminescent dosimeters and pocket dosimeters for personnel dosimetry.
- 8) Calculate the dose rate from a (a) point gamma source, (b) point beta source, (c) point neutron source and (d) point beta source producing bremsstrahlung.
- 9) Perform shielding calculations on gamma, X-rays, beta, bremsstrahlung, and neutrons to reduce the dose to an acceptable level.
- 10) Use time, distance and shielding as a protective measure.
- 11) Perform leaks tests, wipe tests, and air samples, and determine if contamination is present and the amount.
- 12) Apply MPC values to a practical situation.
- 13) Establish a radiation safety unit within an organization utilizing:
  - a) Restricted areas
  - b) RSO
  - c) Radiation safety committee
  - d) Personnel monitoring
  - e) Area surveys
  - f) Leak tests
  - g) Wipe tests
  - h) Posting
  - i) Pertinent records
  - j) Radioactive storage and disposal
  - k) Receiving and shipping

3-31-81

Date

Howard M. Johnson

Howard M. Johnson, Ph.D.  
Associate Professor  
School of Technology  
Oklahoma State University

Items 16 and 17 (continued)

William L. Studt, Ph.D., Section Head, Medicinal Chemistry

Training:

Type of Training: Formal Course

Where trained: Eastern Michigan University

Duration of Training: 1/2 year

Formal Course Included:

- a. Principles and practices of radiation protection.
- b. Radioactivity measurement standardization and monitoring techniques and instruments.
- c. Mathematics and calculations basic to the use and measurement of radioactivity.
- d. Biological effects of radiation.

Experience With Radiation:

<u>Isotope</u>	<u>Maximum Amount</u>	<u>Where</u>	<u>Duration</u>	<u>Type of Use</u>
I-125	1 mCi	University of Michigan	1/4 year	Research work in graduate school
C-14	100 mCi	William H Rorer, Inc.	4 years	Synthesis of $^{14}\text{C}$ Compounds

Items 16 and 17 (continued)

ANTHONY J. VISALLI, B.Sc., Section Head, Analytical Chemistry

Page Two

TRAINING AND EXPERIENCE OF EACH INDIVIDUAL NAMED IN ITEM 4 (Use supplemental sheets if necessary)

B TYPE OF TRAINING		WHERE TRAINED	DURATION OF TRAINING	ON THE JOB (Circle answer)	FORMAL COURSE (Circle answer)
a. Principles and practices of radiation protection		Phila. College of Pharmacy & Science	4 semesters	Yes <input type="radio"/> No <input checked="" type="radio"/>	Yes <input checked="" type="radio"/> No <input type="radio"/>
		St. Joseph's College - Grad. School	2 semesters	Yes <input type="radio"/> No <input checked="" type="radio"/>	Yes <input checked="" type="radio"/> No <input type="radio"/>
b. Radioactivity measurement standardization and monitoring techniques and instruments		As above		Yes <input type="radio"/> No <input checked="" type="radio"/>	Yes <input checked="" type="radio"/> No <input type="radio"/>
c. Mathematics and calculations basic to the use and measurement of radioactivity		As above		Yes <input type="radio"/> No <input checked="" type="radio"/>	Yes <input checked="" type="radio"/> No <input type="radio"/>
d. Biological effects of radiation		As above		Yes <input type="radio"/> No <input checked="" type="radio"/>	Yes <input checked="" type="radio"/> No <input type="radio"/>

D EXPERIENCE WITH RADIATION (Actual use of radioisotopes or equivalent experience)				
ISOTOPE	MAXIMUM AMOUNT	WHERE EXPERIENCE WAS GAINED	DURATION OF EXPERIENCE	TYPE OF USE
<sup>60</sup> Co)	1-2 mCi	Phila. College of Pharmacy and Science	4 semesters	Laboratory Experiments
<sup>90</sup> Sr)		St. Joseph's College - Graduate School	2 semesters	Laboratory Experiments
<sup>14</sup> C )				

Items 16 and 17 (continued)

PAUL R. DARKES, B.S., Senior Organic Chemist

TRAINING AND EXPERIENCE OF EACH INDIVIDUAL NAMED IN ITEM 4 (Use supplemental sheets if necessary)					Page Two
8. TYPE OF TRAINING		WHERE TRAINED	DURATION OF TRAINING	ON THE JOB (Circle answer)	FORMAL COURSE (Circle answer)
a. Principles and practices of radiation protection		Phila. College of Pharmacy and Science	2 semesters	Yes No	<input checked="" type="radio"/> Yes <input type="radio"/> No
b. Radioactivity measurement standardization and monitoring techniques and instruments		11	11	Yes No	<input checked="" type="radio"/> Yes <input type="radio"/> No
c. Mathematics and calculations basic to the use and measurement of radioactivity		11	11	Yes No	<input checked="" type="radio"/> Yes <input type="radio"/> No
d. Biological effects of radiation		11	11	Yes No	<input checked="" type="radio"/> Yes <input type="radio"/> No
9. EXPERIENCE WITH RADIATION (Actual use of radioisotopes or equivalent experience.)					
ISOTOPE	MAXIMUM AMOUNT	WHERE EXPERIENCE WAS GAINED	DURATION OF EXPERIENCE	TYPE OF USE	
<sup>3</sup> H	250 µCi	William H. Rorer, Inc	3 days	Synthesis	
<sup>14</sup> C	60 µCi	William H. Rorer, Inc.	2 years	Synthesis	



Items 16 and 17 (continued)

CHING T. TSUEI, M.S., Senior Organic Chemist, Medicinal Chemistry

TRAINING AND EXPERIENCE OF EACH INDIVIDUAL NAMED IN ITEM 4 (Use supplemental sheets if necessary)					Page Two
8. TYPE OF TRAINING		WHERE TRAINED	DURATION OF TRAINING	ON THE JOB (Circle answer)	FORMAL COURSE (Circle answer)
a. Principles and practices of radiation protection		St. Joseph's College, Phila.	1966, one Semester	Yes No	Yes No
b. Radioactivity measurement standardization and monitoring techniques and instruments		St. Joseph's College, Phila. W. H. Rorer, Inc.	" "	Yes No	Yes No
c. Mathematics and calculations basic to the use and measurement of radioactivity		St. Joseph's College	" "	Yes No	Yes No
d. Biological effects of radiation		W. H. Rorer, Inc.		Yes No	Yes No
9. EXPERIENCE WITH RADIATION (Actual use of radioisotopes or equivalent experience.)					
ISOTOPE	MAXIMUM AMOUNT	WHERE EXPERIENCE WAS GAINED	DURATION OF EXPERIENCE	TYPE OF USE	
$^{14}\text{C}$	40 mc	W. H. Rorer, Inc.	4-1/2 years	synthesis	

Items 16 and 17 (continued)

ROBERT L. PROCACCINI, PH.D., Assistant Director, Clinical Research

TRAINING AND EXPERIENCE OF EACH INDIVIDUAL NAMED IN ITEM 4 (Use supplemental sheets if necessary)					Page Two	
B. TYPE OF TRAINING	WHERE TRAINED			DURATION OF TRAINING	ON THE JOB (Circle answer)	FORMAL COURSE (Circle answer)
a. Principles and practices of radiation protection	University of Rhode Island, RI			6 mos.	Yes <input type="radio"/> No <input checked="" type="radio"/>	Yes <input type="radio"/> No <input checked="" type="radio"/>
b. Radioactivity measurement standardization and monitoring techniques and instruments	11	11	11	6 mos.	Yes <input type="radio"/> No <input checked="" type="radio"/>	Yes <input type="radio"/> No <input checked="" type="radio"/>
c. Mathematics and calculations basic to the use and measurement of radioactivity	11	11	11	6 mos.	Yes <input type="radio"/> No <input checked="" type="radio"/>	Yes <input type="radio"/> No <input checked="" type="radio"/>
d. Biological effects of radiation	11	11	11	6 mos.	Yes <input type="radio"/> No <input checked="" type="radio"/>	Yes <input type="radio"/> No <input checked="" type="radio"/>
P. EXPERIENCE WITH RADIATION. (Actual use of radioisotopes or equivalent experience.)						
ISOTOPE	MAXIMUM AMOUNT	WHERE EXPERIENCE WAS GAINED	DURATION OF EXPERIENCE	TYPE OF USE		
<sup>3</sup> H	2 mCi	University of Rhode Island	4 years	Tracer Experiments		
<sup>14</sup> C		Medical College of GA	1.5 years	11	11	
<sup>32</sup> P	1.5 mCi	W. H. Rorer, Inc.	4 years	11	11	