NRC FORM 374
(7-94)

U.S. NUCLEAR REGULATORY COMMISSION

MATERIALS LICENSE

Amendment No. 24

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, 36, 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. Eastern Michigan University Department of Chemistry Jefferson Science Building 2. Room 225 Ypsilanti, MI 48197	In accordance with application dated September 16, 1996 3. License Number 21-06885-01 is amended in its entirety to read as follows:
	4. Expiration Date October 31, 2001
	5. Docket or Reference No. 030-00818

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. As specified in Section 33.100, Schedule A of 10 CFR 33	A. Any	A. As specified in Section 33.11(b) 10 CFR 33 (Type B Broad License)
B. Californium-252	B. Sealed source (Savannah River Model ALC or SALC)	B. 7 micrograms
C. Plutonium-239	C. Encapsulated as Pu-Be neutron sources (Monsanto Research Corporation)	C. 18 grams

9. Authorized Use:

A. and B. To be used for research and development as defined in 10 CFR Part 30, Section 30.4(q), excluding animal studies.

C. For Storage Only, Incident to disposal.

CONDITIONS

10. Licensed material shall be used only at the licensee's facilities located at the campus of Eastern Michigan University, Ypsilanti, Michigan.

4/,

210078

2 ML 30 SD

MATERIALS LICENSE
SUPPLEMENTARY SHEET

License Number
21-06885-01

Docket or Reference Number
030-00818

Amendment No. 24

11. A. Licensed material shall be used by, or under the supervision of, individuals designated by the licensee's Radiation Protection Officer.

B. Individuals designated to use licensed material for research and development shall meet the training criteria established in 10 CFR Part 33, Section 33.15(b).

C. The Radiation Protection Officer for the activities authorized by this license is Krishnaswamy Rengan.

12. A. Sealed sources and detector cells shall be tested for leakage and/or contamination at intervals not to exceed 6 months or at such other intervals as specified by the certificate of registration referred to in 10 CFR 32.210.

B. Notwithstanding Paragraph A of this Condition, sealed sources designed to emit alpha particles shall be tested for leakage and/or contamination at intervals not to exceed 3 months.

C. In the absence of a certificate from a transferor indicating that a leak test has been made within 6 months prior to the transfer, a sealed source or detector cell received from another person shall not be put into use until tested.

D. Sealed sources need not be leak tested if:

(i) they contain only hydrogen-3; or

(ii) they contain only a radioactive gas; or

(iii) the half-life of the isotope is 30 days or less; or

(iv) they contain not more than 100 microcuries of beta and/or gamma emitting material or not more than 10 microcuries of alpha emitting material; or

(v) they are not designed to emit alpha particles, are in storage, and are not being used. However, when they are removed from storage for use or transferred to another person, and have not been tested within the required leak test interval, they shall be tested before use or transfer. No sealed source or detector cell shall be stored for a period of more than 10 years without being tested for leakage and/or contamination.

E. The leak 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, a report shall be filed with the U.S. Nuclear Regulatory Commission in accordance with 10 CFR 30.50(b)(2), and the source shall be removed immediately from service and decontaminated, repaired, or disposed of in accordance with Commission regulations. The report shall be filed within 5 days of the date the leak test result is known with the U.S. Nuclear Regulatory Commission, Region III, ATTN: Chief, Nuclear Materials Safety Branch, 801 Warrenville Road, Lisle, Illinois 60532-4351. The report shall specify the source involved, the test results, and corrective action taken.

F. 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.

13. Sealed sources or detector cells containing licensed material shall not be opened or sources removed from source holders by the licensee.

14. Licensed material shall not be used in or on human beings.

15. The licensee is authorized to hold radioactive material with a physical half-life of less than 65 days for decay-in-storage before disposal in ordinary trash provided:

A. Radioactive waste to be disposed of in this manner shall be held for decay a minimum of 10 half-lives.

B. Before disposal as ordinary trash, byproduct material shall be surveyed at the container surface with the appropriate survey meter set on its most sensitive scale and with no interposed shielding to determine that its radioactivity cannot be distinguished from background. All radiation labels shall be removed or obliterated.

C. A record of each disposal permitted under this License Condition shall be retained for three years. The record must include the date of disposal, the date on which the byproduct material was placed in storage, the radionuclides disposed, the survey instrument used, the background dose rate, the dose rate measured at the surface of each waste container, and the name of the individual who performed the disposal.

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 limit specified in 10 CFR 30.35(d) for establishing decommissioning financial assurance.

MATERIALS LICENSE
SUPPLEMENTARY SHEET

License Number
21-06885-01

Docket or Reference Number
030-00818

Amendment No. 24

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 U.S. 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 September 16, 1996.

FOR THE U.S. NUCLEAR REGULATORY COMMISSION

Date Oct 7, 1996

By _____
Nuclear Materials Licensing Branch, Region III

COPY

BETWEEN:

LICENSE FEE MANAGEMENT BRANCH, ARM
AND
REGIONAL LICENSING SECTIONS

(FOR LFMS USE)
INFORMATION FROM LTS

PROGRAM CODE: 03611
STATUS CODE: 2
FEE CATEGORY: EX 3M
EXP. DATE: 19940630
FEE COMMENTS: 170.11(A)(4)
DECOM FIN ASSUR REQD: N

LICENSE FEE TRANSMITTAL

A. REGION

1. APPLICATION ATTACHED
APPLICANT/LICENSEE: EASTERN MICHIGAN UNIVERSITY
RECEIVED DATE: 940527
DOCKET NO: 3000818
CONTROL NO.: 397029
LICENSE NO.: 21-06885-01
ACTION TYPE: RENEWAL

2. FEE ATTACHED
AMOUNT: ---
CHECK NO.: 8

3. COMMENTS

SIGNED P. Detlaff
DATE 6-2-94

B. LICENSE FEE MANAGEMENT BRANCH (CHECK WHEN MILESTONE 03 IS ENTERED /)

1. FEE CATEGORY AND AMOUNT: EX 3M FEE EXEMPT 170.11(a)(4)

2. CORRECT FEE PAID. APPLICATION MAY BE PROCESSED FOR:
AMENDMENT ---
RENEWAL ✓
LICENSE ---

3. OTHER ---

SIGNED [illegible]
DATE 6/8/94

RECEIVED

JUN 13 1994

REGION III

NRC FORM 313 (6-93)
10 CFR 30, 32, 33, 34, 35, 36, 39 and 40

U. S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB: NO. 3150-0120
EXPIRES 6-30-96

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 9 HOURS. SUBMITTAL OF THE APPLICATION IS NECESSARY TO DETERMINE THAT THE APPLICANT IS QUALIFIED AND THAT ADEQUATE PROCEDURES EXIST TO PROTECT THE PUBLIC HEALTH AND SAFETY. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (MNBB 7714), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555-0001, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0120), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

APPLICATION FOR MATERIAL LICENSE

INSTRUCTIONS: SEE THE APPROPRIATE LICENSE APPLICATION GUIDE FOR DETAILED INSTRUCTIONS FOR COMPLETING APPLICATION. SEND TWO COPIES OF THE ENTIRE COMPLETED APPLICATION TO THE NRC OFFICE SPECIFIED BELOW.

APPLICATION FOR DISTRIBUTION OF EXEMPT PRODUCTS FILE APPLICATIONS WITH:

DIVISION OF INDUSTRIAL AND MEDICAL NUCLEAR SAFETY
OFFICE OF NUCLEAR MATERIALS SAFETY AND SAFEGUARDS
U.S. NUCLEAR REGULATORY COMMISSION
WASHINGTON, DC 20555-0001

ALL OTHER PERSONS FILE APPLICATIONS AS FOLLOWS:

IF YOU ARE LOCATED IN:

CONNECTICUT, DELAWARE, DISTRICT OF COLUMBIA, MAINE, MARYLAND, MASSACHUSETTS, NEW HAMPSHIRE, NEW JERSEY, NEW YORK, PENNSYLVANIA, RHODE ISLAND, OR VERMONT, SEND APPLICATIONS TO:

LICENSING ASSISTANT SECTION
NUCLEAR MATERIALS SAFETY BRANCH
U.S. NUCLEAR REGULATORY COMMISSION, REGION I
475 ALLENDALE ROAD
KING OF PRUSSIA, PA 19406-1415

ALABAMA, FLORIDA, GEORGIA, KENTUCKY, MISSISSIPPI, NORTH CAROLINA, PUERTO RICO, SOUTH CAROLINA, TENNESSEE, VIRGINIA, VIRGIN ISLANDS, OR WEST VIRGINIA, SEND APPLICATIONS TO:

NUCLEAR MATERIALS LICENSING SECTION
U.S. NUCLEAR REGULATORY COMMISSION, REGION II
101 MARIETTA STREET, NW, SUITE 2900
ATLANTA, GA 30323-0199

IF YOU ARE LOCATED IN:

ILLINOIS, INDIANA, IOWA, MICHIGAN, MINNESOTA, MISSOURI, OHIO, OR WISCONSIN, SEND APPLICATIONS TO:

MATERIALS LICENSING SECTION
U.S. NUCLEAR REGULATORY COMMISSION, REGION III
799 ROOSEVELT ROAD
GLEN ELLYN, IL 60137-5927

ARKANSAS, COLORADO, IDAHO, KANSAS, LOUISIANA, MONTANA, NEBRASKA, NEW MEXICO, NORTH DAKOTA, OKLAHOMA, SOUTH DAKOTA, TEXAS, UTAH, OR WYOMING, SEND APPLICATIONS TO:

NUCLEAR MATERIALS LICENSING SECTION
U.S. NUCLEAR REGULATORY COMMISSION, REGION IV
611 RYAN PLAZA DRIVE, SUITE 400
ARLINGTON, TX 76011-8064

ALASKA, ARIZONA, CALIFORNIA, HAWAII, NEVADA, OREGON, WASHINGTON, AND U.S. TERRITORIES AND POSSESSIONS IN THE PACIFIC, SEND APPLICATIONS TO:

RADIOACTIVE MATERIALS SAFETY BRANCH
U.S. NUCLEAR REGULATORY COMMISSION, REGION V
1450 MARIA LANE
WALNUT CREEK, CA 94596-5368

PERSONS LOCATED IN AGREEMENT STATES SEND APPLICATIONS TO THE U.S. NUCLEAR REGULATORY COMMISSION ONLY IF THEY WISH TO POSSESS AND USE LICENSED MATERIAL IN STATES SUBJECT TO U.S.NUCLEAR REGULATORY COMMISSION JURISDICTIONS.

THIS IS AN APPLICATION FOR *(Check appropriate item)*

- [ ] A. NEW LICENSE
- [ ] B. AMENDMENT TO LICENSE NUMBER _____
- [X] C. RENEWAL OF LICENSE NUMBER 21-06885-01

2. NAME AND MAILING ADDRESS OF APPLICANT *(Include Zip code)*

Eastern Michigan University
Ypsilanti, MI 48197

3. ADDRESS(ES) WHERE LICENSED MATERIAL WILL BE USED OR POSSESSED

Eastern Michigan Universty Campus

4. NAME OF PERSON TO BE CONTACTED ABOUT THIS APPLICATION

Krishnaswamy Rengan
(Chemistry Department)

TELEPHONE NUMBER

(313) 487-0106

SUBMIT ITEMS 5 THROUGH 11 ON 8-1/2 X 11" PAPER. THE TYPE AND SCOPE OF INFORMATION TO BE PROVIDED IS DESCRIBED IN THE LICENSE APPLICATION GUIDE.

5.	RADIOACTIVE MATERIAL a. Element and mass number; b. chemical and/or physical form; and c. maximum amount which will be possessed at any one time.	6.	PURPOSE(S) FOR WHICH LICENSED MATERIAL WILL BE USED.
7.	INDIVIDUAL(S) RESPONSIBLE FOR RADIATION SAFETY PROGRAM AND THEIR TRAINING EXPERIENCE.	8.	TRAINING FOR INDIVIDUALS WORKING IN OR FREQUENTING RESTRICTED AREAS.
9.	FACILITIES AND EQUIPMENT.	10.	RADIATION SAFETY PROGRAM.
11.	WASTE MANAGEMENT.	12.	LICENSEE FEES *(See 10 CFR 170 and Section 170.31)* FEE CATEGORY 170.11 (a)1 | AMOUNT ENCLOSED $ No Fee

13. CERTIFICATION. *(Must be completed by applicant)* THE APPLICANT UNDERSTANDS THAT ALL STATEMENTS AND REPRESENTATIONS MADE IN THIS APPLICATION ARE BINDING UPON THE APPLICANT.

THE APPLICANT AND ANY OFFICIAL EXECUTING THIS CERTIFICATION ON BEHALF OF THE APPLICANT NAMED IN ITEM 2, CERTIFY THAT THIS APPLICATION IS PREPARED IN CONFORMITY WITH TITLE 10, CODE OF FEDERAL REGULATIONS, PARTS 30, 32, 33, 34, 35, 36, 39 AND 40, AND THAT ALL INFORMATION CONTAINED HEREIN IS TRUE AND CORRECT TO THE BEST OF THEIR 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.

CERTIFYING OFFICER -- TYPED/PRINTED NAME AND TITLE	SIGNATURE	DATE
Judith A. Johnson Associate Provost	Judith A. Johnson	May 26, 1994

RECEIVED
MAY 27 1994
REGION III

FOR NRC USE ONLY

TYPE OF FEE	FEE LOG	FEE CATEGORY	AMOUNT RECEIVED	CHECK NUMBER	COMMENTS
NewSwal	Jun 3	EX 3M	$ FEE EXEMPT		
APPROVED BY		170.11(a)(4)	DATE 6/8/94		

NRC FORM 313 (6-93)

PRINTED ON RECYCLED PAPER

CONTROL NO. 397029

5. RADIOACTIVE MATERIAL.

No. Element and Mass Number	Chemical or Physical form	Maximum amount which will be possessed at any one time.
1. Any byproduct material	Any	As Specified in 10CFR33.11(b)
2. Californium-252	Sealed source supplied by Dept. of Energy	7 microgram
3. Plutonium (Berllium)	Sealed Source	0.1 curie (M1098)
4. Plutonium (Beryllium)	Sealed Source	1.0 curie (M1097)

6. PURPOSE(S) FOR WHICH LICENSED MATERIAL WILL BE USED.

The radioactive materials obtained under this license will be used for **research and development as defined in 10CFR30.4.** Experiments will not involve the **internal or external administration** of byproduct materials, or the radiation therefrom, to **human beings**.

INDIVIDUALS RESPONSIBLE FOR RADIATION SAFETY PROGRAM AND THEIR TRAINING AND EXPERIENCE

7.1a **Radiation Safety Officer**

Krishnaswamy Rengan has been appointed as the Radiation Safety Officer (RSO) by the Radiation Safety Committee (RSC). His specialty is nuclear and radiochemistry. He has worked with radioactive materials and has supervised and directed laboratory research involving radioactive materials for nearly thirty-six years. He helped in setting up the various administrative controls and procedures necessary to obtain the Type B Broad Scope NRC license for Eastern Michigan University (EMU). He has been the RSO for nearly ten years. A brief resume is given below:

KRISHNASWAMY RENGAN

VITA AND PUBLICATIONS LIST

Status in U.S.: U.S. Citizen
Degrees: Ph.D. University of Michigan, 1966
M.Sc Kerala University, India, 1958
B.Sc (Hons) Kerala University, 1957

Professional Experience:

Chemistry Department	Asst. Prof.	1970- 1974
Eastern Michigan University	Assoc. Prof.	1974- 1979
	Professor	1979 -

Has established an active research program in nuclear and radio-chemistry with graduate and undergraduate students. The radiochemical work involves development of procedures applicable for fission product separation and neutron activation analysis of environmental samples. Set up a gas jet system at the Ford Nuclear Reactor of the University of Michigan. The gas jet system is being used for the study of gas phase chemical separation of fission products. The gas jet work involves undergraduate and graduate students from EMU and also Ph.D. students from the University of Michigan (through collaboration with Prof. Henry Griffin). Teaches both graduate and undergraduate level courses in nuclear, analytical and general chemistry. In collaboration with Phoenix Memorial Laboratory of University of Michigan, **organized and conducted three one-week workshops on neutron activation analysis.** He has been a member of the organizing committee of the sixth, seventh and eighth "Radiation Measurements" Symposia held in Ann Arbor, MI

Lawrence Livermore National Laboratory (LLNL) Participating Guest, 1979-1981

Has worked with the fast chemistry group at LLNL. During this period developed and/or perfected gas phase chemistry for the separation of selenium and bromine from fission products and studied he decay of short-lived selenium nuclides. The work was performed at the Triga Reactor of the University of California, Berkeley.

Radiochemistry Division
Bhabha Atomic Research Centre Scientific Officer 1958-1961
Bombay, India 1966-1970

During 1958 to 1961 used radiochemical procedures extensively to measure fission yields; studied the effect of oxidation state on fission product recovery and measured isomer yield ratios. Also helped to set up radiochemical procedures for the analysis of effluent water from the laboratory. Determined fission product decontamination in laboratory scale studies for Purex process for plutonium separation.

After returning to BARC in 1966 set up and utilized a GeLi detector and gamma-ray spectroscopic techniques for fission yield measurements. Developed procedures for the recovery of useful fission products from fission product waste. Helped in fission product decontamination measurements associated with high temperature fuel reprocessing studies.

Recent Publications

PUBLICATIONS [last five years]

1. "Ultrafast Chemical separations", Radiochemistry Techniques Monograph, NAS-NS-3118, National Academy Press (1993).

2. "Sorption of silver by Chelex 100 chelating resin", J. Radioanal. Nucl. Chem. 172, 43 (1993).

3. "Radiotracer Techniques Course at Eastern Michigan University: Evolution with Changing Clientele", J. Radioanal. Nucl. Chem. 171, 203 (1993).

4. "Public Education on Sources and Effects of Radioactive Waste Disposal", J. Radioanal. Nucl. Chem. 171, 245 (1993).

5. "Trace Element Correlations between Human Brain and Fingernails", J. Trace and Microprobe Tech. 10, 225 (1992).

6. "Characterizing a source of fission fragments for a gas jet", J. Radioanal. Nucl. Chem. 148, 107 (1991).

7. "Fast chemical separations for the study of short-lived nuclides", in **Exotic Nuclear Spectroscopy**, W C. McHarris (editor), Plenum Press, 1990, p609.

8. "Continuous gas phase chemical separations", J. Radioanal. Chem. 142, 175(1990).

Submitted to the journal :

1. "Determination of trace level mercury in biological and environmental samples by neutron activation analysis", P. Shetty, A. Bijanpour and K. Rengan, manuscript has been submitted to the J. Radioanal. Nucl. Chem.

2. "Chemical reactions of fission products with ethylene using the gas jet technique", E.T. Contis, K. Rengan and H.C. Griffin, manuscript submitted to the Nucl. Instr. Meth.

3. "Transport time of volatile and nonvolatile fission products in a gas jet", N. Davis, E.T. Contis, K. Rengan and H.C. Griffin, manuscript submitted to the Nucl. Instr. Meth.

Invited Talks:

1. "Radioisotope techniques course at Eastern Michigan University, Evolution with Changing Clientale", presented at the Symposium on Education in the Nuclear Sciences, Washington, D.C., August '90.

2. "Fast chemical separations for the study of short-lived nuclides", at the International Symposium on Exotic Nuclei held during the American Chemical Society Meeting in Miami Beach, September 1989.

3. Radiochemical study of short-lived fission products : Recent developments", presented at the International Nuclear Fission Seminar held at Kalpakkam, India in January, 1989.

4. "Fast Radiochemical Separations", presented to the Chemistry Group of Indira Gandhi Atomic Research Centre, Kalpakkam, India on July 22nd, 1988.

Other professional activities [last five years]:

1. Member of the publication committee of the Division of Nuclear Chemistry and Technology of the American Chemical Society.

2. Continue to serve in the Editorial Advisory Board for the Journal of Radioanalytical and Nuclear Chemistry(Articles) and as an Associate Editor for the Journal of Radioanalytical and Nuclear chemistry (Letters).

3. Serving in the Organization Committee for the Joint ACS Great Lakes-Central Regional Meeting to be held in June 1994 in Ann Arbor, MI.

4. Served in the Organization Committee of the 8th Symposium on Radiation Measurements and Applications held in May 1994 in Ann Arbor.

5. Member of the Editorial Committee for the proceedings of the 8th Symposium on Radiation Measurements and Applications to be published by Nuclear Instruments and Methods in Physics Research.

6. Organized and guest edited a special issue of the Journal of Radioanalytical and Nuclear Chemistry on the ***"Status of Nuclear Science Education"*** along with Prof. Steve Yates of the University of Kentucky and Dean Alan Ling of San Jose State University. The issue contains 33 articles from 13 countries. The issue was published as vol 171, issue 1.

7. Served in the Editorial Committee of the "**Proceedings of the seventh symposium on X- and gamma-ray sources and application**" held in Anr Arbor, May 1990. The proceedings were published as a special issue of the journal "Nuclear Instruments and Methods in Physics Research", December 20, 1990.

8. Organized and guest edited a special issue of the Journal of Radioanalytical and Nuclear Chemistry on the **"Chemical aspects of nuclear fission"**. The issue was published in September 1990.

9. Member of the organizing and the editorial committees of the 7th Symposium on Radiation Measurements and Applications to be held in May 1990 in Ann Arbor.

10. Presided over a session on "Environmental Radioactivity" at the Nuclear and Radiation Chemistry Symposium held in Kalpakkam, India in January, 1989.

11. Presided over a technical session on "Nuclear Fission" held at the Nehru Science Centre in Bombay, India, as part of the Golden Jubilee celebration of the discovery of fission on December 22, 1989.

Presentations at Professional Meetings

Coauthor/author of the following papers :

1. "Chemical reactions of fission products with ethylene using the gas jet technique", E.T. Contis, K. Rengan and H.C. Griffin, presented at the 8th Symposium on Radiation Measurements and Applications held in Ann Arbor, MI, in May 1994.

2. "Transport time of volatile and nonvolatile fission products in a gas jet", N. Davis, E.T. Contis, K. Rengan and H.C. Griffin, presented at the 8th Symposium on Radiation Measurements and Applications held in Ann Arbor, MI, in May 1994.

3. "Trace element corelations with age and sex in human fingernails", presented at the Conference on Methods and Applications of Radioanalytical Chemistry - III held in Kona, Hawaii in April 1994.

4. "New Radiochemistry Monograph: Ultrafast Chemical Separations", ACS meeting held in Washington, D.C. August 1992.

5. "Adsorption of Pb^{2+} from Aqueous Solution by Chelex 100", ACS meeting held in Washington, D.C. August 1992.

6. "Gas jet fission products: Solvent extraction Study", ACS meeting held in Washington, D.C. August 1990.

7. "Gas jet fission products: Carrier gas study", ACS meeting held in Miami, September 1989

8. "Fifty years of fast chemistry: study of short-lived fission produ[illegible]sented at "Fifty years with Nuclear Fission", an International Conference held a[illegible]ational Institute of Standards and Technology, Gaithersberg, April 1989.

7.1b Chairman of the Radiation Safety Committee and Alternate Radiation Safety Officer

HOWARD BOOTH
VITA

Howard Booth has worked with low energy beta emitter isotopes.

1. Coursework:
   400 level undergraduate "radioisotopes" covered basic physics and harmful effects of ionization on humans.
   At the Ph.D. level he completed a two term sequence in "Biological Instrumentation"
   Most of the extensive laboratory work involved liquid scintillation counting techniques, handling of low energy isotopes, and quality control for accurate data.

2. Research:
   Dr. Booth's masters thesis centered on iodine bioaccumulation in snail tissues using thick section autoradiography.
   One phase of his Ph.D. dissertation required the extensive use of radioimmunological assay to monitor the purification, and later the binding of several juvenile hormone analogs.

3. Teaching:
   Dr. Booth has taught (as one of three unit sequence) a course in "Radioisotopes in Biological Techniques" which is largely liquid scintillation counting using ^{14}C in bioaccumulation and measurement techniques.
   Dr. Booth involves his Invertebrate Physiology students in a two or three week laboratory project using liquid scintillation counting as the means of measurement of PCBs rate of clearance.

7.2 **Radiation Safety Committee**

During the past several years, federal and state government agencies have monitored the radiation safety practices of universities more closely. Here at EMU, a **Radiation Safety Committee (RSC)** has been the group which is responsible for ensuring institutional compliance with the appropriate radiation safety guidelines. The nature and responsibilities of this committee are described..

RADIATION SAFETY COMMITTEE

The committee is responsible for recommending appropriate radiation safety policies and practices as required by federal/state agencies to all faculty and staff (including Department Heads) who utilize radioactive materials in teaching and/or research. The committee is also responsible for monitoring compliance with the recommended practices so as to ensure safe working conditions for all employees, students, and visitors who work in or pass through the areas of those buildings where radioactive materials are stored/used. In addition, it is the

responsibility of the committee to prepare reports which are required for continuation of our institutional radiation licensing.

Membership: One faculty representative each from the departments which use radioactive materials. These members may be chosen/appointed by appropriate internal procedures in each Department. The term of appointment is indefinite, but for a minimum of three (3) years. The Director of the Office of Research Development and the Radiation Technologist from University Health Services will also be members of the committee. In addition, one representative each from Purchasing, Physical Plant, and a member-at large form University staff will be members of the RSC. The Associate Vice President for Academic Affairs will be an ex-Officio committee member, and **will serve as the principle administrative liaison to the President/Executive Council on radiation safety matters.**

Committee Chairperson: The RSC will select its Chairperson for the period it feels appropriate.

Radiation Safety Officer (RSO): The RSC will elect/appoint the RSO. The RSO must have the qualifications specified by the NRC. The committee also will elect/appoint an alternate RSO to act in the absence of the RSO.

Meetings: The committee will meet at least once every twelve months to review and discuss the Radiation Safety Program on EMU campus. Minutes should be kept and distributed to appropriate faculty, staff, and senior administrators.

8. TRAINING FOR INDIVIDUALS WORKING IN OR FREQUENTING RESTRICTED AREAS

Information on this item is included in Item 10.

9. FACILITIES AND EQUIPMENT

9.1 Facilities Where Radioactive Materials are Used at Present

The following departments use radioactive materials at the present time, at the buildings indicated below:

Department	Building where radioactive material is used
Associated Health Professions	Roosevelt Hall
Biology Department	Hover Natural Science Building and Mark Jefferson Science Complex
Chemistry Department	Mark Jefferson Science Complex
Physics Department	Strong Physical Science Building

The Chemistry Department has one laboratory room (B-113, Mark Jefferson Science Complex) specially designed for medium-high radioactive work. A negative pressure compared to the corridor is maintained in the laboratories. The laboratory room is equipped with four well ventilated fume hoods. Two of the fume hoods are made of stainless steel and will be used for all work involving large amounts of radioactivity. The hoods have a front opening of 32" x 52" and an exhaust rate of 1700 cu. ft. per minute. The facilities also include a foot-operated sink and standard items like lead storage containers, movable lead bricks for shielding, etc.

A storage area for radioactive materials is attached to the laboratory. This area is shielded by a 12" reinforced concrete wall. The californium-252 source is housed in this area.

The counting equipment is located in rooms adjacent to the laboratory.

In addition two other rooms, rooms 2 and 4 of Mark Jefferson are also used for radioactive tracer work.

The Physics Department has one laboratory in Strong Physical Science Building devoted to nuclear physics. The lab is equipped with a sink, regular laboratory benches, storage cabinets, etc. Lead bricks, paraffin blocks and lead-glass blocks are available for shielding. A large steel safe (with lock) is available for the storage of radioactive sources. The two Pu(Be) sources are stored in this room in steel cabinets with locks.

All other laboratory rooms used for radioactive work are properly equipped for the level of radioactivity handled there. In most cases the room has a well-ventilated hood. The rooms are marked with "RADIOACTIVE" sign, the access is restricted to all the rooms where radioactive materials are stored.

9.2 Facilities Where Radioactive Materials May be Used in the Future

As new faulty members are recruited for the various science and technology departments and as the existing faculty members reorient their research, new requests for different uses of radioactive materials and for the use of different laboratory facilities can be expected. @Each request for the use of new laboratory rooms will be reviewed by the RSC; the RSC will visit the laboratory rooms in question and evaluate the facility from the points of views of (i) safe handling of radioactive materials and (ii) security, especially limiting access only to authorized personnel.

The RSC will require satisfactory upgrading of the facility to meet the safety and security aspects before granting permission for use of the laboratory rooms.

9.3 Survey Equipment

A variety of instruments are available for counting alpha and beta particles and gamma rays. Surface barrier detector, G.M. Counters, liquid scintillation counting systems, NaI(Tl) scintillation detectors, Ge(Li) and HPGE detectors and multichannel analyzers are available on campus. A number of radiation survey instruments are also available on campus. The table below gives a list of the survey instruments.

Radiation Survey Instruments

Type of Instrument	Number Available	Radiation Detected	Range	Location
Eberline Ion Chamber Model RO-2	1	Beta Gamma	0-5000 mR/hr	Chemistry
Eberline GM survey meter Model E-140	1	Beta Gamma	0-50 mR/hr	Chemistry
Eberline GM survey paper Model ESP 1	1	Beta Gamma	0-3000 mR/hr	Chemistry
Wm. B. Johnson GM survey meter Model GSM-5	1	Beta Gamma	0-20 mR/hr	Chemistry
Bicron Surveyor GM Model 50	1	Beta Gamma	0-50 mR/hr	Chemistry
Texas Nuclear Model 2650	1	Alpha Beta Gamma	0-100 mR/hr	Physics
Baird-Atomic Model 420	1	Beta Gamma	0-100 mR/hr	Physics
Victoreen GM Survey Meter Model 05-753	1	Beta Gamma	0-1000 mR/hr	Physics
Texas Nuclear Log 2673/2646 Probe	1	Neutrons	0-25K $n/Cm^2/s^1$	Physics
Victoreen Model 488A	1	Neutrons	0-12 K $n/Cm^2/s^1$	Chemistry

Two beta, gamma survey meters of wide range are calibrated by service company once every year; the service company will be a NRC licensed company.

10.RADIATION SAFETY PROGRAM

The scope of teaching and research utilizing radioactive materials at Eastern Michigan University is relatively small. At present there are five faculty members who routinely use radioactive materials; there are two other faculty members who use radioactive materials occasionally. The work also involves research students; the students work under the direct supervision of faculty members. **However, the nature of the work is such that it is necessary to have the flexibility of the Broadscope license.** A **Radiation Safety Committee (RSC)** of six members supervises all the activities involving radioactive materials. One of the faculty members who has expertise in handling radioactive materials acts as the **Radiation Safety Officer**. The procedures are set up for running the small program; the faculty member working with the radioactive materials assumes a lot of the responsibilities which are normally assigned to a Radiation Control Group in a larger program. The Radiation Safety Program on the campus of the Eastern Michigan University is described in the following sections.

10.1 Current license

The application is for the renewal of our Type B Broadscope license #21-06885-01.

10.2 Radiation Safety Committee

The **Radiation Safety Committee (RSC)** was created by the President of the University in 1968 to monitor and control the radiation safety practices of the Univesity personnel. The responsibilities of the RSC were clarified and reiterated by the Associate Vice President for Academic Affairs in 1982. The Associate Provost reiterated the responsibilities of the RSC in 1989 and 1994. A copy of the 1994 memo is included as **Appendix A**. The RSC will continue to serve as the controlling body under the general license. The committee discharges the following duties:

a. **Appoints Radiation Safety Officer**. Presently the secretary of the RSC is serving in that capacity. He is available for advice and assistance on radiological safety matters.

b. **Controls the Procurement and Use of Radioactive Materials.** The committee has set up a procedure for the purchase of radioactive materials. All such purchases must receive prior approval of the RSC or the Radiation Safety Officer (RSO). Approval requires that the user have the necessary experience for the type of experiment for which the material has been requested and that adequate facilities for handling and monitoring be available. If the person's experience for handling radioactivity is not adequate, the request is temporarily denied and efforts are made to (a) place the applicant under the direct supervision of an experienced person or (b) see that the applicant either gets the necessary training by enrolling in an approved course or gets training from one of the experienced users. Before approval, the proposed use of the radioactive material is reviewed, specifically with regard to safety. The form used at present for approval of the purchase of radioactive material is included in the **"Instructions Regarding the Purchase and Handling of Radioactive Materials" (Appendix B)**.

c. Supervises the Handling of Radioactive Materials. Procedures suggested in the NBS Handbook 92 on "Safe Handling of Radioactive Materials" are recommended to all personnel, handling radioactive materials. A general guideline on radiation safety and on the precautions to be taken in a radioactive laboratory is given to all personnel using radioactive materials. A copy of the instructions labeled "**Radiation Safety Instructions**" is included as **appendix C.**

Experimenters are responsible for the monitoring and periodic survey of their laboratories in accordance with procedures approved by the RSO. Records of the monitoring and surveys are to be kept by the experimenter and checked periodically by RSC. The handling procedures for radioactive materials in each laboratory are subject to periodic review by the RSC.

d. Supervises the Control of Radioactive Materials. Individuals procuring radioactive materials are required to keep detailed records of the materials received, transferred or disposed of. The transfer of radioactive materials must be cleared with the RSO and properly recorded. The radioactive laboratories are inspected periodically by the RSC or RSO. During inspection particular attention is paid to the general security of the laboratory, posting of appropriate warning labels, records on surveys,receipt and disposal, and the storage of radioactive samples and waste, **A copy of the general instructions given to individuals on these matters is included as appendix B. A blank form used for inspection reports is included in appendix D.**

The RSC **meets at least once each year**, more often if necessary; minutes of the meetings are kept and distributed to all the committee members and other appropriate personnel.

10.3 Radiation Safety Officer

As pointed out at the beginning of section 10, only five faculty members at EMU routinely use radioactive materials at present. The monitoring, waste disposal and record keeping responsibilities are taken up by the individual faculty members. The records are periodically checked by the RSC or the RSO. **A blank form used for inspection reports is included in appendix D.**

All requests for the purchase of radioactive materials must be approved by the RSO before Purchase Division will process it. The RSO ascertains that the experimenter has the approval of the RSC for working with radioactive material and the experimenter's laboratory has appropriate facilities and is equipped with proper monitoring instruments for the radioactive material requested. If necessary the RSO consults (by telephone) with the RSC before approval. The RSO maintains a file of radioactive purchase requests which serves as an inventory of all radioactive materials on campus. The investigators are required to maintain detailed record of each radioactive materials received by them (showing the quantities used and disposed); the records are periodically checked by the RSC or the RSO.

The RSO furnishes consulting services on monitoring and waste disposal aspects. The RSO supervises and coordinates shipment of wastes to commercial disposers. The RSO periodically inspects the records kept by the faculty members working with radioactive

materials. The RSO keeps the RSC and other radiation workers informed of any changes in NRC rules regarding waste disposal and other materials.

10.4 Administrative Procedures

The RSC has established certain basic rules for the purchase and receival of radioactive materials. In addition the committee has also set up guidelines for the safe handling of radioactive materials, monitoring of the laboratories, record keeping and waste disposal. The following sections outlines the procedures.

10.4.1 Control of Procurement and Use

As mentioned in section 10.2 the procurement and use of radioactiave materials is controlled by the RSC. All users of radioactive materials must have the approval of the RSC. A faculty member who is initiating experiments with radioactive materials for the first time must submit a request giving details of their experience with the handling of radioactive materials as well as the proposed use of the tracer. The details are given in section 10.2b. To order radioactive materials RSC-approved investigator submits a request to the RSO for the purchase of a specific amount of the tracer. The RSO indicates the approval of the purchase in the "Requisition" sent to the Purchasing Department. A copy of the form used in included in Appendix B. The "Requisition" also has information as to whom the material should be delivered. As soon as the material is received the Central Receiving contacts the person who ordered it and delivers it to him/her; if that person is not available the Central Receiving delivers the material to the RSO. A copy of the instruction memo issued by the Director of Purchasing to the staff is included as **Appendix E**.

10.4.2 Safety Evaluations of Proposed Uses

The "Approval Form" (Appendix B) submitted to the RSO along with the "Requisition" for the purchase of radioactive materials has information about the proposed experiment. The RSO evaluates the safety aspects experiment, taking into account the facility where the experiment will be performed, before approval of the purchase. If necessary he consults other members of the committee or requests a meeting of the committee for discussion.

10.4.3 Review of Radiation Dose Received by Experimenters

In 1992 the RSC setup a procedure requiring all users of monitoring devices(e.g. film badge service) to send a copy of the report to RSO. A review of the reports indicate that the doses received are mostly reported as "min". However in order to emphasize ALARA concept two trigger levels will be used:

ALARA-1: An individual receives 50 mRem or higher over a period of a month. A note will be sent to the individual, with a copy to the supervisor of the laboratory, alerting them to the fact that the dose received exceeds the ALARA-level 1. The dose selected, 50 mRem, is approximately one-tenth of the maximum permissible dose, if the dose is uniformly spread over

the year. In addition it is approximately one-tenth of the maximum permissible dose "to an embryo/fetus during the entire pregnancy, due to occupational exposure of a declared pregnant woman." Alerting at this stage will help women evaluate their individual situation.

ALARA-2: An individual receives 150 mRem or higher over a period of a month. A note will be sent to the individual, with a copy to the supervisor of the laboratory, alerting them to the fact that the dose received exceeds the ALARA-level 2. The dose selected, 150 mRem, is approximately one-third of the maximum permissible dose, if the dose is uniformly spread over the year. The note will require the experimenter to evaluate the experimental procedures with respect to radiation exposure, explore possible ways to reduce the dose and submit a report to the Radiation Safety Committee [RSC] in two weeks. The Radiation Safety Officer [RSO] will be available for consultation during the review process. The RSC or the RSO will evaluate the report and provide suggestions if necessary.

10.5 Bioassays

The quantities of ^{3}H and ^{125}I used so far or expected to be used in the near future do not warrant bioassays. If levels of these nuclides suggested in the regulatory guide are used arrangements for bioassays will be made.

10.6 Emergency Procedures

The levels of radioactive materials used are small. The typical emergency will be a spill. The laboratory supervisor instructs the worker about the emergency procedures. Since the faculty member is always directly involved in the experiment emergency action is taken by them. The RSO and other RSC members are available for consultation.

11. WASTE MANAGEMENT

A good amount of tracer work is performed using "short-lived" nuclides like ^{32}P, ^{35}S, ^{51}Cr, ^{82}Br, ^{124}Sb, ^{140}La, ^{203}Hg etc at fraction of a µillicurie level. Solid and liquid wastes are collected, stored to allow for decay, monitored and disposed of. Other liquid wastes are disposed via sewage in conformance with section 20.2003 of 10 CFR Part 20. **Permission is requested to store and dispose of wastes containing radioactive materials with half-lives up to six months .**

At present none of the experimenters use long-lived tracers like ^{3}H and ^{14}C in tracer work at EMU campus. Hence EMU does not face long term waste storage problem. During 1980 some low level ^{3}H and ^{14}C liquid and solid wastes and some animal carcases were disposed of using the services of Atomic Disposal Co., Inc. in Tinley Park, Ill. If necessary, and if such disposal facilities are available for users in Michigan in the future, again such commercial waste disposal service will be employed.

APPENDIX A

EASTERN MICHIGAN UNIVERSITY

Office of the Associate Provost

106 Welch Hall
487-3233

TO: Selected Academic Department Heads and other Administrators (See list below)

DATE: May 24, 1994

FROM: Judith A. Johnson
Associate Provost

SUBJECT: Radiation Safety Committee

During the past several years, federal and state government agencies have monitored the radiation safety practices of universities more closely. Here at Eastern Michigan University, a **Radiation Safety Committee (RSC)** has been the group which is responsible for ensuring institutional compliance with the appropriate radiation safety guidelines. At the request of the RSC I am writing this memo to clarify and update the responsibilities of this committee.

RADIATION SAFETY COMMITTEE

The committee is responsible for recommending appropriate radiation safety policies and practices as required by federal/state agencies to all faculty and staff (including department heads) who will utilize radioactive materials in teaching and/or research. The committee is also responsible for monitoring compliance with the recommended practices so as to ensure safe working conditions for all employees, students, and visitors who work in or pass through the areas of those buildings where radioactive materials are stored/used. In addition, it is the responsibility of the committee to prepare reports which are required for continuation of our institutional radiation licensing.

Membership:

One faculty representative each from the departments which use radioactive materials. These members may be chosen/appointed by appropriate internal procedures in each department. The term of appointment is indefinite, but for a minimum of three (3) years. The

Director of the Office of Research Development and the Radiation Technologist from University Health Services will also be members of the committee. In addition, one representative each from Purchasing, Physical Plant, and a member-at-large from University staff will be members of the Radiation Safety Committee. The Associate Provost will be an ex-officio committee member, and **will serve as the principle administrative liaison to the President/Executive Council on radiation safety matters**.

Committee Chairperson:

The Radiation Safety Committee will select its Chairperson for the period it feels appropriate.

Radiation Safety Officer (RSO):

The Radiation Safety Committee will elect/appoint the Radiation Safety Officer. The RSO must have the qualifications specified by the NRC. The committee also will elect/appoint an alternate RSO to act in the absence of the RSO.

Meetings:

The committee will meet at least once every twelve months to review and discuss the Radiation Safety program on the Eastern Michigan University campus. Minutes should be kept and distributed to appropriate faculty, staff, and senior administrators.

/bl

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APPENDIX B

INSTRUCTIONS REGARDING THE PURCHASE AND HANDLING OF RADIOACTIVE MATERIALS

PURCHASE OF RADIOACTIVE MATERIAL

All purchases of radioactive materials must receive prior approval of the Radiation Safety Committee (RSC). Fill out this form, attach to the departmental purchase requisition and forward to:

K. Rengan
Radiation Safety Officer
Chemistry Department
Mark Jefferson

The requisition should be specifically marked "**Radioactive Material**". It should also have the name, telephone number and address of the individual to be contacted upon arrival of the material.

A copy of this form and the purchase requisition will be forwarded to the University Purchasing Department. A second copy of this form will be sent to the experimenter. **Page three of this form should be completed by the experimenter and sent to K. Rengan as soon as the material is received.**

Instructions for Receiving Radioactive Material

The package containing the radioactive material will be delivered by the Central Receiving directly to the person identified in the purchase order. Upon receipt, inspect the package for external damage. If no damage is apparent monitor the external surface for contamination by wipe test. Keep record of the wipe test. **If the package is damaged immediately inform you laboratory supervisor for further action; keep the package aside while waiting for the arrival of your supervisor**.

All users of radioactive materials must also have the approval of the RSC. To obtain such approval, contact the chairman of the RSC.

Approval Form For The Purchase of Radioactive Material

Date: Requisition No.

1. Name:

   Department: Telephone No.:

2. Radioactive isotope, chemical forms, amount:

3. Proposed use (include the amount to be used in each experiment)

4. Describe monitoring procedure and frequency (specifydetector, efficiency and relevant information):

5. a. Rooms in which the radioactive isotope will be used and stored:

   b. Are these rooms properly posted and secured for radioactive work?

Date: Approved by:

Receipt of Radioactive Material*

Requisition Number:

Purchase order Number:

Nuclide:

Amount :

Date Received:

Status of the package when received :

No damage _____ Damaged** _____

**If damaged do not open; inform your supervisor for further action.

External surface was monitored; the wipe test showed

no contamination _____ contamination# ____

#If contamination exceed the NRC limit the delivery carrier has to be notified immediately. Contact your supervisor for further action.
Describe below the action taken.

Status of the vial containing the radioactive solution: _____

Stored at: Room _____ of _____

*The portion pertaining to the receipt of the radioactive material should be **completed by the experimenter as soon as the material is received by him/her.** A copy of this form should be sent to the RSO immediately (K. Rengan, Chemistry Department) so that the material can be included in the Radioactive Material Inventory.

Revised 1994

RECORD OF RADIOACTIVE MATERIALS RECEIVED

Each individual receiving radioactive material should maintain a detailed record showing the radioactive nuclide received, quantity and the date. The record should show the dates and results of any tests for leakage required for the source as well as amounts removed for transfer or disposal. These records will be checked periodically by the RSC.

TRANSFER OF RADIOACTIVE MATERIALS

The transfer of any radioactive material outside its designated use areas or the transfer of radioactive material into the University area from outside must be cleared with the Radiation Safety Officer. Depending on the quantity and nature of the material to be transferred, the Radiation Safety Officer may require the "Transfer of Radioactive Material" form to be filled out. In all cases the individual must keep proper records of the transfer. **Appropriate precautions need to be taken in terms of dose and contamination. For transporting sources containing more than a few microcuries consult with the RSO first.**

"FORM" - See next page.

TRANSFER OF RADIOACTIVE MATERIAL

Material to be transported*

AMOUNT

Chemical Form:

Transported from _____

To _____

By _____

Dose outside the shield:

Date: _____

*If it is a sealed source to be transported back and forth, continue the record on the back of this form (for further transportations).

WASTE DISPOSAL

The disposal of radioactive wastes is an important aspect of the use of radioactive materials. The individual user is referred to NBS Handbook 92 and US NRC regulations given in 10 CFR part 20, subpart K(20.2001-2007). These documents are available with the Radiation Safety Officer.

Please note that only certain type of readily soluble radioactive materials can be disposed into sanitary sewage. Nuclear Regulatory Commission has strict regulations concerning such disposal. The rules are specified in the sections of 10 CFR part 20.2003. The quantity of sewage flowing out of the University buildings will vary over a wide range, depending on the time of the year. **In addition local sewer processing plants may have problems associated with even small amounts of radioactivity, even if NRC guidelines allow it.** The individual user should consult the Radiological Safety Officer before disposing of any radioactive waste through the sewage system.

Liquid waste containing large amounts of long-lived radioactive materials have to be stored carefully until disposal facilities are available. The storage area should be monitored periodically for leakage.

All solid radioactive wastes containing long-lived radioactive materials must be stored safely until the State of Michigan has a disposal facility or the users in the State of Michigan are allowed send the waste for disposal at other licensed facilities for disposal. Solid radioactive wastes containing short-lived radioactive materials are to be stored for ten half-lives to allow for decay, monitored with appropriate detection system and disposed of; record of such disposal should be kept.

MONITORING OF WORK AREAS

Each of the laboratories using radioactive material should be surveyed at frequent intervals **in accordance with safety procedures approved by the Radiation Safety Officer**. It is the responsibility of the individual in charge of the laboratory to make surveys at the proper intervals and to keep a record of them.

PERSONNEL MONITORING

According to 10 CFR 20.1502 appropriate personnel monitoring equipment must be supplied to individuals who are entering restricted areas and are likely to receive a dose in excess of 10% of the limits set in 10CFR part20.1201 (20.1208 for declared pregnant woman).

The individual in charge of the laboratory must consult the Radiation Safety Officer regarding this question (i.e. whether personnel monitoring equipment should be provided under a specific circumstance) and make the necessary arrangements for personnel monitoring equipment.

SAFE HANDLING OF RADIOACTIVE MATERIALS

The rules to be observed will depend on the actual radioisotope being handled, the amount and the particular experiment. **Four video tapes are available at the Instructional Support Center [Room 102, Library] which give general information on radiation safety.**

Video Title	Time
Radiation Safety I	15 min
Radiation Safety II	15 min 30 sec
Radiation Safety III	10 min 53 sec
The Key to Decontamination Procedures	16 min

As part of the required radiation safety training you are required to view the videos before starting to work with radioactive materials. In addition your laboratory supervisor will give information pertaining to the safety aspects of your experiments.

Some general guidelines are given below:

1. A film badge must be worn by all persons in areas designated as Radiation areas, unless specifically excluded by the rules of that area.

2. Eating, smoking and drinking are strictly prohibited in radiation areas.

3. Direct contact with radioactive materials must be avoided. Protective laboratory coats, gloves, safety glasses, etc. should be worn.

4. Adequate lead shielding should be used to minimize personnel exposure to radiation.

5. Pipetting of solutions should be carried out using safety pipettes.

6. A well-ventilated fume hood should be used in all work where radioactive material may be lost by volatilization, spraying, etc.

7. Radioactive materials must be stored in properly designated areas. All containers of radioactive materials must be labelled with standard warning tape or labels. Such labels on empty containers not in use must be removed or otherwise obliterated.

8. All liquid and solid radioactive wastes must be collected in properly marked containers and disposed of in accordance with approved procedures.

9. Personal items, food and drinks must not be stored along with radioactive materials.

10. Transfer of radioactive materials outside the designated use areas must be cleared with the Radiation Safety Officer.

11. Radiation areas should be surveyed at frequent intervals in accordance with the safety procedures approved by the Radiation Safety Officer.

12. Any spillage or contamination must be reported immediately to the person in charge of the laboratory.

13. Proper steps should be taken immediately to prevent spread of contamination and also to decontaminate the affected area.

14. In case of personal contamination the affected person should not leave the area; he (or she) should summon help.

15. If the spill involves millicurie level of radioactive material all persons not involved in the spill should leave the room. The supervisor should be contacted immediately to take charge of the cleanup operation. Entry to the area should be secured. The supervisor should take appropriate action for decontamination of the person and the area and should inform the RSO.

APPENDIX C

RADIATION SAFETY INSTRUCTIONS
10CFR19.12

Eastern Michigan University

INTRODUCTION:

The purpose of these instructions is to inform all individuals working in rooms where radioactive materials are handled about: (1) health protection problems associated with radiation exposure; (2) radiation protection devices and techniques; (3) low level radioactive waste disposal; (4) U.S. Nuclear Regulatory Commission (NRC) regulations and licenses; (5) responsibilites for reporting violations of NRC regulations and licenses; and (6) obtaining radiation exposure records. At the present the radioactive materials are confined to a few rooms in Mark Jefferson Science Building, Strong Hall, Roosevelt Hall, and Hover. The work involves storage, transfer and use of a variety of radioactive materials which, if improperly handled, are particularly hazardous.

HEALTH PROTECTION PROBLEMS ASSOCIATED WITH RADIATION EXPOSURE:

Radiation from radioactive substances is a stream of fast-flying particles or waves which can neither be seen nor felt. Danger from radiation depends on the length of time and the levels of radiation to which a person is exposed.

Most people are exposed to about 1/10 rem each year from naturally occurring background radiation. (A rem is the unit in which radiation exposure is measured and is simple a label for a certain amount of radiation.) Exposure of the entire body to 100 rem in a short period of time may cause sickness, followed by apparent complete recovery.

The NRC has set 5 rems as occupational limit for radiation workers (10CFR20.1201). Personnel exposures are monitored monthly to ensure that these limits are not exceeded.

The NRC requires that the exposure to embryo/fetus does not exceed 0.5 rem during the entire pregnancy of a declared pregnant woman, i.e., a woman who has voluntarily informed her employer, in writing, of her pregnancy and the estimated date of conception [10CFR1208.]. The limit is reduced because of the sensitivity of a rapidly developing fetus to radiation.

RADIATION PROTECTION DEVICES AND TECHNIQUES:

Danger from radiation is caused by exposure from nearby sources and from exposure due to sources on or internal to individuals caused by contamination resulting from physical contact between a person and a radioactive material.

Exposure to radiation can be limited by: (1) limiting the time of work in a radiation field, (2) maximizing the distance between work areas and radiation sources, and (3) maximizing the distance between work areas and radiation sources, and (3) placing a heavy object or shield between yourself and a radiation source. Contamination is limited by: (1) protective clothing, (2) staying clear of contaminated

areas and equipment, (3) monitoring hands and clothing frequently while working with radioactive materials, (4) removal of contaminated articles of clothing, and (5) washing contaminated parts of the body.

PERSONNEL MONITORING

According to 10 CFR 20.1502 appropriate personnel equipment must be supplied to individuals who are entering restricted area and are likely to receive a dose in excess of 10% of the limits specified [5 rems per year for adults]. If your work involves handling radioactive materials or working near a radiation area **where you could receive 10% of the maximum dose specified for occupational radiation workers**, a film badge monitor or a dosimeter will be provided. The individual, before starting to work with radioactive materials, should ascertain with their supervisor or the RSO whether personnel monitoring devices should be worn. **It is the responsibility of the faculty supervisor to make the necessary arrangements for personnel monitoring equipment.**

LOW LEVEL RADIOACTIVE WASTE

Low level radioactive waste, such as contaminated blotter paper and polyethylene sample holders, is to be deposited in specially marked containers. The containers are to be used exclusively for radioactive and contaminated materials. No liquids are permitted in containers of solid wastes. Radioactive liquid wastes are to be collected separately in properly labelled containers.

U.S. NUCLEAR REGULATORY COMMISSION(NRC) REGULATIONS AND LICENSES:

Rules and regulations governing radioactive work are in accordance with procedures designed to minimize individual danger from radiation. Procedures are based upon NRC rules and regulations. EMU has a Type B Broad Scope License granted by NRC. NRC rules and regulations, the EMU license and safety procedures are available for inspection from the Radiation Safety Officer.

RADIATION SAFETY COMMITTEE:

EMU has a Radiation Safety Committee (RSC) which regulates all matters concerning radioactive materials. The Radiation Safety Officer, (RSO), who is also a member of RSC), in consultation with the RSC conducts the operation. The names of RSC members and their telephone numbers are available from Krish Rengan, RSO, or from the Office of the Associate Provost.

REPORTING VIOLATIONS OF NRC REGULATIONS

All known or suspected violations of NRC regulations must be reported to the RSO or any member of the RSC. Any condition that you suspect may cause unnecessary exposure to radiation or radioactive material should be reported to the RSO immediately.

RADIATION EXPOSURE RECORDS:

You may obtain a report on the amount of radiation exposure you received working at EMU **if you worked in a radiation area and used a film badge.** Mail your name, social security number, name of the department in which you worked and your immediate supervisor, the approximate dates you were at EMU and a request for your exposure record to your supervisor.

SAFE HANDLING OF RADIOACTIVE MATERIALS

The rules to be observed will depend on the actual radioisotope being handled, the amount and the particular experiment. **Four video tapes are available at the Instructional Support Center [Room 102, Library] which give general information on radiation safety.**

Video Title	Time
Radiation Safety I	15 min
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Radiation Safety III	10 min 53 sec
The Key to Decontamination Procedures	16 min

As part of the required radiation safety training you are required to view the videos before starting to work with radioactive materials. In addition your laboratory supervisor will give information pertaining to the safety aspects of your experiments.

Some general guidelines are given below:

1. A film badge must be worn by all persons in areas designated as Radiation areas, unless specifically excluded by the rules of that area.

2. Eating, smoking and drinking are strictly prohibited in radiation areas.

3. Direct contact with radioactive materials must be avoided. Protective laboratory coats, gloves, safety glasses, etc. should be worn.

4. Adequate lead shielding should be used to minimize personnel exposure to radiation.

5. Pipetting of solutions should be carried out using safety pipettes.

6. A well-ventilated fume hood should be used in all work where radioactive material may be lost by volatilization, spraying, etc.

7. Radioactive materials must be stored in properly designated areas. All containers of radioactive materials must be labelled with standard warning tape or labels. Such labels on empty containers not in use must be removed or otherwise obliterated.

8. All liquid and solid radioactive wastes must be collected in properly marked containers and disposed of in accordance with approved procedures.

9. Personal items, food and drinks must not be stored along with radioactive materials.

10. Transfer of radioactive materials outside the designated use areas must be cleared with the Radiation Safety Officer.

11. Radiation areas should be surveyed at frequent intervals in accordance with the safety procedures approved by the Radiation Safety Officer.

12. Any spillage or contamination must be reported immediately to the person in charge of the laboratory.

13. Proper steps should be taken immediately to prevent spread of contamination and also to decontaminate the affected area.

14. In case of personal contamination the affected person should not leave the area; he (or she) should summon help.

15. If the spill involves millicurie level of radioactive material all persons not involved in the spill should leave the room. The supervisor should be contacted immediately to take charge of the cleanup operation. Entry to the area should be secured. The supervisor should take appropriate action for decontamination of the person and the area and should inform the RSO.

Radiation Safety Committee

Howard Booth Biology Dept. Mark Jefferson 487-4391	Chairman RSC Alternate RSO
K. Rengan Chemistry Dept. B-114 Jefferson 487-0086, 487-0106	Secretary RSC Radiation Safety Officer
David L. Clifford Office of Research Development 487-3090	Member
Helen Gates-Bryant Purchasing 487-1203	Member
Judith Glotfelty University Health Services 487-1122	Member
Albert Robinson University Parking 487-0346	Member
Stephen Sonstein Associate Health Professions 487-4094	Member
Ray Sowers Physical Plant 487-3380	Member
Marshall Thomsen Physics Department 487-4144	Member
Associate Provost 146 Pierce Hall 487-3233	Ex-Officio member

RECEIPT OF INSTRUCTIONS:

Please sign and return the following sheet to your supervisor. Also please send a copy of this to K. Rengan, RSO, Chemistry Department.

I have received instructions from my supervisor about safe handling of radioactive materials to be used in our experiments. Further I have read the **"RADIATION SAFETY INSTRUCTIONS" and understand them.**

I viewed the four video tapes available at the Instructional Support Center at the time and date shown below:

Date viewed: _____

Time viewed; _____

_____
Printed Name

_____
Signature Date

_____
Faculty/Student-Course No./Experimenter-Dept.

Revised 1994

APPENDIX D
EASTERN MICHIGAN UNIVERSITY
RADIATION SAFETY COMMITTEE
RADIOACTIVE LABORATORY INSPECTION REPORT

Laboratory inspected :

Date inspected :

Person(s) in-charge :

Inspection team :

General laboratory status (storage, security, signs etc.) :

Comments on records :
Monitoring records -

Waste disposal records -

Material receipt records -

Additional comments -

RADIATION SAFETY COMMITTEE

RADIOACTIVE LABORATORY INSPECTION REPORT

(continued)

Radionuclides in use (or stored) :

Quantity of each (approximate) :

Dose level - Waste :

Dose level - Fume hood :

Dose level - Storage :

Survey meter used :

Wipe tests - samples from

1.

2.

3.

Signature of Inspectors :

Howard Booth **Krish Rengan**

Form Date 4/30/91

APPENDIX E

EASTERN MICHIGAN UNIVERSITY
INTEROFFICE MEMORANDUM

TO: Dr. K. Rengan, PhD., Chairman
Radiation Safety Committee
Helen Gates-Bryant, Buyer, Purchasing
Rick Paffenroth, Manager, University Stores

FROM: Gary L. Reffitt, Director
Purchasing and Communications

DATE: May 25, 1994

SUBJECT: Purchase of Radioactive Materials

RADIOACTIVE MATERIALS PROCEDURES

1.	Originating Department:		Complete authorization form and requisition requesting materials. Forward to K. Rengan, University Radiation Safety Officer, Chemistry Department.
2.	University Radiation Safety Officer		Approve - Forward to Purchasing Disapprove - Return to Department
3.	Purchasing		Create purchase order. Attach radioactive material receiving record to Central Receiving Copy.
4.	Central Receiving	A.	All deliveries will be properly identified as radioactive.
		B.	**NO** shipments will be opened for inspection.
		C.	Complete radioactive material receiving record.
		D.	Contact individual requesting materials to arrange delivery.
		E.	If individual cannot be contacted, contact University Radiation Safety Officer, K. Rengan at 7-0086 or 7-0106.

CONTROL NO. 397029

Eastern Michigan University

INTER-OFFICE CORRESPONDENCE

TO: All Members of Purchasing Staff and Frank Miller Central Receiving

DATE: October 17, 1977

FROM: William D. Swihart
Director of Purchasing

SUBJECT: (Update) Rules for Purchase of Radio Active Materials

Purchasing

Today I met with the Radiation Safety Committee and discussed procedures which will have to be followed in the purchasing and receiving of radiation supplies.

All requisitions must have the signature of Dr. Krishnaswamy Rengan, Ph.D., Chairman of the Radiation Safety Committee, approving the purchase of any radioactive materials prior to their purchase. Any requisition received without his approval will be sent immediately to Dr. Rengan's office in Jefferson ScienceBuilding. If approved, he will return it to the Purchasing Department.

No shipments will be permitted to be made unless there is an authorized purchase order issued to the vendor. Any materials arriving without the proper authorization are to be returned. Each requisition, in addition to having authorization form the Radiation Safety Committee, must also have on that same requisition the individual's name who is to receive the shipment, his telephone number and location.

Receiving

Rules for receiving of radioactive materials must be very strict. All personnel authorized to receive shipments must be made aware of the rules of the University for receiving this material. No shipments will be opened for inspection. I am advised that according to all laws, such materials must be so marked on the outside of the package stating the package contains radioactive materials.

As soon as a shipment is received, immediately pull the purchase order and call the individual whose name is designated on the purchase order. Upon contacting the individual you will set up a time when it is agreeable for both the Receiving Department to deliver, and the individual, or one to whom he designates the responsibility to receive that material. No material will be delivered directly to the department without first notifying the designated person on the purchase order prior to its delivery. If the individual stated on the purchase order wishes to pick up the shipment at Receiving he is free to do so. When the individual arrives and he is a person you do not know, you are within your rights to ask for identification.

As you can see, both the Purchasing Department and the Receiving Department will have a great responsibility to insure the University receives only authorized shipments of radioactive materials.

If, after receiving this memo, you feel it is necessary to have a Staff meeting and discuss this further, I will be glad to call one. In the Receiving Department, I will be only too happy to meet with your department, sit down and discuss this with them and answer any questions you may have. The responsibility of carrying out the above procedures is each person who is involved. Because of its importance, we will not tolerate any deviation from this procedure unless discussed with me.

WDS:jlh

xc: Dr. Krishnaswamy Rengan, Ph D.
Chairman Radiation Safety Committee

Robert A. Andrews
Manager of Service Operations

OCT 0 7 1996

Krish Rengan, Ph.D.
Eastern Michigan University
Department of Chemistry
Jefferson Science Building
Room 225
Ypsilanti, MI 48197

Dear Dr. Rengan :

Enclosed is Amendment No. 24 renewing your NRC Material License No. 21-06885-01 in accordance with your request.

Please review the enclosed document carefully and be sure that you understand all conditions. If there are any errors or questions, please notify the U.S. Nuclear Regulatory Commission, Region III office at (630) 829-9887 so that we can provide appropriate corrections and answers.

Please be advised that your license expires at the end of the day, in the month, and year stated in the license. Unless your license has been terminated, you must conduct your program involving byproduct materials in accordance with the conditions of your NRC license, representations made in your license application, and NRC regulations. In particular, note that you must:

1. Operate in accordance with NRC regulations 10 CFR Part 19, "Notices, Instructions and Reports to Workers; Inspections," 10 CFR Part 20, "Standards for Protection Against Radiation," and other applicable regulations.

2. Notify NRC, in writing, within 30 days:

   a. When the Radiation Safety Officer permanently discontinues performance of duties under the license or has a name change; or

   b. When the licensee's mailing address changes (no fee is required if the location of byproduct material remains the same).

3. In accordance with 10 CFR 30.36(b) and/or license condition, notify NRC, promptly, in writing, and request termination of the license when you decide to terminate all activities involving materials authorized under the license.

4. Request and obtain a license amendment before you:

   a. Change Radiation Safety Officers;

   b. Order byproduct material in excess of the amount, or radionuclide, or form different than authorized on the license;

397029

c. Add or change the areas of use or address or addresses of use identified in the license application or on the license; or

d Change ownership of your organization.

5. Submit a complete renewal application with proper fee or termination request at least 30 days before the expiration date of your license. You will receive a reminder notice approximately 90 days before the expiration date. Possession of byproduct material after your license expires is a violation of NRC regulations. A license will not normally be renewed, except on a case-by-case basis, in instances where licensed material has never been possessed or used.

In addition, please note that NRC Form 313 requires the applicant, by his/her signature, to verify that the applicant understands that all statements contained in the application are true and correct to the best of the applicant's knowledge. The signatory for the application should be the licensee or certifying official rather than a consultant.

You will be periodically inspected by NRC. Failure to conduct your program in accordance with NRC regulations, license conditions, and representations made in your license application and supplemental correspondence with NRC will result in enforcement action against you. This could include issuance of a notice of violation, or imposition of a civil penalty, or an order suspending, modifying or revoking your license as specified in the General Policy and Procedures for NRC Enforcement Actions. Since serious consequences to employees and the public can result from failure to comply with NRC requirements, prompt and vigorous enforcement action will be taken when dealing with licensees who do not achieve the necessary meticulous attention to detail and the high standard of compliance which NRC expects of its licensees.

Sincerely,
Original Signed By
John D. Jones
Nuclear Materials Licensing Branch

License No.: 21-06885-01
Docket No.: 030-00818
Enclosures:
1. Amendment No. 24
2. 10 CFR Part 19
3. 10 CFR Part 20
4. 10 CFR Part 30
5. Form NRC-3
6. NRC Form 313

DOCUMENT NAME: M:\03000818.CL6

To receive a copy of this document, indicate in the box: "C" = Copy without attachment/enclosure "E" = Copy with attachment/enclosure "N" = No copy

OFFICE	DNMS/RIII									
NAME	jjones:jaw									
DATE	08/7/96									

OFFICIAL RECORD COPY

EASTERN MICHIGAN UNIVERSITY
Ypsilanti, Michigan 48197

U.S. Nuclear Regulatory Commission
Region III
801 Warrenville Road
Lisle, IL 60532-4351
Attention: Mr. John D. Jones

September 16, 1996

Dear Mr. John Jones:

Subject: License Renewal Application
License No. 21-06885-01
Control No. 397029

I have enclosed the revised application for renewal. The material incorporates the information on the storage room as well as some other changes that took place. If you have any questions please call me at 313-487-0086 or fax 313-487-1496.

Thank you.

Sincerely,

Krish Rengan

Krish Rengan

Copy to : Dr. Ronald Collins
Provost & VP for Acad. Affairs

Department of Chemistry
(313) 487-0106 FAX: (313) 487-1496

NRC FORM 313 U. S. NUCLEAR REGULATORY COMMISSION

(6-93)
10 CFR 30, 32, 33
34, 35, 36, 39, and 40

APPROVED BY OMB: NO. 3150-0120
EXPIRES 6-30-96

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 9 HOURS. SUBMITTAL OF THE APPLICATION IS NECESSARY TO DETERMINE THAT THE APPLICANT IS QUALIFIED AND THAT ADEQUATE PROCEDURES EXIST TO PROTECT THE PUBLIC HEALTH AND SAFETY. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (MNBB 7714), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555-0001, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0120), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

APPLICATION FOR MATERIAL LICENSE

INSTRUCTIONS: SEE THE APPROPRIATE LICENSE APPLICATION GUIDE FOR DETAILED INSTRUCTIONS FOR COMPLETING APPLICATION. SEND TWO COPIES OF THE ENTIRE COMPLETED APPLICATION TO THE NRC OFFICE SPECIFIED BELOW.

APPLICATION FOR DISTRIBUTION OF EXEMPT PRODUCTS FILE APPLICATIONS WITH:

DIVISION OF INDUSTRIAL AND MEDICAL NUCLEAR SAFETY
OFFICE OF NUCLEAR MATERIALS SAFETY AND SAFEGUARDS
U.S. NUCLEAR REGULATORY COMMISSION
WASHINGTON, DC 20555-0001

ALL OTHER PERSONS FILE APPLICATIONS AS FOLLOWS:

IF YOU ARE LOCATED IN:

CONNECTICUT, DELAWARE, DISTRICT OF COLUMBIA, MAINE, MARYLAND, MASSACHUSETTS, NEW HAMPSHIRE, NEW JERSEY, NEW YORK, PENNSYLVANIA, RHODE ISLAND, OR VERMONT, SEND APPLICATIONS TO:

LICENSING ASSISTANT SECTION
NUCLEAR MATERIALS SAFETY BRANCH
U.S. NUCLEAR REGULATORY COMMISSION, REGION I
475 ALLENDALE ROAD
KING OF PRUSSIA, PA 19406-1415

ALABAMA, FLORIDA, GEORGIA, KENTUCKY, MISSISSIPPI, NORTH CAROLINA, PUERTO RICO, SOUTH CAROLINA, TENNESSEE, VIRGINIA, VIRGIN ISLANDS, OR WEST VIRGINIA, SEND APPLICATIONS TO:

NUCLEAR MATERIALS LICENSING SECTION
U.S. NUCLEAR REGULATORY COMMISSION, REGION II
101 MARIETTA STREET, NW, SUITE 2900
ATLANTA, GA 30323-0199

IF YOU ARE LOCATED IN:

ILLINOIS, INDIANA, IOWA, MICHIGAN, MINNESOTA, MISSOURI, OHIO, OR WISCONSIN, SEND APPLICATIONS TO:

MATERIALS LICENSING SECTION
U.S. NUCLEAR REGULATORY COMMISSION, REGION III
799 ROOSEVELT ROAD
GLEN ELLYN, IL 60137-5927

ARKANSAS, COLORADO, IDAHO, KANSAS, LOUISIANA, MONTANA, NEBRASKA, NEW MEXICO, NORTH DAKOTA, OKLAHOMA, SOUTH DAKOTA, TEXAS, UTAH, OR WYOMING, SEND APPLICATIONS TO:

NUCLEAR MATERIALS LICENSING SECTION
U.S. NUCLEAR REGULATORY COMMISSION, REGION IV
611 RYAN PLAZA DRIVE, SUITE 400
ARLINGTON, TX 76011-8064

ALASKA, ARIZONA, CALIFORNIA, HAWAII, NEVADA, OREGON, WASHINGTON, AND U.S. TERRITORIES AND POSSESSIONS IN THE PACIFIC, SEND APPLICATIONS TO:

RADIOACTIVE MATERIALS SAFETY BRANCH
U.S. NUCLEAR REGULATORY COMMISSION, REGION V
1450 MARIA LANE
WALNUT CREEK, CA 94596-5356

PERSONS LOCATED IN AGREEMENT STATES SEND APPLICATIONS TO THE U.S. NUCLEAR REGULATORY COMMISSION ONLY IF THEY WISH TO POSSESS AND USE LICENSED MATERIAL IN STATES SUBJECT TO U.S. NUCLEAR REGULATORY COMMISSION JURISDICTIONS.

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

- [ ] A. NEW LICENSE
- [ ] B. AMENDMENT TO LICENSE NUMBER _____
- [X] C. RENEWAL OF LICENSE NUMBER 21-06885-01

2. NAME AND MAILING ADDRESS OF APPLICANT *(Include Zip code)*

Eastern Michigan University
Ypsilanti, MI 48197

3. ADDRESS(ES) WHERE LICENSED MATERIAL WILL BE USED OR POSSESSED

Eastern Michigan Universty Campus

4. NAME OF PERSON TO BE CONTACTED ABOUT THIS APPLICATION

Krishnaswamy Rengan
(Chemistry Department)

TELEPHONE NUMBER
(313) 487-0106

SUBMIT ITEMS 5 THROUGH 11 ON 8-1/2 X 11" PAPER. THE TYPE AND SCOPE OF INFORMATION TO BE PROVIDED IS DESCRIBED IN THE LICENSE APPLICATION GUIDE.

5.	RADIOACTIVE MATERIAL. a. Element and mass number, b. chemical and/or physical form, and c. maximum amount which will be possessed at any one time.	6.	PURPOSE(S) FOR WHICH LICENSED MATERIAL WILL BE USED.
7.	INDIVIDUAL(S) RESPONSIBLE FOR RADIATION SAFETY PROGRAM AND THEIR TRAINING EXPERIENCE.	8.	TRAINING FOR INDIVIDUALS WORKING IN OR FREQUENTING RESTRICTED AREAS.
9.	FACILITIES AND EQUIPMENT	10.	RADIATION SAFETY PROGRAM.
11.	WASTE MANAGEMENT	12.	LICENSEE FEES *(See 10 CFR 170 and Section 170.31)* FEE CATEGORY 170.11 (a)1 — AMOUNT ENCLOSED $ No Fee

13. CERTIFICATION *(Must be completed by applicant)* THE APPLICANT UNDERSTANDS THAT ALL STATEMENTS AND REPRESENTATIONS MADE IN THIS APPLICATION ARE BINDING UPON THE APPLICANT.

THE APPLICANT AND ANY OFFICIAL EXECUTING THIS CERTIFICATION ON BEHALF OF THE APPLICANT NAMED IN ITEM 2, CERTIFY THAT THIS APPLICATION IS PREPARED IN CONFORMITY WITH TITLE 10, CODE OF FEDERAL REGULATIONS, PARTS 30, 32, 33, 34, 35, 36, 39 AND 40, AND THAT ALL INFORMATION CONTAINED HEREIN IS TRUE AND CORRECT TO THE BEST OF THEIR 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.

CERTIFYING OFFICER – TYPED/PRINTED NAME AND TITLE
Judith A. Johnson Associate Provost

SIGNATURE

DATE
May 26, 1994

RECEIVED
SEP 17 1996
REGION III

FOR NRC USE ONLY

TYPE OF FEE	FEE LOG	FEE CATEGORY	AMOUNT RECEIVED $	CHECK NUMBER	COMMENTS

APPROVED BY

DATE

NRC FORM 313 (6-93)

PRINTED ON RECYCLED PAPER

5. RADIOACTIVE MATERIAL.

No. Element and Mass Number	Chemical or Physical form	Maximum amount which will be possessed at any one time.
1. Any byproduct material	Any	As Specified in 10CFR33.11(b)
2. Californium-252	Sealed source supplied by Dept. of Energy	7 microgram
3. Plutonium (Beryllium)	Sealed Source	0.1 curie (M1098)
4. Plutonium (Beryllium)	Sealed Source	1.0 curie (M1097)

6. PURPOSE(S) FOR WHICH LICENSED MATERIAL WILL BE USED.

The radioactive materials obtained under this license will be used for **research and development as defined in 10CFR30.4.** Experiments will not involve the **internal or external administration** of byproduct materials, or the radiation therefrom, to **human beings**.

INDIVIDUALS RESPONSIBLE FOR RADIATION SAFETY PROGRAM AND THEIR TRAINING AND EXPERIENCE

7.1a **Radiation Safety Officer**

Krish Rengan has been appointed as the Radiation Safety Officer (RSO) by the Radiation Safety Committee (RSC). His specialty is nuclear and radiochemistry. He has worked with radioactive materials and has supervised and directed laboratory research involving radioactive materials for nearly thirty-six years. He helped in setting up the various administrative controls and procedures necessary to obtain the Type B Broad Scope NRC license for Eastern Michigan University (EMU). He has been the RSO for more than ten years. A brief resume is given below:

KRISH RENGAN

VITA AND PUBLICATIONS LIST

Status in U.S.: U.S. Citizen
Degrees: Ph.D. University of Michigan, 1966
M.Sc Kerala University, India, 1958
B.Sc (Hons) Kerala University, 1957

Professional Experience:

Chemistry Department	Asst. Prof.	1970- 1974
Eastern Michigan University	Assoc. Prof.	1974- 1979
	Professor	1979 -

Has established an active research program in nuclear and radiochemistry with graduate and undergraduate students. The radiochemical work involves development of procedures applicable for fission product separation and neutron activation analysis of environmental samples. Set up a gas jet system at the Ford Nuclear Reactor of the University of Michigan. The gas jet system is being used for the study of gas phase chemical separation of fission products. The gas jet work involves undergraduate and graduate students from EMU and also Ph.D. students from the University of Michigan (through collaboration with Prof. Henry Griffin). Teaches both graduate and undergraduate level courses in nuclear, analytical and general chemistry. In collaboration with Phoenix Memorial Laboratory of University of Michigan, **organized and conducted three one-week workshops on neutron activation analysis.** He has been a member of the organizing committee of the sixth, seventh and eighth "Radiation Measurements" Symposia held in Ann Arbor, MI.

Lawrence Livermore National Laboratory (LLNL) Participating Guest 1979-1981

Has worked with the fast chemistry group at LLNL. During this period developed and/or perfected gas phase chemistry for the separation of selenium and bromine from fission products and studied he decay of short-lived selenium nuclides. The work was performed at the Triga Reactor of the University of California, Berkeley.

Radiochemistry Division
Bhabha Atomic Research Centre Scientific Officer 1958-1961
Bombay, India 1966-1970

During 1958 to 1961 used radiochemical procedures extensively to measure fission yields; studied the effect of oxidation state on fission product recovery and measured isomer yield ratios. Also helped to set up radiochemical procedures for the analysis of effluent water from the laboratory. Determined fission product decontamination in laboratory scale studies for Purex process for plutonium separation.

After returning to BARC in 1966 set up and utilized a GeLi detector and gamma-ray spectroscopic techniques for fission yield measurements. Developed procedures for the recovery of useful fission products from fission product waste. Helped in fission product decontamination measurements associated with high temperature fuel reprocessing studies.

Recent Publications

PUBLICATIONS [last five years]

1. "Evolution and applications of radiochemical procedures: From Marie Curie to Darleane Hoffman", E.T. Contis and K. Rengan, J. Radianl. Nucl. Chem. **203**, 273 (1996).
2. "Trace element correlations with age and sex in human fingernails", K. Chaudhary*, W.D. Ehmann, K. Rengan and W.R. Markesbery, J. Radianl. Nucl. Chem. **195**, 31 (1995).
3. "Ultrafast radiochemical separations", K. Rengan, Nuclear and Radiochemistry Symposium Proceedings, NUCAR95, (1995), p58.
4. "Transport time of volatile and nonvolatile fission products in a gas jet", N. Davis**, E. Contis, K. Rengan and H. Griffin, Nucl. Instr. Meth. Phys. Res. **A353**, 627 (1994).
5. "Chemical reactions of fission products with ethylene using the gas jet technique", E. Contis, K. Rengan and H. Griffin, Nucl. Instr. Meth. Phys. Res.**A353**, 631 (1994).
6. "Determination of trace level mercury in biological and environmental samples by neutron activation analysis", P. Shetty*, A. A. Moosavi-Movahedi* and K. Rengan, J. Radioanal. Nucl. Chem. **182**, 205 (1994).
7. "Ultrafast Chemical separations", K. Rengan and R.A. Meyer, Radiochemistry Techniques Monograph, NAS-NS-3118, National Academy Press (1993).
8. "Sorption of silver by Chelex 100 chelating resin", R.N. Ceo*, M.R. Kazerouni* and K. Rengan, J. Radioanal. Nucl. Chem. 172, 43 (1993).
9. "Radiotracer Techniques Course at Eastern Michigan University: Evolution with Changing Clientele", K. Rengan, J. Radioanal. Nucl. Chem. 171, 203 (1993).
10. "Public Education on Sources and Effects of Radioactive Waste Disposal", J.E. Martin and K. Rengan, J. Radioanal. Nucl. Chem. 171, 245 (1993).
11. "Trace Element Correlations between Human Brain and Fingernails", R. Chaudhary*, W.D. Ehmann, K. Rengan and W.R. Markesbery, J. Trace and Microprobe Tech. 10. 225 (1992).

12. "Characterizing a source of fission fragments for a gas jet", R.N. Ceo, H.C. Griffin and K. Rengan, J. Radioanal. Nucl. Chem. 148, 107 (1991).
13. "Continuous gas phase chemical separations", K. Rengan, J. Radioanal. Chem. 142, 173(1990).

***EMU Graduate students**
****EMU Undergraduate students**

Submitted to the journal:

1. "Fast chemical separations for the study of fission products", K. Rengan, invited paper, will appear in "Frontiers in Nuclear Chemistry", a commemorative volume to be published to mark the centenary year of the discovery of radioactivity.
2. "Chelating resins: Sorption characteristics in chloride media", K. Rengan, to be published in the proceedings of Ehmann Award Symposium; will appear as an issue of the J. Radioanal. Nucl. Chem.

Invited Talks:

1. "Radioactivity: Education needs from kindergarten through college", Symposium on "Tracing atomic theory from kindergarten through college", 14th Biennial Conference on Chemical Education, Clemson, August 1996.
2. "Chelating resins: Sorption characteristics", Ehmann Award Symposium, organized by the Division of Nuclear Chemistry ans Technology, ACS, March 1996, New Orleans.
3. "Ultrafast radiochemical separations", K. Rengan, Nuclear and Radiochemistry Symposium, NUCAR95, Kalpakkam, India, February 1995.

Other professional activities [last five years]:

1. Continue to serve in the Editorial Advisory Board for the Journal of Radioanalytical and Nuclear Chemistry(Articles) and as an Associate Editor for the Journal of Radioanalytical and Nuclear chemistry (Letters).
2. Serving as a member of the Publications Committee of the Division of Nuclear Chemistry and Technology of the American Chemical Society.
3. Organized a special issue of the Journal of Radioanalytical and Nuclear Chemistry to celebrate the one-hundreth year of the discovery of radioactivity by Becquerel. The issue appeared as J. Radioanal. Nucl. Chem. vol. 203, issue 2, March 1996.
4. Served in the Organization Committee for the Joint ACS Great Lakes-Central Regional Meeting held in June 1994 in Ann Arbor, MI.
5. Served as the General Chairman for the Nuclear Chemistry Symposia of the Joint ACS Great Lakes-Central Regional Meeting held in June 1994 in Ann Arbor, MI.
6. Served in the Organization Committee of the 8th Symposium on Radiation Measurements and Applications held in May 1994 in Ann Arbor.
7. Member of the Editorial Committee of the "**Proceedings of the 8th Symposium on Radiation Measurements and Applications**" published by Nuclear Instruments and Methods in Physics Research, December 1994..
8. Presided over the "Materials Analysis" sessions of the 8th Symposium on Radiation Measurements and Applications held in May 1994 in Ann Arbor.
9. Organized and guest edited a special issue of the Journal of Radioanalytical and Nuclear Chemistry on the "***Status of Nuclear Science Education***" along with Prof. Steve Yates of the University of Kentucky and Dean Alan Ling of San Jose State University. The issue contains 33 articles from 13 countries. The issue was published as vol 171, issue 1 (1993).

Presentations at Professional Meetings

1. "Study of sorption of Cu(II), Sn(IV) and Sb(V) by Chelex 100 chelating resin", M. Yeh* and K. Rengan, presented at the Joint Regional ACS Meeting, Ann Arbor, MI, June, 1994.
2. "Chemical reactions of fission products with ethylene using the gas jet technique", E.T. Contis, K. Rengan and H.C. Griffin, presented at the 8th Symposium on Radiation Measurements and Applications held in Ann Arbor, MI, in May 1994.
3. "Transport time of volatile and nonvolatile fission products in a gas jet", N. Davis**, E.T. Contis, K. Rengan and H.C. Griffin, presented at the 8th Symposium on Radiation Measurements and Applications held in Ann Arbor, MI, in May 1994.
4. "Trace element corelations with age and sex in human fingernails", K Chaudhary*, W.D. Ehmann, K. Rengan and W.R. Markesbery, presented at the Conference on Methods and Applications of Radioanalytical Chemistry - III held in Kona, Hawaii in April 1994.
5. "New Radiochemistry Monograph: Ultrafast Chemical Separations", K. Rengan and R.A. Meyer, ACS meeting held in Washington, D.C. August 1992.
6. "Adsorption of Pb^{2+} from Aqueous Solution by Chelex 100", M. Yeh* and K. Rengan, ACS meeting held in Washington, D.C. August 1992.

***EMU Graduate students**
****EMU Undergraduate students**

7.1b Chairman of the Radiation Safety Committee and Alternate Radiation Safety Officer

Professor Merlyn Minick

RADIATION BACKGROUND

1. Participant in the **Chemical-Biological-Radiological (CBR) Warfare School**, Gifu, Japan, early 1951. Worked with ^{238}U, ^{234}Th, ^{226}Ra, $^{222}Rn(?)$, ^{206}Pb, ^{90}Sr, ^{45}Ca, ^{131}I, ^{24}Na and (total body) ^{40}K.

2. **Radiation Officer**, Squad Leader, Second Infantry Division, Korean War, 1951-1952.

3. **RESEARCH ASSOCIATE**: Working with 4-^{14}C-cortisol, cortisone, corticosterone and aldosterone at the division of Endocrinology and Metabolism, Department of Internal Medicine, University of Michigan Medical School, Ann Arbor, MI from 1956 to 1966.

4. Participant in a certified and two quarter-term update **in Radiological Effects and Methodology**, sponsored by the U.S. AEC, (Washington D.C.) at Wayne State University, Detroit, MI, 1966. In addition to new developments in the knowledge of radiation effects, the methodologically-based subjects included various advanced training in radiation detection and measurement, including neutron activation analysis. Isotopes which were studied in detail are: ^{22}Na, ^{51}Cr, ^{203}Hg, ^{32}P, ^{144}Ce, ^{65}Zn, ^{60}Co, ^{14}C, ^{35}S, ^{74}As, ^{131}I, ^{59}Fe, ^{55}Fe, ^{210}Pb, ^{110}Ag. In addition, a rather extensive ore collection from Colorado was made available (each of which was radioactive). Furthermore, a cloud chamber was provided for each student to visually demonstrate, particularly, the random emission of helium nuclei.

5. Utilized numerous polyenoic, saturated and long-chain 1-^{14}C-free fatty acids in tissue studies during doctoral work along with the fatty acid soaps of UO_2^{++} in attempting to develop an ultramicro method for determining the concentrations of free fatty acids in 10 μl quantities of intracellular and /or extracellular fluids.

6. **Professor** (Physiology) in the Department of Biology at Eastern Michigan University for 29 years, teaching, advising and supervising undergraduate and graduate student concerned with the effects of radiation on living biological systems and the safe and appropriate use of isotopes in biological study.

7.2 **Radiation Safety Committee**

Eastern Michigan University has established a **Radiation Safety Committee (RSC).** The RSC is responsible for ensuring institutional compliance with the appropriate radiation safety guidelines. The nature and responsibilities of this committee are described below.

RADIATION SAFETY COMMITTEE

The committee is responsible for recommending appropriate radiation safety policies and practices as required by federal/state agencies to all faculty and staff (including Department Heads) who utilize radioactive materials in teaching and/or research. In addition, it is the responsibility of the committee to prepare reports which are required for continuation of our institutional radiation licensing.

Membership: One faculty representative each from the departments which use radioactive materials. These members may be chosen/appointed by appropriate internal procedures in each Department. The term of appointment is indefinite, but for a minimum of three (3) years. The Director of the Office of Research Development and the Radiation Technologist from University Health Services will also be members of the committee. In addition, one representative each from Purchasing, Physical Plant, and a member-at large form University staff will be members of the RSC. **The Provost/Vice President for Academic Affairs will be an ex-Officio committee member, and will serve as the principle administrative liaison to the President/Executive Council on radiation safety matters.**

Committee Chairperson : The RSC will select its Chairperson for the period it feels appropriate.

Radiation Safety Officer (RSO) : The RSC will elect/appoint the RSO. The RSO must have the qualifications specified by the NRC. The RSO controls the procurement and use of radioactive materials and supervises the handling of radioactive materials. The committee also will elect/appoint an alternate RSO to act in the absence of the RSO.

Meetings : The committee will meet at least once every twelve months to review and discuss the Radiation Safety Program on EMU campus. Minutes should be kept and distributed to appropriate faculty, staff, and senior administrators.

8. TRAINING FOR INDIVIDUALS WORKING IN OR FREQUENTING RESTRICTED AREAS

Information on this item is included in Item 10.

9. FACILITIES AND EQUIPMENT

9.1 Facilities Where Radioactive Materials are Used at Present

The following departments use radioactive materials at the present time, at the buildings indicated below:

Department	Building where radioactive material is used
Associated Health Professions	Roosevelt Hall
Biology Department	Hover Natural Science Building and Mark Jefferson Science Complex
Chemistry Department	Mark Jefferson Science Complex
Physics Department	Strong Physical Science Building

The Chemistry Department has one laboratory room (B-113, Mark Jefferson Science Complex) specially designed for medium-high radioactive work. A negative pressure compared to the corridor is maintained in the laboratories. The laboratory room is equipped with four well ventilated fume hoods. Two of the fume hoods are made of stainless steel and will be used for all work involving large amounts of radioactivity. The hoods have a front opening of 32" x 52" and an exhaust rate of 1700 cu. ft. per minute. The facilities also include a foot-operated sink and standard items like lead storage containers, movable lead bricks for shielding, etc.

A storage area for radioactive materials is attached to the laboratory. This area is shielded by a 12" reinforced concrete wall. The californium-252 sources and two Pu(Be) sources are housed in this area. In addition stock solutions of radioactive materials are stored here. **Section 9.4 provides a schematic of the storage room and the dose profile.**

The counting equipment is located in rooms adjacent to the laboratory.

In addition two other rooms, rooms 226 and 430 of Mark Jefferson are also used for radioactive tracer work.

The Physics Department has one laboratory in Strong Physical Science Building devoted to nuclear physics. The lab is equipped with a sink, regular laboratory benches, storage cabinets, etc. Lead bricks, paraffin blocks and lead-glass blocks are available for shielding. A large steel safe (with lock) is available for the storage of

radioactive sources. At present all the radioactive materials are stored in room 224B of Stong Physical Science Building.

All other laboratory rooms used for radioactive work are properly equipped for the level of radioactivity handled there. In most cases the room has a well-ventilated hood. The rooms are marked with "RADIOACTIVE" sign; the access is restricted to all the rooms where radioactive materials are stored.

9.2 Facilities Where Radioactive Materials May be Used in the Future

As new faulty members are recruited for the various science and technology departments and as the existing faculty members reorient their research, new requests for different uses of radioactive materials and for the use of different laboratory facilities can be expected. Each request for the use of new laboratory rooms will be reviewed by the RSO; the RSO will visit the laboratory rooms in question and evaluate the facility from the points of views of (i) safe handling of radioactive materials and (ii) security, especially limiting access only to authorized personnel. The RSO will require satisfactory upgrading of the facility to meet the safety and security aspects before granting permission for use of the laboratory rooms. The RSC will act in advisory capacity, if called on by the RSO.

9.3 Survey Equipment

A variety of instruments are available for counting alpha and beta particles and gamma rays. Surface barrier detector, G.M. Counters, liquid scintillation counting systems, NaI(Tl) scintillation detectors, Ge(Li) and HPGE detectors and multichannel analyzers are available on campus. A number of radiation survey instruments are also available on campus. The table below gives a list of the survey instruments.

Radiation Survey Instruments

Type of Instrument	Number Available	Radiation Detected	Range	Location
Eberline Ion Chamber Model RO-2	1	Beta Gamma	0-5000 mR/hr	Chemistry
Eberline GM survey meter Model E-140	1	Beta Gamma	0-50 mR/hr	Chemistry
Eberline GM survey paper Model ESP 1	1	Beta Gamma	0-3000 mR/hr	Chemistry
Wm. B. Johnson GM survey meter Model GSM-5	1	Beta Gamma	0-20 mR/hr	Chemistry
Bicron Surveyor GM Model 50	1	Beta Gamma	0-50 mR/hr	Chemistry
Texas Nuclear Model 2650	1	Alpha Beta Gamma	0-100 mR/hr	Physics
Baird-Atomic Model 420	1	Beta Gamma	0-100 mR/hr	Physics
Victoreen GM Survey Meter Model 05-753	1	Beta Gamma	0-1000 mR/hr	Physics
Texas Nuclear Log 2673/2646 Probe	1	Neutrons	0-25K $n/Cm^2/s^1$	Physics
Victoreen Model 488A	1	Neutrons	0-12 K $n/Cm^2/s^1$	Chemistry

One beta-gamma survey meter of wide range will be calibrated by service company once every year; the service company will be a NRC licensed company.

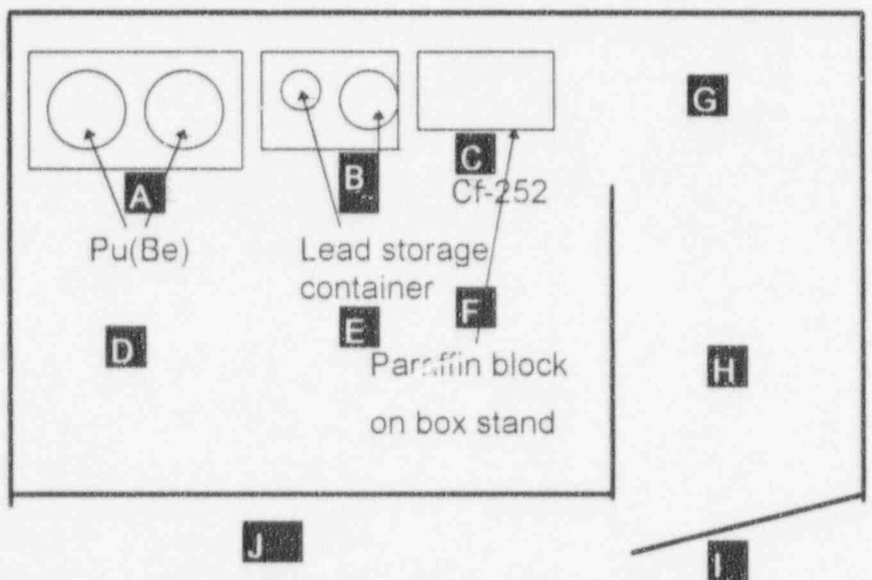
9.4 STORAGE ROOM
B-114B Mark Jefferson Science Complex
Radiation Dose Chart

The source room, B-114B, is located inside the Radiochemistry Laboratory (B-114) and houses the following neutron sources:

- Two Cf-252 sealed sources - SR-CF-156 containing 1.004 μg (6/30/96) and SR-CF-206Z containing 0.301 μg (6/30/96) .
- Two Pu(Be) sources in storage (1 and 0.1 Ci); the sources are expected to be disposed off in 1997 through the Department of Energy program.

In addition stock solutions of Cs-137 and Co-60 are also stored in lead container.

The Pu(Be) sources are in separate barrels kept in a steel cabinet. The Cf sources are normally kept in a shipping container. During the week(s) of experimental use the Cf sources are kept in a paraffin block on box stand near the shipping container. The figure below shows a schematic of the arrangements in room B-114B.



Schematic of room B-114B of Mark Jefferson Science Complex

A,B,C - contact with cabinet, shelf or stand
D,E,F - 50 cm from A,B or C

Dose in Source Room B-114B

Measured on August 20, 1996

Sources stored: Two Pu(Be) sources in steel cabinet
Cs-137 stored in lead container
Two Cf-252 sources - in shipping container
or in irradiation position [0.301 μg and 1.004 μg on 6/30/96]

Cf in shipping container **Cf in paraffin block**

Position	Gamma dose*	Neutron dose**	Neutron dose**	Gamma dose*	Neutron dose**	Neutron dose**
A	0.5	600	3	0.5	600	3
B	0.5	2000	10	0.2	400	2
C	0.3	500	2.5	2.5	1500	7.5
D	0.2	200	1	0.2	200	1
E	0.2	600	3	0.2	200	1
F	0.2	400	2	0.4	400	2
G	0	100	0.5	0.2	50	0.25
H	0	0	0	0	50	0.25
I	0	0	0	0	<20	<0.1
J		0	0	0	<20	<0.1

Top of container **Top of source**

	5	6000	30	40	20,000	100

*Gamma dose measured with Eberline Ion Chamber RO2 (serial 651, EMU#699169), calibrated on 7/26/96

**Neutron dose measured with Ludlum count rate meter model 12 (with polyethylene sphere, 200 cpm = 1 mrem)

Room B-114B has a special lock and is accessible only to authorized personnel. Detailed instructions about the room are provided by K. Rengan to users before receiving authorization. The instructions regarding the use of the Cf-252 sources for neutron irradiation are reproduced below.

Entry into Room B-114B of Mark Jefferson and Use of the Cf-252 Sources

1. Only persons authorized by K. Rengan can enter the room and use the Cf-252 sources.
2. The Cf sources will be positioned on paraffin block by K. Rengan. **DO NOT HANDLE THE SOURCES.**
3. **NEVER HAVE ANY PART OF YOUR BODY DIRECTLY ABOVE THE SOURCE.**
4. Samples for irradiation should be prepared in 13-mm diameter test tubes and capped. The test tubes should be positioned in the holes drilled in paraffin (around the Cf sources). For producing ^{128}I the irradiation time is 20 to 30 minutes.
5. When entering and leaving the room be sure the door closes completely.
6. The room also houses Pu(Be) sources, stock radioactive solutions in lead containers as well as solid radioactive wastes in barrels.
7. The Cf sources are the major radiation sources in the room. The maximum dose is on top of the source (at contact) - 40 mRem/hr gamma and 100 mRem/hr neutrons. **If the body is exposed at this position the maximum permissible dose of 100 mRem per week will be obtained in about 40 minutes**. **AT ALL TIMES KEEP AS FAR AWAY FROM THE SOURCE AS POSSIBLE**. Refer to dose information posted at the entrance.
8. Prior to working in B-114B read NRC-3 Notice to Employees poasted at the entrance.

I have read the above instructions. I understand the instructions and will abide by them all the time. I have retained a copy of the instructions for my record.

Signature: _____

Date: _____

10. RADIATION SAFETY PROGRAM

The scope of teaching and research utilizing radioactive materials at Eastern Michigan University is relatively small. At present there are five faculty members who routinely use radioactive materials; there are two other faculty members who use radioactive materials occasionally. The work also involves research students; the students work under the direct supervision of faculty members. **However, the nature of the work is such that it is necessary to have the flexibility of the Broadscope license.** A **Radiation Safety Committee (RSC)** is appointed by the Vice President for Academic Affairs. One of the faculty members who has expertise in handling radioactive materials is appointed as the **Radiation Safety Officer (RSO) by the RSC**. **The RSO takes care of the day to day aspects of radiation safety. The RSC advises the RSO on policy aspects.** The procedures are set up for running the small program; the faculty member working with the radioactive materials assumes a lot of the responsibilities which are normally assigned to a Radiation Control Group in a larger program. The Radiation Safety Program on the campus of the Eastern Michigan University is described in the following sections.

10.1 Current license

The application is for the renewal of our Type B Broadscope license #21-06885-01.

10.2 Radiation Safety Committee

The **Radiation Safety Committee (RSC)** was created by the President of the University in 1968 to monitor and control the radiation safety practices of the Univesity personnel. The members of RSC are appointed by the Vice President of Academic Affairs, based on the recommendation from appropriate departments. The membership include one faculty representative each from the departments which use radioactive materials; these members may be chosen by appropriate internal procedures in each Department and recommended to the Vice President of Academic Affairs. The term of appointment is indefinite, but for a minimum of three (3) years. The Director of the Office of Research Development and the Radiation Technologist from University Health Services will also be members of the committee. In addition, one representative each from Purchasing, Physical Plant, and a member-at large form University staff will be members of the RSC. **The Vice President for Academic Affairs will be an ex-Officio committee member, and will serve as the principle administrative liaison to the President/Executive Council on radiation safety matters.**

Committee Chairperson : The RSC will select its Chairperson for the period it feels appropriate.

Radiation Safety Officer (RSO) : The RSC will elect/appoint the RSO. The RSO must have the qualifications specified by the NRC. The RSO controls the procurement and use of radioactive materials and supervises the handling of radioactive materials. The committee also will elect/appoint an alternate RSO to act in the absence of the RSO.

The RSC **meets at least once each year**, more often if necessary; minutes of the meetings are kept and distributed to all the committee members and other appropriate personnel.

10.3 **Radiation Safety Officer**

The RSO, with the advise of RSC, discharges the following duties:

a. **Controls the Procurement and Use of Radioactive Materials.** The committee has set up a procedure for the purchase of radioactive materials. All such purchases must receive prior approval of the RSO. Approval requires that the user have the necessary experience for the type of experiment for which the material has been requested and that adequate facilities for handling and monitoring be available. If the person's experience for handling radioactivity is not adequate, the request is temporarily denied and efforts are made to (a) place the applicant under the direct supervision of an experienced person or (b) see that the applicant either gets the necessary training by enrolling in an approved course or gets training from one of the experienced users. Before approval, the proposed use of the radioactive material is reviewed, specifically with regard to safety. The form used at present for approval of the purchase of radioactive material is included in the "**Instructions Regarding the Purchase and Handling of Radioactive Materials" (Appendix A)**.

b. **Supervises the Handling of Radioactive Materials**. Procedures suggested in the NBS Handbook 92 on "Safe Handling of Radioactive Materials" are recommended to all personnel, handling radioactive materials. A general guideline on radiation safety and on the precautions to be taken in a radioactive laboratory is given to all personnel using radioactive materials. A copy of the instructions labeled "**Radiation Safety Instructions**" is included as **appendix B.** Experimenters are responsible for the monitoring and periodic survey of their laboratories in accordance with procedures approved by the RSO. Records of the monitoring and surveys are to be kept by the experimenter and checked periodically by RSO. The handling procedures for radioactive materials in each laboratory are subject to periodic review by the RSO.

c. **Supervises the Control of Radioactive Materials**. Individuals procuring radioactive materials are required to keep detailed records of the materials received, transferred or disposed of. The transfer of radioactive materials must be cleared with the RSO and properly recorded. The radioactive laboratories are inspected periodically by the RSO. During inspection particular attention is paid to the general security of the laboratory, posting of appropriate warning labels, records on surveys,receipt and disposal, and the storage of radioactive samples and waste. A copy of the general instructions given to individuals on these matters is included as **appendix A. A blank form used for inspection reports is included in appendix C.**

The RSO maintains a file of radioactive purchase requests which serves as an inventory of all radioactive materials on campus. The investigators are required to maintain detailed record of each radioactive materials received by them (showing the quantities used and disposed); the records are periodically checked by the RSO.

The RSO furnishes consulting services on monitoring and waste disposal aspects. The RSO supervises and coordinates shipment of wastes to commercial disposers. The RSO periodically inspects the records kept by the faculty members working with radioactive materials. The RSO keeps the RSC and other radiation workers informed of any changes in NRC rules regarding waste disposal and other materials.

10.4 Administrative Procedures

The RSC has established certain basic rules for the purchase and receival of radioactive materials. In addition the committee has also set up guidelines for the safe handling of radioactive materials, monitoring of the laboratories, record keeping and waste disposal. The following sections outlines the procedures.

10.4.1 Control of Procurement and Use

As mentioned in section 10.3 the procurement and use of radioactiave materials is controlled by the RSO. All users of radioactive materials must have the approval of the RSO. A faculty member who is initiating experiments with radioactive materials for the first time must submit a request giving details of their experience with the handling of radioactive materials as well as the proposed use of the tracer. The details are given in section 10.3a. To order radioactive materials the investigator submits a request to the RSO for the purchase of a specific amount of the tracer. The RSO indicates the approval of the purchase in the "Requisition" sent to the Purchasing Department. A copy of the form used in included in Appendix A. The "Requisition" also has information as to whom the material should be delivered. As soon as the material is received the Central Receiving contacts the person who ordered it and delivers it to him/her; if that person is not available the Central Receiving delivers the material to the RSO. A copy of the instruction memo issued by the Director of Purchasing to the staff is included as **Appendix D**.

10.4.2 Safety Evaluations of Proposed Uses

The "Approval Form" (Appendix A) submitted to the RSO along with the "Requisition" for the purchase of radioactive materials has information about the proposed experiment. The RSO evaluates the safety aspects experiment, taking into account the facility where the experiment will be performed, before approval of the purchase. If necessary he consults other members of the committee or requests a meeting of the committee for discussion.

10.4.3 Review of Radiation Dose Received by Experimenters

In 1992 the RSC setup a procedure requiring all users of monitoring devices(e.g. film badge service) to send a copy of the report to RSO. A review of the reports indicate that the doses received are mostly reported as "min". However in order to emphasize ALARA concept two trigger levels will be used:

ALARA-1: An individual receives 50 mRem or higher over a period of a month. A note will be sent to the individual, with a copy to the supervisor of the laboratory, alerting them to the fact that the dose received exceeds the ALARA-level 1. The dose selected, 50 mRem, is approximately one-tenth of the maximum permissible dose, if the dose is uniformly spread over the year. In addition it is approximately one-tenth of the maximum permissible dose "to an embryo/fetus during the entire pregnancy, due to occupational exposure of a declared pregnant woman." Alerting at this stage will help women evaluate their individual situation.

ALARA-2: An individual receives 150 mRem or higher over a period of a month. A note will be sent to the individual, with a copy to the supervisor of the laboratory, alerting them to the fact that the dose received exceeds the ALARA-level 2. The dose

selected, 150 mRem, is approximately one-third of the maximum permissible dose, if the dose is uniformly spread over the year. The note will require the experimenter to evaluate the experimental procedures with respect to radiation exposure, explore possible ways to reduce the dose and submit a report to the Radiation Safety Committee [RSC] in two weeks. The Radiation Safety Officer [RSO] will be available for consultation during the review process. The RSC or the RSO will evaluate the report and provide suggestions if necessary.

10.5 Bioassays

The quantities of ^{3}H and ^{125}I used so far or expected to be used in the near future do not warrant bioassays. If levels of these nuclides suggested in the regulatory guide are used arrangements for bioassays will be made.

10.6 Emergency Procedures

The levels of radioactive materials used are small. The typical emergency will be a spill. The laboratory supervisor instructs the worker about the emergency procedures. Since the faculty member is always directly involved in the experiment emergency action is taken by them. The RSO and other RSC members are available for consultation.

11. WASTE MANAGEMENT

A good amount of tracer work is performed using "short-lived" nuclides like ^{32}P, ^{35}S, ^{51}Cr, ^{82}Br, ^{124}Sb, ^{140}La, ^{203}Hg etc at fraction of a millicurie level. Solid and liquid wastes are collected, stored to allow for decay, monitored and disposed of. Other liquid wastes are disposed via sewage in conformance with section 20.2003 of 10 CFR Part 20. **Permission is requested to store and dispose of wastes containing radioactive materials with half-lives up to six months** .

At present none of the experimenters use long-lived tracers like ^{3}H and ^{14}C in tracer work at EMU campus. Hence EMU does not face long term waste storage problem. During 1980 some low level H-3 and C-14 liquid and solid wastes and some animal carcases were disposed of using the services of Atomic Disposal Co., Inc. in Tinley Park, Ill. If necessary, and if such disposal facilities are available for users in Michigan in the future, again such commercial waste disposal service will be employed.

Appendix A

INSTRUCTIONS REGARDING THE PURCHASE AND HANDLING OF RADIOACTIVE MATERIALS

PURCHASE OF RADIOACTIVE MATERIAL

All purchases of radioactive materials must receive prior approval of the Radiation Safety Officer (RSO). Fill out this form, attach to the departmental purchase requisition and forward to:

K. Rengan
Radiation Safety Officer
Chemistry Department
Mark Jefferson

The requisition should be specifically marked "**Radioactive Material**". It should also have the name, telephone number and address of the individual to be contacted upon arrival of the material.

A copy of this form and the purchase requisition will be forwarded to the University Purchasing Department. A second copy of this form will be sent to the experimenter. **Page three of this form should be completed by the experimenter and sent to K. Rengan as soon as the material is received.**

Instructions for Receiving Radioactive Material

The package containing the radioactive material will be delivered by the Central Receiving directly to the person identified in the purchase order. Upon receipt, inspect the package for external damage. If no damage is apparent monitor the external surface for contamination by wipe test. Keep record of the wipe test. **If the package is damaged immediately inform you laboratory supervisor for further action; keep the package aside while waiting for the arrival of your supervisor**.

All users of radioactive materials must also have the approval of the RSO. To obtain such approval, contact the RSO or the chairman of the RSC.

Approval Form For The Purchase of Radioactive Material

Date: Requisition No.

1. Name:

   Department: Telephone No.:

2. Radioactive isotope, chemical forms, amount:

3. Proposed use (include the amount to be used in each experiment)

4. Describe monitoring procedure and frequency (specifydetector, efficiency and relevant information):

5. a. Rooms in which the radioactive isotope will be used and stored:

   b. Are these rooms properly posted and secured for radioactive work?

Date: Approved by:

Receipt of Radioactive Material*

Requisition Number:

Purchase order Number:

Nuclide:

Amount :

Date Received:

Status of the package when received :

No damage _____ Damaged** _____

**If damaged do not open; inform your supervisor for further action.

External surface was monitored; the wipe test showed

no contamination _____ contamination# ____

#If contamination exceed the NRC limit the delivery carrier has to be notified immediately. Contact your supervisor for further action.

Describe below the action taken.

Status of the vial containing the radioactive solution: _____

Stored at: Room _____ of _____

*The portion pertaining to the receipt of the radioactive material should be **completed by the experimenter as soon as the material is received by him/her.** A copy of this form should be sent to the RSO immediately (K. Rengan, Chemistry Department) so that the material can be included in the Radioactive Material Inventory.

Revised 1996

RECORD OF RADIOACTIVE MATERIALS RECEIVED

Each individual receiving radioactive material should maintain a detailed record showing the radioactive nuclide received, quantity and the date. The record should show the dates and results of any tests for leakage required for the source as well as amounts removed for transfer or disposal. These records will be checked periodically by the RSC.

TRANSFER OF RADIOACTIVE MATERIALS

The transfer of any radioactive material outside its designated use areas or the transfer of radioactive material into the University area from outside must be cleared with the Radiation Safety Officer. Depending on the quantity and nature of the material to be transferred, the Radiation Safety Officer may require the "Transfer of Radioactive Material" form to be filled out. In all cases the individual must keep proper records of the transfer. **Appropriate precautions need to be taken in terms of dose and contamination. For transporting sources containing more than a few microcuries consult with the RSO first.**

"FORM" - See next page.

TRANSFER OF RADIOACTIVE MATERIAL

Material to be transported*

AMOUNT

Chemical Form:

Transported from _____

To _____

By _____

Dose outside the shield:

Date: _____

*If it is a sealed source to be transported back and forth, continue the record on the back of this form (for further transportations).

WASTE DISPOSAL

The disposal of radioactive wastes is an important aspect of the use of radioactive materials. The individual user is referred to NBS Handbook 92 and US NRC regulations given in 10 CFR part 20, subpart K(20.2001-2007). These documents are available with the Radiation Safety Officer.

Please note that only certain type of readily soluble radioactive materials can be disposed into sanitary sewage. Nuclear Regulatory Commission has strict regulations concerning such disposal. The rules are specified in the sections of 10 CFR part 20.2003. The quantity of sewage flowing out of the University buildings will vary over a wide range, depending on the time of the year. **In addition local sewer processing plants may have problems associated with even small amounts of radioactivity, even if NRC guidelines allow it.** The individual user should consult the Radiological Safety Officer before disposing of any radioactive waste through the sewage system.

Liquid waste containing large amounts of long-lived radioactive materials have to be stored carefully until disposal facilities are available. The storage area should be monitored periodically for leakage.

All solid radioactive wastes containing long-lived radioactive materials must be stored safely until the State of Michigan has a disposal facility or the users in the State of Michigan are allowed send the waste for disposal at other licensed facilities for disposal. Solid radioactive wastes containing short-lived radioactive materials are to be stored for ten half-lives to allow for decay, monitored with appropriate detection system and disposed of; record of such disposal should be kept.

MONITORING OF WORK AREAS

Each of the laboratories using radioactive material should be surveyed at frequent intervals **in accordance with safety procedures approved by the Radiation Safety Officer**. It is the responsibility of the individual in charge of the laboratory to make surveys at the proper intervals and to keep a record of them.

PERSONNEL MONITORING

According to 10 CFR 20.1502 appropriate personnel monitoring equipment must be supplied to individuals who are entering restricted areas and are likely to receive a dose in excess of 10% of the limits set in 10CFR part20.1201 (20.1208 for declared pregnant woman).

The individual in charge of the laboratory must consult the Radiation Safety Officer regarding this question (i.e. whether personnel monitoring equipment should be provided under a specific circumstance) and make the necessary arrangements for personnel monitoring equipment.

SAFE HANDLING OF RADIOACTIVE MATERIALS

The rules to be observed will depend on the actual radioisotope being handled, the amount and the particular experiment. **Four video tapes are available at the Instructional Support Center [Room 102, Library] which give general information on radiation safety.**

Video Title	Time
Radiation Safety I	15 min
Radiation Safety II	15 min 30 sec
Radiation Safety III	10 min 53 sec
The Key to Decontamination Procedures	16 min

As part of the required radiation safety training you are required to view the videos before starting to work with radioactive materials. In addition your laboratory supervisor will give information pertaining to the safety aspects of your experiments.

Some general guidelines are given below:

1. A film badge must be worn by all persons in areas designated as Radiation areas, unless specifically excluded by the rules of that area.

2. Eating, smoking and drinking are strictly prohibited in radiation areas.

3. Direct contact with radioactive materials must be avoided. Protective laboratory coats, gloves, safety glasses, etc. should be worn.

4. Adequate lead shielding should be used to minimize personnel exposure to radiation.

5. Pipetting of solutions should be carried out using safety pipettes.

6. A well-ventilated fume hood should be used in all work where radioactive material may be lost by volatilization, spraying, etc.

7. Radioactive materials must be stored in properly designated areas. All containers of radioactive materials must be labelled with standard warning tape or labels. Such labels on empty containers not in use must be removed or otherwise obliterated.

8. All liquid and solid radioactive wastes must be collected in properly marked containers and disposed of in accordance with approved procedures.

9. Personal items, food and drinks must not be stored along with radioactive materials.

10. Transfer of radioactive materials outside the designated use areas must be cleared with the Radiation Safety Officer.

11. Radiation areas should be surveyed at frequent intervals in accordance with the safety procedures approved by the Radiation Safety Officer.

12. Any spillage or contamination must be reported immediately to the person in charge of the laboratory.

13. Proper steps should be taken immediately to prevent spread of contamination and also to decontaminate the affected area.

14. In case of personal contamination the affected person should not leave the area; he (or she) should summon help.

15. If the spill involves millicurie level of radioactive material all persons not involved in the spill should leave the room. The supervisor should be contacted immediately to take charge of the cleanup operation. Entry to the area should be secured. The supervisor should take appropriate action for decontamination of the person and the area and should inform the RSO.

Appendix B

RADIATION SAFETY INSTRUCTIONS
10CFR19.12

Eastern Michigan University

INTRODUCTION:

The purpose of these instructions is to inform all individuals working in rooms where radioactive materials are handled about: (1) health protection problems associated with radiation exposure; (2) radiation protection devices and techniques; (3) low level radioactive waste disposal; (4) U.S. Nuclear Regulatory Commission (NRC) regulations and licenses; (5) responsibilites for reporting violations of NRC regulations and licenses; and (6) obtaining radiation exposure records. At the present the radioactive materials are confined to a few rooms in Mark Jefferson Science Building, Strong Hall, Roosevelt Hall, and Hover. The work involves storage, transfer and use of a variety of radioactive materials which, if improperly handled, are particularly hazardous.

HEALTH PROTECTION PROBLEMS ASSOCIATED WITH RADIATION EXPOSURE:

Radiation from radioactive substances is a stream of fast-flying particles or waves which can neither be seen nor felt. Danger from radiation depends on the length of time and the levels of radiation to which a person is exposed.

Most people are exposed to about 1/10 rem each year from naturally occurring background radiation. (A rem is the unit in which radiation exposure is measured and is simple a label for a certain amount of radiation.) Exposure of the entire body to 100 rem in a short period of time may cause sickness, followed by apparent complete recovery.

The NRC has set 5 rems as occupational limit for radiation workers (10CFR20.1201). Personnel exposures are monitored monthly to ensure that these limits are not exceeded.

The NRC requires that the exposure to embryo/fetus does not exceed 0.5 rem during the entire pregnancy of a declared pregnant woman, i.e., a woman who has voluntarily informed her employer, in writing, of her pregnancy and the estimated date of conception [10CFR1208.]. The limit is reduced because of the sensitivity of a rapidly developing fetus to radiation.

RADIATION PROTECTION DEVICES AND TECHNIQUES:

Danger from radiation is caused by exposure from nearby sources and from exposure due to sources on or internal to individuals caused by contamination resulting from physical contact between a person and a radioactive material.

Exposure to radiation can be limited by: (1) limiting the time of work in a radiation field, (2) maximizing the distance between work areas and radiation sources, and (3) maximizing the distance between work areas and radiation

sources, and (3) placing a heavy object or shield between yourself and a radiation source. Contamination is limited by: (1) protective clothing, (2) staying clear of contaminated areas and equipment, (3) monitoring hands and clothing frequently while working with radioactive materials, (4) removal of contaminated articles of clothing, and (5) washing contaminated parts of the body.

PERSONNEL MONITORING

According to 10 CFR 20.1502 appropriate personnel equipment must be supplied to individuals who are entering restricted area and are likely to receive a dose in excess of 10% of the limits specified [5 rems per year for adults]. If your work involves handling radioactive materials or working near a radiation area **where you could receive 10% of the maximum dose specified for occupational radiation workers**, a film badge monitor or a dosimeter will be provided. The individual, before starting to work with radioactive materials, should ascertain with their supervisor or the RSO whether personnel monitoring devices should be worn. **It is the responsibility of the faculty supervisor to make the necessary arrangements for personnel monitoring equipment.**

LOW LEVEL RADIOACTIVE WASTE

Low level radioactive waste, such as contaminated blotter paper and polyethylene sample holders, is to be deposited in specially marked containers. The containers are to be used exclusively for radioactive and contaminated materials. No liquids are permitted in containers of solid wastes. Radioactive liquid wastes are to be collected separately in properly labelled containers.

U.S. NUCLEAR REGULATORY COMMISSION(NRC) REGULATIONS AND LICENSES:

Rules and regulations governing radioactive work are in accordance with procedures designed to minimize individual danger from radiation. Procedures are based upon NRC rules and regulations. EMU has a Type B Broad Scope License granted by NRC. NRC rules and regulations, the EMU license and safety procedures are available for inspection from the Radiation Safety Officer.

RADIATION SAFETY COMMITTEE:

EMU has a Radiation Safety Committee (RSC) which regulates all matters concerning radioactive materials. The Radiation Safety Officer, (RSO), who is also a member of RSC), in consultation with the RSC conducts the operation. The names of RSC members and their telephone numbers are available from Krish Rengan, RSO, or from the Office of the Associate Provost.

REPORTING VIOLATIONS OF NRC REGULATIONS

All known or suspected violations of NRC regulations must be reported to the RSO or any member of the RSC. Any condition that you suspect may cause unnecessary exposure to radiation or radioactive material should be reported to the RSO immediately.

RADIATION EXPOSURE RECORDS:

You may obtain a report on the amount of radiation exposure you received working at EMU **if you worked in a radiation area and used a film badge.** Mail your name, social security number, name of the department in which you worked and your immediate supervisor, the approximate dates you were at EMU and a request for your exposure record to your supervisor.

SAFE HANDLING OF RADIOACTIVE MATERIALS

The rules to be observed will depend on the actual radioisotope being handled, the amount and the particular experiment. **Four video tapes are available at the Instructional Support Center [Room 102, Library] which give general information on radiation safety.**

Video Title	Time
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As part of the required radiation safety training you are required to view the videos before starting to work with radioactive materials. In addition your laboratory supervisor will give information pertaining to the safety aspects of your experiments.

Some general guidelines are given below:

1. A film badge must be worn by all persons in areas designated as Radiation areas, unless specifically excluded by the rules of that area.

2. Eating, smoking and drinking are strictly prohibited in radiation areas.

3. Direct contact with radioactive materials must be avoided. Protective laboratory coats, gloves, safety glasses, etc. should be worn.

4. Adequate lead shielding should be used to minimize personnel exposure to radiation.

5. Pipetting of solutions should be carried out using safety pipettes.

6. A well-ventilated fume hood should be used in all work where radioactive material may be lost by volatilization, spraying, etc.

7. Radioactive materials must be stored in properly designated areas. All containers of radioactive materials must be labelled with standard warning tape or labels. Such labels on empty containers not in use must be removed or otherwise obliterated.

8. All liquid and solid radioactive wastes must be collected in properly marked containers and disposed of in accordance with approved procedures.

9. Personal items, food and drinks must not be stored along with radioactive materials.

10. Transfer of radioactive materials outside the designated use areas must be cleared with the Radiation Safety Officer.

11. Radiation areas should be surveyed at frequent intervals in accordance with the safety procedures approved by the Radiation Safety Officer.

12. Any spillage or contamination must be reported immediately to the person in charge of the laboratory.

13. Proper steps should be taken immediately to prevent spread of contamination and also to decontaminate the affected area.

14. In case of personal contamination the affected person should not leave the area; he (or she) should summon help.

15. If the spill involves millicurie level of radioactive material all persons not involved in the spill should leave the room. The supervisor should be contacted immediately to take charge of the cleanup operation. Entry to the area should be secured. The supervisor should take appropriate action for decontamination of the person and the area and should inform the RSO.

Radiation Safety Committee

Merlyn Minick Biology Dept. Mark Jefferson 487-4391	Chairman RSC Alternate RSO
K. Rengan Chemistry Dept. B-114 Jefferson 487-0086, 487-0106	Secretary RSC Radiation Safety Officer
Director Office of Research Development 487-3090	Member
Purchasing Agent in charge of procurement of radioactive materials Purchasing 487-1203	Member
Judith Glotfelty University Health Services 487-1122	Member
Albert Robinson University Parking 487-0346	Member
Gary Hammerberg Associate Health Professions 487-4094	Member
Malcolm Marts Physical Plant 487-3380	Member
Wade Shen Physics Department 487-4144	Member
Provost and Vice President of Academic Affairs 146 Pierce Hall 487-3200	Ex-Officio member

RECEIPT OF INSTRUCTIONS:

Please sign and return the following sheet to your supervisor. Also please send a copy of this to K. Rengan, RSO, Chemistry Department.

I have received instructions from my supervisor about safe handling of radioactive materials to be used in our experiments. Further I have read the **"RADIATION SAFETY INSTRUCTIONS" and understand them**.

I viewed the four video tapes available at the Instructional Support Center at the time and date shown below:

Date viewed: _____

Time viewed; _____

_____
Printed Name

_____
Signature Date

_____
Faculty/Student-Course No./Experimenter-Dept.

Revised 1996

Appendix C

EASTERN MICHIGAN UNIVERSITY
RADIATION SAFETY COMMITTEE
RADIOACTIVE LABORATORY INSPECTION REPORT

Laboratory inspected :

Date inspected :

Person(s) in-charge :

Inspection team :

General laboratory status (storage, security, signs etc.) :

Comments on records :
Monitoring records -

Waste disposal records -

Material receipt records -

Additional comments -

RADIATION SAFETY COMMITTEE
RADIOACTIVE LABORATORY INSPECTION REPORT

(continued)

Radionuclides in use (or stored) :

Quantity of each (approximate) :

Dose level - Waste :

Dose level - Fume hood :

Dose level - Storage :

Survey meter used :

Wipe tests - samples from

1.

2.

3.

Signature of Inspectors :

Krish Rengan

Form Date 9/10/96

APPENDIX D

EASTERN MICHIGAN UNIVERSITY
INTEROFFICE MEMORANDUM

TO: Dr. K. Rengan, PhD., Chairman
Radiation Safety Committee
Helen Gates-Bryant, Buyer, Purchasing
Rick Paffenroth, Manager, University Stores

FROM: Gary L. Reffitt, Director
Purchasing and Communications

DATE: May 25, 1994

SUBJECT: Purchase of Radioactive Materials

RADIOACTIVE MATERIALS PROCEDURES

1.	Originating Department:		Complete authorization form and requisition requesting materials. Forward to K. Rengan, University Radiation Safety Officer, Chemistry Department.
2.	University Radiation Safety Officer		Approve - Forward to Purchasing Disapprove - Return to Department
3.	Purchasing		Create purchase order. Attach radioactive material receiving record to Central Receiving Copy.
4.	Central Receiving	A.	All deliveries will be properly identified as radioactive.
		B.	NO shipments will be opened for inspection.
		C.	Complete radioactive material receiving record.
		D.	Contact individual requesting materials to arrange delivery.
		E.	If individual cannot be contacted, contact University Radiation Safety Officer, K. Rengan at 7-0086 or 7-0106.

Eastern Michigan University

INTER-OFFICE CORRESPONDENCE

TO: All Members of Purchasing Staff and Frank Miller, Central Receiving

DATE: October 17, 1977

FROM: William D. Swihart, Director of Purchasing

SUBJECT: (Update) Rules for Purchase of Radio Active Materials

Purchasing

Today I met with the Radiation Safety Committee and discussed procedures which will have to be followed in the purchasing and receiving of radiation supplies.

All requisitions must have the signature of Dr. Krishnaswamy Rengan, Ph.D., Chairman of the Radiation Safety Committee, approving the purchase of any radioactive materials prior to their purchase. Any requisition received without his approval will be sent immediately to Dr. Rengan's office in Jefferson ScienceBuilding. If approved, he will return it to the Purchasing Department.

No shipments will be permitted to be made unless there is an authorized purchase order issued to the vendor. Any materials arriving without the proper authorization are to be returned. Each requisition, in addition to having authorization form the Radiation Safety Committee, must also have on that same requisition the individual's name who is to receive the shipment, his telephone number and location.

Receiving

Rules for receiving of radioactive materials must be very strict. All personnel authorized to receive shipments must be made aware of the rules of the University for receiving this material. No shipments will be opened for inspection. I am advised that according to all laws, such materials must be so marked on the outside of the package stating the package contains radioactive materials.

As soon as a shipment is received, immediately pull the purchase order and call the individual whose name is designated on the purchase order. Upon contacting the individual you will set up a time when it is agreeable for both the Receiving Department to deliver, and the individual, or one to whom he designates the responsibility to receive that material. No material will be delivered directly to the department without first notifying the designated person on the purchase order prior to its delivery. If the individual stated on the purchase order wishes to pick up the shipment at Receiving he is free to do so. When the individual arrives and he is a person you do not know, you are within your rights to ask for identification.

As you can see, both the Purchasing Department and the Receiving Department will have a great responsibility to insure the University receives only authorized shipments of radioactive materials.

If, after receiving this memo, you feel it is necessary to have a Staff meeting and discuss this further, I will be glad to call one. In the Receiving Department, I will be only too happy to meet with your department, sit down and discuss this with them and answer any questions you may have. The responsibility of carrying out the above procedures is each person who is involved. Because of its importance, we will not tolerate any deviation from this procedure unless discussed with me.

WDS:jlh

xc: Dr. Krishnaswamy Rengan, Ph D.
Chairman Radiation Safety Committee

Robert A. Andrews
Manager of Service Operations

CONVERSATION RECORD

TIME 01:00pm DATE 07/31/96

○ VISIT ○ CONFERENCE X TELEPHONE

○ INCOMING
X OUTGOING

NAME OF PERSON(S) CONTACTED OR IN CONTACT ORGANIZATION (OFFICE, DEPT.ETC.) TELEPHONE NO. 313 4870066
K. Rengan, Ph.D. RSO, Eastern Michigan University

SUBJECT
License Renewal (License No. 21-06885-01)

SUMMARY

We discussed the differences between a broadscope A license and a broadscope B license. I pointed out that in a broadscope type B license a radiation safety committee is not required. He stated that he had not understood that fact and would much prefer to not have an RSC due to difficulties of obtaining a quorum for the meetings and the fact that the University has a very limited number of authorized users. He indicated that he would like to amend the application to place all of the committee responsibilities on the RSO. We will continue these discussions

ACTION REQUIRED
None

NAME OF PERSON DOCUMENTING CONVERSATION SIGNATURE DATE
John D. Jones John D. Jones 07/31/96

ACTION TAKEN

SIGNATURE TITLE DATE

JUN 0 3 1994

Eastern Michigan University
ATTN: K. Rengan
Radiation Safety Officer
Department of Chemistry
Jefferson Science Building
Room 225
Ypsilanti, MI 48197

License No. 21-06885-01
Control No. 397029

Dear Mr. Rengan:

SUBJECT: LICENSE RENEWAL APPLICATION

This is to acknowledge receipt of your application for renewal of the material(s) license identified above. Your application is deemed timely filed, and accordingly, the license will not expire until final action has been taken by this office.

Any correspondence regarding the renewal application should reference the control number specified and your license number.

Sincerely,

Original Signed By
Marianne Meenan, Chief
Nuclear Materials Support Section

RIII
Meenan/bt
06/3/94