The College Of
WILLIAM&MARY

Department of Chemistry

P.O. Box 8795
Williamsburg, Virginia 23187-8795
804/221-2540, Fax 221-2715

DL-022095_02

February 20, 1995

U.S. Nuclear Regulatory Commission
Region II
Material Radiation Protection Section
101 Marietta Street, NW, Suite 2900
Atlanta GA 30323

Ladies and Gentlemen:

I would like to renew Materials License number 45-03499-09 issued to the Department of Chemistry at the College of William and Mary for storage only incident to disposal. We are currently in contact with a company to transport all of our radioactive material for disposal. We hope to have this completed in the next few months.

I would also like to amend the license in two ways:

1. In condition #12, delete Patricia M. Kane, Ph.D., who is no longer associated with William and Mary.

2. In conditions # 6, 7, and 8, add Strontium 90, sealed source, 0.3 microcurie. This source was overlooked in our original application dated January 31, 1990. Prior to that time it was covered under a university-wide license and an earlier departmental license. The source is currently about 0.21 microcurie.

Any questions concerning this request should be addressed to:

Richard L. Kiefer
Department of Chemistry
College of William and Mary
P.O. Box 8795
Williamsburg, VA 23187-8795
Telephone: (804) 221-2553
Fax: (804) 221-2715

Copies of the current license and the Radiation Safety Manual are enclosed. I appreciate your attention to these requests.

Sincerely,

[signature]

Richard L. Kiefer, RSO
Department of Chemistry

Combine with 2/3 Amend Request

Chartered 1693

NRC FORM 374
(10-89)

U.S. NUCLEAR REGULATORY COMMISSION

MATERIALS LICENSE

Amendment No. 1

Pursuant to the Atomic Energy Act of 1954, as amended, the Energy Reorganization Act of 1974 (Public Law 93-438), and Title 10, Code of Federal Regulations, Chapter I, Parts 30, 31, 32, 33, 34, 35, 39, 40 and 70, and in reliance on statements and representations heretofore made by the licensee, a license is hereby issued authorizing the licensee to receive, acquire, possess, and transfer byproduct, source, and special nuclear material designated below; to use such material for the purpose(s) and at the place(s) designated below; to deliver or transfer such material to persons authorized to receive it in accordance with the regulations of the applicable Part(s). This license shall be deemed to contain the conditions specified in Section 183 of the Atomic Energy Act of 1954, as amended, and is subject to all applicable rules, regulations and orders of the Nuclear Regulatory Commission now or hereafter in effect and to any conditions specified below.

Licensee	
1 College of William and Mary Department of Chemistry	In accordance with letter dated January 17, 1992
2 Williamsburg, Virginia 23185	3 License number 45-03499-09 is amended in its entirety to read as follows:
	4 Expiration date March 31, 1995
	5 Docket or Reference No. 030-31503

6 Byproduct, source, and/or special nuclear material		7 Chemical and/or physical form		8 Maximum amount that licensee may possess at any one time under this license	
A.	Hydrogen 3	A.	Foils and/or liquid	A.	72 millicuries
B.	Carbon 14	B.	Sealed sources and liquids	B.	1 millicurie
C.	Sulfur 35	C.	Powder and solution	C.	11 millicuries
D.	Chlorine 36	D.	Sealed source	D.	0.5 microcurie
E.	Cobalt 60	E.	Sealed source	E.	0.5 microcurie
F.	Selenium 75	F.	Aqueous solution	F.	0.01 microcurie
G.	Barium 133	G.	Sealed source	G.	0.5 microcurie
H.	Cesium 137	H.	Sealed source	H.	2 microcuries
I.	Promethium 147	I.	Sealed source	I.	0.01 microcurie
J.	Lead 210	J.	Sealed source and/or aqueous solution	J.	0.6 microcurie
K.	Phosphorus 32	K.	Aqueous solution	K.	2 millicuries

9. Authorized Use:

A. through K. Laboratory research, teaching and training of students.

MATERIALS LICENSE
SUPPLEMENTARY SHEET

License number 45-03499-09

Docket or Reference number 030-31503

Amendment No. 1

CONDITIONS

10. Licensed material shall be used only at the licensee's facilities, College of William and Mary, Williamsburg, Virginia.

11. The Radiation Protection Officer for the activities authorized by this license is Richard L. Kiefer, Ph.D.

12. Licensed material shall be used by, or under the supervision of, Richard L. Kiefer, Ph.D. or **Patricia M. Kane, Ph.D.**

13. Sealed sources containing licensed material shall not be opened by the licensee.

14. A.(1) The source(s) specified in Item 7, shall be tested for leakage and/or contamination at intervals not to exceed 6 months. Any source received from another person which is not accompanied by a certificate indicating that a test was performed within 6 months before the transfer shall not be put into use until tested.

(2) Notwithstanding the periodic leak test required by this condition, any licensed sealed source is exempt from such leak tests when the source contains 100 microcuries or less of beta and/or gamma emitting material or 10 microcuries or less of alpha emitting material.

B. Any source in storage and not being used need not be tested. When the source is removed from storage for use or transfer to another person, it shall be tested before use or transfer.

C. The test shall be capable of detecting the presence of 0.005 microcurie of radioactive material on the test sample. If the test reveals the presence of 0.005 microcurie or more of removable contamination, the source shall be removed from service and decontaminated, repaired, or disposed of in accordance with Commission regulations. A report shall be filed within 5 days of the date the leak test result is known with the U. S. Nuclear Regulatory Commission, Region II, Division of Radiation Safety and Safeguards, Nuclear Material Safety Section, 101 Marietta Street, Suite 2900, Atlanta, Georgia 30323. The report shall specify the source involved, the test results, and corrective action taken. Records of leak test results shall be kept in units of microcuries and shall be maintained for inspection by the Commission. Records may be disposed of following Commission inspection.

D. Tests for leakage and/or contamination shall be performed by the licensee or by other persons specifically licensed by the Commission or an Agreement State to perform such services.

15. The licensee shall maintain records of information important to safe and effective decommissioning at the licensee's facilities as specified in Condition 10. pursuant to the provisions of 10 CFR 30.35(g) until this license is terminated by the Commission.

16. In addition to the possession limits in Item 8, the licensee shall further restrict the possession of licensed material to quantities below the minimum specified in 10 CFR 30.35(g) for establishing decommissioning financial assurance.

NRC Form 374A (5-84) U.S. NUCLEAR REGULATORY COMMISSION

License number 45-03499-09

Docket or Reference number 030-31503

Amendment No. 1

MATERIALS LICENSE
SUPPLEMENTARY SHEET

(cont.) CONDITIONS

17. Except as specifically provided otherwise in this license, the licensee shall conduct its program in accordance with the statements, representations, and procedures contained in the documents including any enclosures, listed below. The Nuclear Regulatory Commission's regulations shall govern unless the statements, representations and procedures in the licensee's application and correspondence are more restrictive than the regulations.

A. Application dated January 31, 1990

B. Letters dated:

- March 7, 1990
- January 17, 1992
- January 23, 1992 (faxed)

UNITED STATES NUCLEAR REGULATORY COMMISSION

FOR THE U.S. NUCLEAR REGULATORY COMMISSION

EARL G. WRIGHT

Date JAN 27 1992

By Earl G. Wright

Region II, Nuclear Materials Safety Section
101 Marietta Street, Suite 2900
Atlanta, GA 30323

RADIATION SAFETY MANUAL

College of William and Mary

Department of Chemistry

Williamsburg, Virginia

Revised: January, 1990

The policies and procedures discussed in this manual are in compliance with regulations established by the Nuclear Regulatory Commission under Title 10, Code of Federal Regulations, Parts 19, 20, and 30. A copy of the Title 10 regulations is available for inspection in Room 203, Rogers Hall.

I. GENERAL

A. The Department Radiation Safety Officer (DRSO)

The DRSO must evaluate the radiological safety aspects of all proposed activities involving the use of radionuclides. Each investigator shall present to the DRSO, in writing, a description of proposed activities in which radionuclides are involved prior to the initiation of such activities.

B. Procurement of Radioactive Materials

No requisition or purchase order for any radioactive substance will be approved unless specific written approval for that purchase is granted by the DRSO.

C. Receipt of Radioactive Materials

The DRSO shall inspect all incoming shipments according to the following method:

1. Visually inspect package for any signs of damage (e.g., wetness, crushed).

2. Measure exposure rate at 3 feet from package surface and record.

3. Measure surface exposure rate and record.

4. Put on gloves

5. Open the outer package (following manufacturer's directions, if supplied) and remove packing slip. Open inner package to verify contents (compare requisition, packing slips, and label on container) and check integrity of final source container (inspect for breakage of seals or vials, loss of liquid, or discoloration of packing material). Check also that shipment does not exceed possession limits.

6. Wipe external surface of final source container with moistened cotton swab or filter paper, assay and record where appropriate.

7. Monitor the packing materials and packages before discarding. If packaging materials are contaminated, treat as radioactive waste. If not, obliterate radiation labels before discarding in regular trash.

D. Storage of Radioactive Materials

All unsealed radioactive substances will be stored in Rogers Hall Room 217. Sealed sources will be stored in Rogers Hall Room 203.

II. BASIC STANDARDS OF MAXIMUM PERMISSIBLE RADIATION EXPOSURE (taken from NBS Handbook 69, pp 4-5)

The limits that follow are fulfilled by applying the following principles to external radiation exposures:

(1) keeping the time of exposure at a minimum
(2) keeping human tissues at as great a distance from the radiation source as is practicable.
(3) keeping adequate shielding materials between the source and human tissue.

A. Accumulated Dose (Radiation workers)

1. External exposure to critical organs.

Whole body, head and trunk, active blood-forming organs, eyes, and gonads: The Maximum Permissible Dose (MPD) to the most critical organs, accumulated at any age, shall not exceed 5 REMS multiplied by the number of years beyond 18, and the dose in any 18 consecutive weeks shall not exceed 3 REMS.

Thus, the accumulated MPD = (N-18) x 5 where N is the age in years and is greater than 18.

2. External dose to other organs.

Skin of whole body: MPD = 10 (N-18) REMS, and the dose in any 13 consecutive weeks shall not exceed 6 REMS.

Hands and forearms, feet and ankles: MPD = 75 REMS/year, and the dose in any 13 consecutive weeks shall not exceed 25 REMS.

3. Internal exposures.

The permissible levels from internal emitters will be consistent as far as possible with age-proration and dose principles above. Control of the internal dose will be controlled by limiting the body burden of radionuclides. This is accomplished in the laboratory by prevention of ingestion, inhalation, or transcutaneous absorption of radioactive materials. It is achieved by good housekeeping and work habits, and by operation in a laboratory with proper equipment for the handling of radioisotopes, including protective coverings, manipulating devices, suitable ventilation, and waste disposal facilities.

III. RULES APPLYING TO ALL WORKERS USING RADIOACTIVE MATERIALS

1. A copy of these rules must be posted in every laboratory in which work with radioactive materials is performed.

2. A film badge must be worn if it is determined that an individual may receive a radiation dose in excess of 1.25 Rems in any calendar quarter. Such determination will be made by the DRSO using a calibrated survey meter. The individual must always wear the film badge assigned to him or her.

3. Do not eat, drink, smoke, or apply cosmetics in any laboratory in which work with radioactive materials is performed.

4. Wash hands thoroughly before handling any object that will be placed in the mouth or on the face (e.g., before smoking, drinking, putting on eyeglasses, etc.).

5. Wear a laboratory coat and disposable plastic gloves when working with radioactive material.

6. All work must be performed over table surfaces or trays lined with removable, absorbent paper.

7. NEVER PIPETTE RADIOACTIVE SOLUTIONS BY MOUTH. Use remote measuring devices, such as disposable syringes, safety pipetting bulbs, etc.

8. Regularly discard all waste material in special containers which are labeled. Solid waste containers must be separate from liquid waste containers. All solid waste containers must be lined with plastic bags which can be removed. All liquid waste containers must have lids which fit securely.

9. All radioactive material must be contained in appropriately shielded containers.

10. Keep all work areas free from equipment and materials which are not required for the immediate procedure.

11. All glassware which contains or has contained radioactive substances must be marked with radiation tape or radiation signs until it has been decontaminated.

12. All containers of radioactive substances, including waste, must be labeled as radioactive and must show the date, the type, and the activity of the radioactive material contained, with radiation level, if applicable.

IV. EMERGENCY PROCEDURES

Minor Spills

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

2. PREVENT THE SPREAD: Cover the spill with absorbent paper.

3. CLEAN UP: Use disposable gloves and, if necessary, handling tongs. Carefully fold the absorbent paper and pad, insert into a plastic bag, and dispose of in the radioactive waste container. Include all other contaminated materials such as disposable gloves.

4. SURVEY: With a G-M Survey Meter, check the area around the spill. Also, check hands and clothing for contamination.

5. REPORT: Report the incident to the DRSO.

Major Spills

1. CLEAR THE AREA: Notify all persons not involved in the spill to vacate the room.

2. PREVENT THE SPREAD: Cover the spill with absorbent pads, but do not attempt to clean it up. Confine the movement of all personnel potentially contaminated to prevent the spread.

3. SHIELD THE SOURCE: If possible, the spill should be shielded, but only if it can be done without further contamination or without significantly increasing radiation exposure to personnel.

4. CLOSE THE ROOM: Leave the room and lock the door(s) to prevent entry.

5. CALL FOR HELP: Notify the DRSO <u>IMMEDIATELY</u>.

6. PERSONNEL DECONTAMINATION: Contaminated clothing should be removed and stored for further evaluation by the DRSO. If the spill is on the skin, flush thoroughly and then wash with mild soap and lukewarm water.

DRSO	HOME TELEPHONE	OFFICE TELEPHONE
Richard L. Kiefer	229-7042	221-2553

V. ROUTINE AREA SURVEY PROCEDURES

A. All laboratory areas will be surveyed immediately before and immediately after the use of radioactive materials.

B. The survey will consist of:

1. A measurement of radiation levels with a survey meter sufficiently sensitive to detect 0.1 mR/hr, and/or

2. A series of wipe tests to measure contamination levels. This method for performing wipe tests will be sufficiently sensitive to detect 100 dpm. Routine wipe tests will be made with parafilm squares or filter paper having a surface area of 1 in^2 (6.23 cm^2). A wipe will cover an area of at least 100 cm^2. The wipe sample will be counted in a liquid scintillation counter to an error no greater than 20%.

C. A permanent record will be kept of all survey results, including negative results. The record will include:

1. The location, date, and type of equipment used.

2. Name of the person conducting the survey.

3. A drawing of the area surveyed, identifying relevant features such as storage areas for radioactive materials, radioactive waste areas, etc.

4. Measured exposure rates or contamination levels keyed to location on the drawing, pointing out rates that require corrective action.

5. Corrective action taken in the case of contamination or excessive exposure rates, the reduced contamination levels or exposure rates after corrective actionwas taken, and any appropriate comments.

F. In general, any detectable contamination of <u>any surface</u> shall be reported to the DRSO. The area will be cleaned if the contamination level measured by liquid scintillation exceeds 100 dpm/100 cm^2.

<u>A contaminated area which emits over 2.0 millirems per hour is seriously contaminated</u>. Personnel must not work in an area where radiation exceeds this amount.

VI. PERSONNEL MONITORING

A. Bioassays

Phosphorus-32. Hands, face and body will be monitored with a GM survey meter after use. If contamination is found, a urinalysis will be performed at 24 hours. If activity is detected, further urinalyses will be performed daily.

Hydrogen-3. In laboratories where the amount of this radionuclide used is greater than 10^{-2} Ci, all workers will have a urinalysis not more than one month prior to beginning work, and at two week intervals during work periods.

Carbon-14 and Sulfur-35. In laboratories where the amount used is greater than 10^{-3} Ci, all workers will have one urinalysis prior to beginning work, biweekly urinalyses while working, and one urinalysis within one month after termination of use of the radionuclide.

B. External Radiation

If an individual suspects that he or she has received an over-exposure of external radiation from any source, he or she should immediately inform the DRSO for reference to Health Services. The exposed worker should be removed from areas in which he or she might conceivably receive more radiation, and should not be allowed to return to work in such areas until authorized by the DRSO.

VII. OTHER PROCEDURES AND REQUIREMENTS

A. Equipment

Glassware and equipment used in experiments with radioactive materials shall be kept separate from other equipment and will not be used for other work until demonstrated to be free of contamination.

B. Laboratories Using Radionuclides

The DRSO will designate appropriate areas in which work with radioactive nuclides at various activity levels may be conducted. Approval of a project by the DRSO is contingent upon the availability of adequate laboratory facilities for assignment as work areas.

Every laboratory so designated by the DRSO must have appropriate monitoring instruments during use of radioactive materials.

C. Posting of Warning Signs and Rules

Areas in which radioactive materials are located or are being used shall be posted with appropriate radiation hazard signs.

Each project supervisor shall post on the laboratory wall a copy of parts III (Rules Applying to all Workers with Radionuclides) and IV (Emergency Procedures) of this manual.

D. Storage of Radioactive Materials

1. Stock sources

Radiation at the surface of the containers of any radioactive materials shall not exceed 200 mrem per hour and the container shall be kept in such a place that the radiation intensity at the nearest occupied area is 0.6 mrem per hour or less.

Such containers shall be kept in a place not readily accessible to unauthorized personnel when not in use and shall be conspicuously labeled with radiation hazard signs.

2. Gaseous Products

Radioactive gases or materials with radioactive gaseous vapors must be stored in gas tight containers, and must be kept in areas with satisfactory ventilation, preferably in approved hoods.

E. Disposal of Wastes

1. General Rules

Radioactive wastes shall not be disposed of by the conventional methods of disposing of nonradioactive wastes. This means particularly that contaminated liquid wastes may not be discharged into a sink. Contaminated animals must not be incinerated in general purpose incinerators.

2. Radioactive Waste Containers

Every laboratory using radioactive nuclides must have at least one container for contaminated solid wastes and one for contaminated liquid waste. Solid and liquid contaminated wastes shall be kept separately.

The container for solid waste may be of the usual type but must be lined with a disposable liner. For liquid wastes other than scintillation fluid, glass jugs or carboys are best for storage. Such a container must be kept in a place that if accidently broken, the contents will be retained in a

small area (e.g., set in a large pan).

For scintillation fluid wastes, vials containing the waste material will be screwed tightly and disposed directly in an appropriately lined and labeled waste barrel located in Room 4 of Millington Hall.

Each waste container must be tagged with A Radioactive Hazard sign. Maintenance employees (janitors, etc.) must be instructed never to empty them.

3. Ultimate Disposal

Vials containing scintillation fluid waste will be deposited in labeled waste barrels in Room 4 of Millington Hall. All solutions (other than scintillation fluid) containing radioactive materials will be evaporated to dryness, unless this results in release of radioactive material in gaseous form. The solid waste will be deposited in labeled waste barrels in Room 4 of Millington Hall for disposal by a licensed commercial firm.

F. Calibration of Survey Meters and Liquid Scintillation Counter

At least annually all survey meters will be calibrated by a commercial company providing such service. Each scale of the instruments shall be calibrated at 1/3 and 2/3 of full scale. The exposure rate measured by the instrument shall differ from the true exposure rate by less than 10% of full scale. Readings within 20% are acceptable only if a calibration graph is attached to the instrument. Each survey meter is to be checked with a reference gamma source kept with the instrument prior to each use to insure that the instruments are in working order. The counting efficiency of each liquid scintillation counter will be checked before use with the appropriate unquenched reference standards:

Carbon-14, 0.0227 microcurie, 12-12-88 (Beckman CCR1712)
Hydrogen-3, 0.0476 microcurie, 12-12-88 (Beckman HCR0605)

The liquid scintillation counters are located in Room 4 of Millington Hall.

A report of the yearly calibration of all instruments in the Department of Chemistry is kept as a part of the DRSO's records.

W&M Rad-Form-1

Request for Radioisotope Use by Non-Licensed Users

Name:

Training or experience with radioisotopes:
(dates and locales)

Date (s) of Experiment (s)

Description of Experiment:
(use additional pages if needed)

Safety Analysis:
Describe monitoring -
(1) before
(2) during
(3) after
Waste disposal -

_____

Reviewed on _____ 19 _____

Approval of Licensed Supervisor _____

D R S O Approval _____

W&M Rad-Form-2

PURCHASE REQUEST FORM FOR RADIOACTIVE MATERIAL BY LICENSED USERS

DATE:

RADIOISOTOPE:

Form

a) Sealed - ☐ b) Liquid - ☐

c) Other (specify) - ☐ _____

ACTIVITY REQUESTED: _____ uCi

PERSON REQUESTING - _____

ORDER TO BE PLACED WITH:

NAME OF COMPANY: _____

ADDRESS: _____

TELEPHONE NO. _____

* * * * * * * * * *

Specify your use of this radioisotope below:

DRSO AUTHORIZATION: _____

WAM Rad-Form-3

RADICACTIVE SHIPMENT RECEIPT REPORT

1. P.O.# _____ Survey Date _____ Time _____

   Supplier _____ Surveyor _____

2. Condition of Package:

   _____ O.K. _____ Punctured _____ Status ____ Wet

   _____ Crushed _____ Other _____

3. Measured Radiation Levels: a. Package surface _____ mR/hr

   b. 3' from surface _____ mR/hr

   Equipment used in measurement _____

4. Describe contents of package:

   a. Radionuclide _____

   b. Amount _____

   c. Chem Form _____

5. Describe any discrepancies between packing slip and packing contents:

   _____

   _____

6. Wipe results from: a. Outer container _____ CPM = _____ DPM

   eff = ( )

   b. Final source container _____ CPM = _____ DPM

   eff = ( )

   c. background _____ CPM

   Equipment used in measurement _____

7. Survey results of packing material and cartons _____ mR/hr.

   Equipment used in measurement _____

8. Disposition of package after inspection _____

9. If NRC/Carrier notification required, give time, date and persons notified.

W&M Rad.Form-4

AREA RADIATION SURVEY REPORT

Department _____

Location (Room) _____ Date _____

Individual conducting survey _____

Type of survey:

G-M Survey Meter _____

Wipe test and liquid scintillation counting _____

Sketch area monitored, with numbered areas in which tests were made:

Exposure rates or DPM above background at numbered sites:

1. _____ 6. _____
2. _____ 7. _____
3. _____ 8. _____
4. _____ 9. _____
5. _____ 10. _____

Corrective action, if any:

Report filed if any (other than this form).

1 μCi = 3.7×10^4 DPS
= 2.2×10^6 DPM

WM Rad-Form 63

RADIOISOTOPE INVENTORY RECORD (UNSEALED SOURCES)

Date of Inventory _____

Amount stored at last inventory (mCi)								
Amount held as solid liquid waste at last inventory (mCi)								
Amount received since last inventory (mCi)								
Amount converted to solidliquid waste since last inventory (mCi)								
Total amount stored at this inventory (mCi)								
Total amount held as solid/liquid waste at this inventory (mCi)								

Comments:

Date of last inventory:

WCM Rad-Form 7

PERSONNEL MONITOR REPORT

Name of individual assayed _____ Date _____

Social Security Number _____

Name of individual conducting assay _____

Isotope assayed _____

Type of assay: _____ (urinalysis, G-M scan, etc.)

Results:

DPM above background per ml urine _____

Milliroentgen/hour

left hand _____

right hand _____

left foot _____

right foot _____

face _____

other _____

Notification of individual (attach letter) _____ Date _____

Other action taken.

BETWEEN:

License Fee Management Branch, ARM
and
Regional Licensing Sections

(FOR LFMS USE)
INFORMATION FROM LTS

Program Code: 03620
Status Code: 0
Fee Category: EX 3M
Exp. Date: 19950331
Fee Comments: 170.11(A)(4)
Decom Fin Assur Reqd: N

LICENSE FEE TRANSMITTAL

A. REGION II

1. APPLICATION ATTACHED
   Applicant/Licensee: WILLIAM AND MARY, COLLEGE OF
   Received Date: 950221
   Docket No: 3031503
   Control No.: 256325
   License No.: 45-03499-09
   Action Type: Amendment

2. FEE ATTACHED
   Amount: ---
   Check No.: ---

3. COMMENTS

Signed Nancy L Hoott
Date FEB 22 1995

B. LICENSE FEE MANAGEMENT BRANCH (Check when milestone 03 is entered ( ))

1. Fee Category and Amount: FEE EXEMPT

2. Correct Fee Paid. Application may be processed for:
   Amendment ✓
   Renewal
   License

3. OTHER

Signed
Date