VOID SHEET

TO: License Fee Management Branch

FROM: R III

SUBJECT: VOIDED APPLICATION

Control Number: 395502

Applicant: University of Notre Dame

Date Voided: 8-31-93

Reason for Void: Requested by licensee in letter dated August 11, 1993. Rather than renew the irradiator license, 13-01983-16, as originally requested by action referenced above, the licensee requested voiding this action and terminating this license (CN 395584) concurrent with an amendment (CN 395583) to add the irradiator to their broad scope license, 13-01983-15.

Loren J. Hueter 8-31-93
Signature Date

Attachment:
Official Record Copy of
Voided Action

FOR LFMB USE ONLY

Final Review of VOID Completed:

☐ Refund Authorized and processed

☐ No Refund Due

☑ Fee Exempt or Fee Not Required

Comments: ____________

Log completed ☑

Processed by: SAC 4/19/94

ML 3¢ DH

040261

9405110320 930831
PDR ADOCK 03019527
C PDR

(FOR LFMS USE)
INFORMATION FROM LTS

PROGRAM CODE: 03510
STATUS CODE: 2
FEE CATEGORY: EX 3E
EXP. DATE: 19930831
FEE COMMENTS: 170.11(A)(4)
DECOM FIN ASSUR REQD:

BETWEEN:

LICENSE FEE MANAGEMENT BRANCH, ARM
AND
REGIONAL LICENSING SECTIONS

LICENSE FEE TRANSMITTAL

A. REGION

1. APPLICATION ATTACHED
   APPLICANT/LICENSEE: NOTRE DAME, UNIVERSITY OF
   RECEIVED DATE: 930730
   DOCKET NO: 3019527
   CONTROL NO.: 395502
   LICENSE NO.: 13-01983-16
   ACTION TYPE: RENEWAL

2. FEE ATTACHED
   AMOUNT: 0
   CHECK NO.: 0

EX 3E

3. COMMENTS

SIGNED Deborah Hersey
DATE 8-2-93

FEE EXEMPT

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

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

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

3. OTHER

SIGNED AC
DATE 8-10-93

RECEIVED

AUG 16 1993

REGION III

NRC FORM 313
(3-92)
10 CFR 30, 32, 33, 34, 35 and 40

U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB: NO. 3150-0120
EXPIRES 6-30-93

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 3.25 HOURS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (MNBB 7714), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555, 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 MATERIAL SAFETY AND SAFEGUARDS
U.S. NUCLEAR REGULATORY COMMISSION
WASHINGTON, DC 20555

ALL OTHER PERSONS FILE APPLICATIONS AS FOLLOWS:

IF YOUR ARE LOCATED IN:

CONNECTICUT, DELAWARE, DISTRICT OF COLUMBIA, MAINE, MARYLDAND, 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 SAFETY SECTION
U.S. NUCLEAR REGULATORY COMMISSION, REGION II
101 MARIETTA STREET, NW, SUITE 2900
ATLANTA, GA 30323

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

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

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

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

NUCLEAR MATERIALS SAFETY SECTION
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.

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

[ ] A. NEW LICENSE
[ ] B. AMENDMENT TO LICENSE NUMBER ______
[X] C. RENEWAL OF LICENSE NUMBER 13-01983-16

2. NAME AND MAILING ADDRESS OF APPLICANT (Includes Zip Code)

University of Notre Dame
Risk Management and Safety Department
University of Notre Dame
~~Notre Dame, IN 46556~~

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

Biological Sciences Department
Juniper Road, Galvin Life Science Building
University of Notre Dame Notre Dame, IN 46556

4. NAME OF PERSON TO BE CONTACTED ABOUT THIS APPLICATION: Robert M. Zerr

TELEPHONE NUMBER: (219) 631-5037

SUBMIT ITEMS 5 THROUGH 11 ON 8½ 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 AND EXPERIENCE.

8. TRAINING FOR INDIVIDUALS WORKING IN OR FREQUENTING RESTRICTRED AREAS.

9. FACILITIES AND EQUIPMENT.

10. RADIATION SAFETY PROGRAM.

11. WASTE MANAGEMENT.

12. LICENSEE FEES (See 10 CFR 170 and Section 170.31) Exempt by Section 170.11 (4) of 10 CFR 10
FEE CATEGORY
AMOUNT ENCLOSED $ -0-

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, 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 OFFICE TO MAKE A WILLFULLY FALSE STATEMENT OR REPRESENTATION TO ANY DEPARTMENT OR AGENCY OF THE UNITED STATES AS TO ANY MATTER WITHIN ITS JURISDICTION.

SIGNATURE—CERTIFYING OFFICER	TYPED/PRINTED NAME	TITLE	DATE
James J. Lyphout	James J. Lyphout	Associate Vice President for Business Affairs	

FOR NRC USE ONLY

TYPE OF FEE	FEE LOG	FEE CATEGORY	COMMENTS
Renewal	Aug 2	III EX 3E	
AMOUNT RECEIVED	CHECK NUMBER		
FEE EXEMPT			
APPROVED BY	170.11(a)(4)		

RECEIVED
JUL 30 1993
8-10-93
~~REGION III~~

NRC FORM 313 (3-92)

CONTROL NO. 395502

James J. Lyphout
Associate Vice President · Business Affairs

Telephone 219/239-6646

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1842 · 1992
SESQUICENTENNIAL

University of Notre Dame
Notre Dame, Indiana 46556

July 29, 1993

U.S. Nuclear Regulatory Commission
Region III
Material Licensing Section
799 Roosevelt Road
Glen Ellyn, IL 60137

Gentlemen:

Enclosed is an application for the renewal of our U.S. Nuclear Regulatory Commission Materials License Number 13-01983-16.

As provided in Section 170.11 (4), we believe the University is exempt from payment of a license renewal fee.

Please let us know if we can further clarify any statement in this document, or if we can be of assistance to you in any way.

Sincerely,

James J. Lyphout

James J. Lyphout
Associate Vice President
for Business Affairs

JJL:mcn

Enclosures

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JUL 30 1993
REGION III

CONTROL NO. 395502

Item 5 - Radioactive Material

a. Cesium 137
b. Sealed sources - custom ORNL Teletherapy Type Capsule
c. 4000 Curies - original - Current Activity 1963 curies
d. Ohio Nuclear, Inc. Model II Irradiator

Item 6 - Purposes for Which Licensed Material Will Be Used

The irradiator will be used for the irradiation of biological and chemical samples. The terms "biological or chemical samples" do not include human beings, explosive materials or food for human consumption. The irradiator will be used in research and development as defined in Section 30.4 (q) or 10 CFR 30.

Item 7 - Individual (s) Responsible for Radiation Safety Program and Their Training and Experience

Regulating the use of radioactive material and radiation producing devices is the ultimate responsibility of the University of Notre Dame's Radiation Control Committee. Members of the Committee are appointed for two year terms by the President of the University. Administration of certain responsibilities of this Committee shall be delegated to the Radiation Safety Officer, who shall be qualified by training and experience in radiation safety. University Faculty Members wishing designation as Responsible Investigator and permission to use the Cesium Irradiator must complete the appropriate application (RCC Form 1) and submit it to the Radiation Control Committee. The Radiation Control Committee will rule on the qualifications of the individual to operate the Irradiator in a safe manner on the basis of experience and training.

Listed on the following pages are the members of the Radiation Control Committee and brief resumes of their technical qualifications including training and experience.

Individuals Responsible For Radiation Safety Program
And Their Training And Experience

Radiation Control Committee

1. John Lucey, Ph.D., Associate Professor, Aerospace and Mechanical Engineering, Committee Chairman.
2. Edgar Berners, Ph.D., Associate Faculty Fellow, Physics Department
3. Roger Bretthauer, Ph.D., Professor, Chemistry Department
4. Emerson Funk, Ph.D., Professor, Physics Department
5. Richard Hilliard, Director, Research Compliance, Advanced Studies, ex-officio
6. Charles Kulpa, Jr., Ph.D., Associate Professor, Biological Sciences Department
7. James Lyphout, Associate Vice President for Business Affairs, ex-officio
8. Andy Welding, Health Physicist, Risk Management and Safety Department, ex-officio
9. Howard Saz, Ph.D., Professor, Biological Sciences Department
10. Edward Ulicny, Staff Professional Specialist, Radiation Research Laboratory
11. Robert Zerr, Radiation Safety Officer and Director, Risk Management and Safety, ex-officio

Name: John Lucey

Title: Associate Professor

Department: Aerospace/Mech. Eng.

Degree/Area: Ph.D./Nuclear Eng. from

University: Mass. Institute of Technology

Training

Type	Where Trained	Date(s) of Training	Duration of Training	Formal Y or N	On the Job Y or N
a) Principle and Practices of Radiation Protection.	Mass. Institute of Technology	1960-1965	5 years	Y	Y
b) Radioactivity measurement, monitoring techniques, and instruments.	Mass. Institute of Technology	1960-1965	5 years	Y	Y
c) Mathematics and calculations basic to the use and measurement of radioactivity.	Mass. Institute of Technology	1960-1965	5 years	Y	Y
d) Biological effects of radiation.	Mass. Institute of Technology	1960-1965	5 years	Y	Y

Experience

Byproduct, source and/or special nuclear material	Chemical and/or Physical Form	Max. Amount (mCi or Kg)	Where Experience Gained	Duration of Experience	Dates of Experience
^{137}Cs	Sealed	15 mCi	Notre Dame	21 years	1966-1987
^{239}Pu	PuBe (Sealed)		Notre Dame	21 years	1966-1987
Natural Uranium	UO_2	4188 Kg	Notre Dame	21 years	1966-1987

Type of use for radioactive material:

Radioactive material used in Nuclear Engineering Laboratories for educational purposes.

TRAINING EXPERIENCE INFORMATION FOR INDIVIDUALS RESPONSIBLE FOR RADIATION SAFETY PROGRAM - UNIVERSITY OF NOTRE DAME

Name: Edgar D. Berners

Degree/Area: Ph.D.- Nuclear Phy. from

Title: Associate Faculty Fellow

University: University of Wisconsin

Department: Physics

Training

Type	Where Trained	Date(s) of Training	Duration of Training	Formal Y or N	On the Job Y or N
a) Principle and Practices of Radiation Protection	U. Wisc.	1953-1955	2 yrs.	N	Y
b) Radioactivity measurement, montioring techniques and instruments.	U. Wisc.	1953-1957	4 yrs.	Y	Y
c) Mathematics and calculations basic to the use and measurement of radioactivity.	U. Wisc.	1953-1955	2 yrs.	Y	Y
d) Biological effects of radiation.					

Experience

Byproduct, source and/or special nuclear material	Chemical and/or Physical Form	Max. Amount (mCi or Kg)	Where Experience Gained	Duration of Experience	Dates of Experience
^{226}Ra	Sealed Source	1.0 mCi	U. Wisc.	1 yr.	1955-1956
^{198}Au	Sealed Source	1.0 mCi	Argonne Lab	1 yr.	1962-1963
Pu	Sealed Source	1000 mCi	Notre Dame	25 yrs.	1968-1993
Accelerators			U. Wisc	4 yrs.	1953-1957
Accelerators			Notre Dame	25 yrs.	1968-1993

Type of use for Radioactive Material:

Calibration of detectors

Neutron flux measurements

CONTROL NO. 395502

RADIATION SAFETY PROGRAM - UNIVERSITY OF NOTRE DAME

Name: Roger Bretthauer

Title: Professor

Department: Chemistry

Degree/Area: Ph.D./Biochemistry from

University: Michigan State University

Training

Type	Where Trained	Date(s) of Training	Duration of Training	Formal Y or N	On the Job Y or N
a) Principle and Practices of Radiation Protection.	Michigan State U. of Wisconsin	1958-61 1962-64	On the Job 6 years	N	Y
b) Radioactivity measurement, monitoring techniques, and instruments.	Michigan State U. of Wisconsin	1958-61 1962-64	6 years	N	Y
c) Mathematics and calculations basic to the use and measurement of radioactivity.	Michigan State U. of Wisconsin	1958-61 1962-64	6 years	N	Y
d) Biological effects of radiation.	Michigan State U. of Wisconsin	1958-61 1962-64	6 years	N	Y

Experience

Byproduct, source and/or special nuclear material	Chemical and/or Physical Form	Max. Amount (mCi or Kg)	Where Experience Gained	Duration of Experience	Dates of Experience
^{3}H	Sodium Borohydride	500 mCi	Notre Dame	29 years	1964-93
^{14}C	Organic Cpds.	10 mCi	"	"	"
^{32}P	(sugars, amino	20 mCi	"	"	"
^{35}S	acids, &	10 mCi	"	"	"
^{33}P	nucleotides)	20 mCi	"	"	"

Type of use for radioactive material:

Tracers for in vitro and in vivo metabolic studies.

TRAINING AND EXPERIENCE INFORMATION FOR INDIVIDUALS RESPONSIBLE FOR
RADIATION SAFETY PROGRAM - UNIVERSITY OF NOTRE DAME

Name: Emerson Funk

Title: Professor

Department: Physics

Degree/Area: Experimental Ph.D./Nuclear Physics from

University: University of Michigan

Training

Type	Where Trained	Date(s) of Training	Duration of Training	Formal Y or N	On the Job Y or N
a) Principle and Practices of Radiation Protection.	University of Michigan	1954-58	2 years	Y	Y
b) Radioactivity measurement, monitoring techniques, and instruments.	University of Michigan	1954-58	2 years	Y	Y
c) Mathematics and calculations basic to the use and measurement of radioactivity.	University of Michigan	1954-58	2 years	Y	Y
d) Biological effects of radiation.	University of Notre Dame	1958-61	1 year	Y	Y

Experience

Byproduct, source and/or special nuclear material	Chemical and/or Physical Form	Max. Amount (mCi or Kg)	Where Experience Gained	Duration of Experience	Dates of Experience
^{57}Co	Sealed	5 mCi	Notre Dame	35 years	1958 - 93
^{14}C	Sealed	3 mCi	"	"	"
^{137}Cs	Sealed	10 mCi	"	"	"
^{241}Am	Sealed	12 mCi	"	"	"
^{244}Cm	Sealed	1 mCi	"	"	"
Plus many nuclides (≈ 25) in rare-earth region Z=57-71 such as 146Pm, 146Eu,					
173Lu, 182Ta in oxide, metal, liquid forms (Low-Level 10-100 µCi)					

Type of use for radioactive material:

Nuclear Spectroscopy and research in nuclear physics, decay scheme studies and detector calibrations.

CONTROL NO. 395502

TRAINING AND EXPERIENCE

RADIATION SAFETY PROGRAM - UNIVERSITY OF NOTRE DAME

Name: Richard A. Hilliard

Title: Director, Research Compliance

Department: Graduate School
Research Division

Degree/Area: Ph.D. Entomology from

University: Texas A & M University

Training

Type	Where Trained	Date(s) of Training	Duration of Training	Formal Y or N	On the Job Y or N
a) Principle and Practices of Radiation Protection.	TAMU	1974-1977	3 years	Y	Y
b) Radioactivity measurement, monitoring techniques, and instruments.	TAMU	1974-1977	3 years	Y	Y
c) Mathematics and calculations basic to the use and measurement of radioactivity.	TAMU	1974-1977	3 years	Y	Y
d) Biological effects of radiation.	TAMU	1974-1977	3 years	Y	Y

Experience

Byproduct, source and/or special nuclear material	Chemical and/or Physical Form	Max. Amount (mCi or Kg)	Where Experience Gained	Duration of Experience	Dates of Experience
^{14}C, ^{3}H,	Amino Acids	20 mCi	TAMU	9 years	1974-1983
^{35}S	Amino Acids	10 mCi	UND	3 years	1984-1989

Type of use for radioactive material:

In viro and in vitro labelling of proteins.

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MAY 25 1990
RISK MANAGEMENT
AND SAFETY

Name: Charles Kulpa

Title: Associate Professor

Department: Biological Sciences

Degree/Area: Ph.D./Microbiology from

University: University of Michigan

Training

Type	Where Trained	Date(s) of Training	Duration of Training	Formal Y or N	On the Job Y or N
a) Principle and Practices of Radiation Protection.	University of Michigan	1966-71	5 years	N	Y
b) Radioactivity measurement, monitoring techniques, and instruments.	University of Michigan NIH, Bethesda, MD	1966-71 1971-72	5 years 1 year	N	Y
c) Mathematics and calculations basic to the use and measurement of radioactivity.	University of Michigan NIH, Bethesda, MD	1966-71 1971-72	5 years 1 year	N	Y
d) Biological effects of radiation.	NIH, Bethesda MD	1971-72	1 year	Y	Y

Experience

Byproduct, source and/or special nuclear material	Chemical and/or Physical Form	Max. Amount (mCi or Kg)	Where Experience Gained	Duration of Experience	Dates of Experience
^{3}H	Glycerol, galactose	20 mCi	Notre Dame	21 years	1972-93
^{14}C	Carbohydrates	5 mCi	"	"	1972-93
^{32}P	Nucleotides	15 mCi	"	12 years	1981-93
^{125}I	Iodinated Antibodies	5 mCi	"	17 years	1976-93

Type of use for radioactive material:

Biological experiments: incorporation into cellular materials.

CONTROL NO. 395502

Name: James J. Lyphout

Title: Associate Vice President for Business Affairs
Ex-Officio Member

Experience: Member of Radiation Control Committee since July 1984

RADIATION SAFETY [illegible]

Name: Andrew G. Welding

Title: Health Physicist

Department: Risk Management and Safety

Degree/Area: [illegible]. Nuclear Med. Technology
B.A. Education from
Indiana University

University: Purdue University

Training

Type	Where Trained	Date(s) of Training	Duration of Training	Formal Y or N	On the Job Y or N
a) Principle and Practices of Radiation Protection.	Indiana Univ. Medical Center	1983, 1984	1 year	Y	N
b) Radioactivity measurement, monitoring techniques, and instruments.	Indiana Univ. Medical Center	1983, 1984	1 year	Y	N
	Nevada Test Site	1986	2 weeks	N	Y
	Oak Ridge Labs	1986	5 weeks	Y	N
c) Mathematics and calculations basic to the use and measurement of radioactivity.	Indiana Univ. Medical Center	1983, 1984	1 year	Y	N
	Oak Ridge Labs	1986	5 weeks	Y	N
d) Biological effects of radiation.	Indiana Univ. Medical Center	1983, 1984	1 year	Y	N
	Oak Ridge Labs	1986	5 weeks	Y	N

*On the job experience and training in all of the above areas with the Indiana State Board of Health, Radiological Health Section, January 1985 to June 1988.

Experience

Byproduct, source and/or special nuclear material	Chemical and/or Physical Form	Max. Amount (mCi or Kg)	Where Experience Gained	Duration of Experience	Dates of Experience
^{99m}Tc	Radiopharmaceutical	30.0 mCi	I.U.M.C.	1 year	8/83 - 8/84
^{123}I	"	0.3 mCi	"	"	"
^{131}I	"	0.1 mCi	"	"	"
^{201}Tl	"	2.0 mCi	"	"	"
^{111}In	"	5.0 mCi	"	"	"
^{67}Ga	"	5.0 mCi	"	"	"
^{133}Xe	"	30.0 mCi	"	"	"
^{137}Cs	Sealed	140.0 mCi	Notre Dame	5 years	7/88 - 7/93

Type of use for radioactive material:

Diagnostic Nuclear Medicine

Calibration of Portable Survey Meters

Registration and inspection of isotopes and radiation producing machine while with Radiological Health Section, ISBH, 1985 - 1988.

CONTROL NO. 395502

) Howard Saz | Degree/Area: Ph.D./Microbiology from

e: Professor | University: Western Reserve

artment Biological Sciences

ining

Type	Where Trained	Date(s) of Training	Duration of Training	Formal Y or N	On the Job Y or N
rinciple and Practices Radiation Protection.	Western Reserve University	1948-52	4 years	Y	Y
adioactivity measurement, monitoring echniques, and nstruments.	Western Reserve University	1948-52	4 years	Y	Y
athematics and calculations basic to the use nd measurement of adioactivity.	Western Reserve University	1948-52	4 years	Y	Y
logical effects of ion.	Western Reserve University	1948-52	4 years	Y	Y

erience

roduct, source /or special lear material	Chemical and/or Physical Form	Max. Amount (mCi or Kg)	Where Experience Gained	Duration of Experience	Dates of Experience
^{3}H	Organic Compounds	25 mCi	Sheffield U.	1 year	1952
^{14}C	Organic Compounds Sodium Bicarbonate	20 mCi	L. S. U.	6 years	1953-59
^{32}P	Potassium Phosphate	15 mCi	John Hopkins	9 years	1959-68
^{32}P	Phosphate Labelled		Notre Dame	24 years	1969-93
	ATP				

pe of use for radioactive material:

Biochemical studies of metabolism and organic synthesis of various compounds. Mode of drug action studies.

Name: Edward Ulicny

Title: Staff Professional Specialist

Department: Radiation Research Laboratory

Degree/Area: [illegible].A. from

University: Duquesne University

Training

Type	Where Trained	Date(s) of Training	Duration of Training	Formal Y or N	On the Job Y or N
a) Principle and Practices of Radiation Protection.	Carnegie-Mellon Notre Dame	1/59-7/76 7/76	1 year 1 year	N	Y
b) Radioactivity measurement, monitoring techniques, and instruments.	Carnegie-Mellon Notre Dame	1/59-7/76 7/76-10/86	1 year 1 year	N	Y
c) Mathematics and calculations basic to the use and measurement of radioactivity.	Carnegie-Mellon Notre Dame	1/59-7/76 7/76-10/86	1 year 1 year	N	Y
d) Biological effects of radiation.	Carnegie-Mellon Notre Dame	1/59-7/76 7/76-10/86	1 year 1 year	N	Y

Experience

Byproduct, source and/or special nuclear material	Chemical and/or Physical Form	Max. Amount (mCi or Kg)	Where Experience Gained	Duration of Experience	Dates of Experience
^{60}Co	Sealed	30,000 Ci	Carnegie-Mellon	28 years	1/59-1987
				Total	
VandeGraff Accelerators			Notre Dame	34 years	1959 - 1993

Type of use for radioactive material:

Irradiation of chemical systems.

CONTROL NO. 395502

Name: Robert Zerr

Title: Director

Department: Environ. Health & Safety

Degree/Area: M.S./Bionucleonics from

University: Purdue University

Training

Type	Where Trained	Date(s) of Training	Duration of Training	Formal Y or N	On the Job Y or N
a) Principle and Practices of Radiation Protection.	Purdue Brookhaven Nat'l Lab	1975-77 1977	2 years 3 months	Y Y	Y Y
b) Radioactivity measurement, monitoring techniques, and instruments.	Purdue Brookhaven Nat'l Lab	1975-77. 1977	2 years 3 months	Y Y	Y Y
c) Mathematics and calculations basic to the use and measurement of radioactivity.	Purdue Brookhaven Nat'l Lab	1975-77 1977	2 years 3 months	Y Y	Y Y
d) Biological effects of radiation.	Purdue Brookhaven Nat'l Lab	1975-77 1977	2 years 3 months	Y Y	Y Y

Experience

Byproduct, source and/or special nuclear material	Chemical and/or Physical Form	Max. Amount (mCi or Kg)	Where Experience Gained	Duration of Experience	Dates of Experience
^{131}I	NaI	10 mCi	Franklin Col.	6 months	1975
^{51}Cr	$NaCrO_4$	10 mCi	Purdue	1 year	1976
^{137}Cs	Sealed	100 mCi	Notre Dame	16 years	1977-1993
^{3}H	HTO	0.1 mCi	Notre Dame	16 years	1977-1993
^{14}C	Toluene	0.1 mCi	Notre Dame	16 years	1977-1993

Type of use for radioactive material:

Animal tracer studies and calibration of liquid scintillation and portable survey meters.

Item 8 - Training Provided To Users

A Radiation Safety Training Course is offered three times a year to users of the Cesium Irradiator and users of other sealed and non-sealed radioactive materials. An outline of the training program, including topics that are covered and the time spent on each topic is provided below. The Radiation Safety Officer or the Health Physicist will be the course instructor.

	Time Spent
I. Introduction - Organizational Structure Radiation Safety	10 min.
II. Basic Fundamentals of Radiation	20 min.
A. Atomic Structure and Particles B. Radioactivity and Types of Radiation C. Interaction With Matter D. Radioactive Decay	
III. Units of Radiation Measurements, Biological Effects of Radiation and Radiation Exposure Limits	15 min.
Videotape: "Radiation Bioeffects" Produced by FDA - Center for Devices and Radiological Health - 1983.	35 min.
IV. Principles of Radiation Film Badges and Detection Instruments	15 min.
Hands-on Use of G.M. Counter - Lab Practical	20 min.
V. Basic Principles of Radiation Protection	20 min.
a. Reducing External Radiation Exposure b. Reducing Internal Radiation Exposure c. Personnel Protection Rules d. Laboratory Facilities e. Emergency Procedures f. Decontamination Procedures	
Videotapes:	
Part I Introduction to Radiation Safety	16 min.
Part II Safe Laboratory Techniques	16 min.
Part III Emergency Procedures	11 min.
Produced by Indiana University, Environmental Health and Safety Department, 1983	

CONTROL NO. 395502

VI. Take Home Exam - Attached with answers. Passing score 60%. Individuals not passing will receive additional instruction from Radiation Safety Officer in areas determined deficient. 120 min.

VII. Users of the Cesium Irradiator will also receive on-the-job training by the Radiation Safety Officer or Health Physicist. This training will include: 30 min.

1. Discussion of mechanical principles of operation for the unit and the built-in safety features.

2. Discussion of the area radiation monitor, its detection capabilities and alarm indications.

3. Observation of the unit being operated by trainer.

4. Actual operation of the unit by trainee.

5. Discussion of measures to follow if over-exposure to radiation occurs or is suspected.

Records documenting the training of each individual will be maintained in the Risk Management and Safety Department.

Problem Set for 1993 Radiological Health Training Course

Participant____________________________________ Dept._______________

Responsible Investigator____

Problems for Part II - Atomic Structure and Radiation

1. A tritiated (^3H) water sample contains 6.9×10^8 dpm. How many millicuries and how many microcuries are there?

2. A Carbon 14 labeled protein contains 1.09 mCi. How many disintegrations/min, disintegrations/sec and bequerels are there?

3. A ^{32}P source with an initial activity of 625 uCi has decayed two half-lives (28.6 days). What activity remains?

4. An Iodine 125 source was assayed on Jan. 4 as 8.5 mCi. How much activity remains on Feb. 22? (49 days) (t1/2 of ^{125}I is 60.2 days).

5. Your lab receives 500 uCi of ^{32}P in a lead container. You survey the container with a G.M. survey meter and obtain a reading of 20.0 mR/hr. You remove the ^{32}P from the lead container and place it behind a 1/4" piece of Plexiglass. Taking the G.M. meter, you obtain a reading of 0.2 mR/hr. What type(s) of radiation were you detecting outside the lead container?

What type(s) of radiation were you detecting through the Plexiglass?

Section III Problems

6. Excessive radiation to the eye can produce ______________________.

7. Irradiation of the skin can cause the loss of hair by destruction of ______________________________________.

8. A Physics Department student employee receives a whole body exposure of 1.05 rads of thermal neutron radiation when he accidentally walks into a target room of the VandeGraaff accelerator. His equivalent exposure is ______________rems.

9. Did the above employee exceed his monthly exposure limit? __________
His quarterly exposure limit? __________
His annual exposure limit? __________

10. The recommended Maximum Permissible Dose to the fetus is __________.

11. Indicate which tissues are more resistant (R) or more Sensitive (S) to radiation than other tissues.

Nervous System ________	Blood forming Tissue ________
Gonadal "Tissue" ________	Eye ____________________
Bone ______________	Skin ____________________
Muscle ______________	G. I. "Tissue" ______________

12. The thyroid is considered the ____________________ organ when using radioiodine because iodine readily accumulates in the thyroid than any other tissue.

13. The largest man-made source of genetically significant radiation exposure to the population today is (circle one)

(a) medical and dental x-rays
(b) nuclear power
(c) fallout
(d) cosmic radiation

Problem Set for Section IV

14. Calculate the exposure rate (mR/hr) from Iodine 125 for the following:

a. 5.0 mCi of ^{125}I at 50 cm; at 1.0 meter.

b. 7.5 mCi of ^{125}I at 10 cm; at 50 cm.

15. A Biology student swallowed some tritiated water and six hours later submitted a urine sample for analysis. The urine sample's observed count rate was determined to be 4800 cpm. 100 ul of a tritiated water standard (activity 1 uCi/ml) is added to the urine sample and then recounted. A count rate of 75,000 cpm was observed. Background was determined to be 50 cpm. Determine the counting efficiency and the activity of the sample.

16. In general, end window GM counters are best used for the detection of

a. alpha particles
b. weak beta particles
c. energetic beta particles
d. gamma rays

17. The efficiency of a GM counter for detecting gammas is approximately ______________________ per cent.

18. The best method for detecting tritium on a lab bench is to use a

a. thin window GM survey meter
b. "Cutie Pie"
c. air monitor
d. "Juno"
e. wipe test and a liquid scintillation counter

19. Which type of dosimeter would be used in a radionuclide laboratory that uses only ^{3}H and ^{14}C.

a. film badge
b. pocket dosimeter
c. finger badge
d. none of the above

Problem Set for Part V.

20. The radiation level in front of a radionuclide fume hood is measured with a survey meter and reads 3.0 mR/hr. How long can a person work in front of the hood and not exceed a total dose of 10 mR ?

How much total dose will be received if the person spends only 20 minutes in front of the hood?

21. 15 mR/hr (I_1) is measured at 0.5 meters from a gamma radiation source. What is the I_2 at 2 meters from the source?

20 mR/hr is measured at 0.4 meters from a ^{51}Cr source. What is the I_2 at 10 cm from the source?

22. If the exposure rate at the surface of a 10 mCi ^{32}P source is 60 mR/hr, what would be the exposure rate at the surface after three half-lives have past? (t1/2 for ^{32}P is 14.3 days)

How many half-lives would need to pass before the exposure rate is less than 2 mR/hr?

23. Which type of radiation is easily shielded but presents the greatest radiation hazard when internally deposited in the body?

a. x-rays
b. neutrons
c. betas
d. alphas

24. The following procedure would not be acceptable after a radiation incident involving a spill:

a. notify the Radiation Safety Officer
b. clean the spill from the area of highest concentration toward the area of lowest concentration
c. flush the floor with water and let it run into the sanitary sewer
d. inform others in the lab that a spill had occurred
e. after cleaning check for contamination with a wipe test

25. Exposure to internal radiation may be controlled by concurrent application of all of the following techniques except:

a. washing hands after working with radioisotopes
b. prohibiting mouthpipeting of radioisotopes
c. shielding of radioisotopes
d. prohibiting storage of food or drink in radioisotope refrigerators

26. If the exposure rate at the surface of a radiation source exceeds ____________________, shielding must be used to reduce personnel exposure levels.

Course critique: If you have any comments or suggestions concerning the course material, instructor, training manual or homework, please indicate below.

Return Problem Set to: Risk Management and Safety Department
122 Campus Security Building
CAMPUS

DEADLINE FOR RETURNING EXAMS: FRIDAY, July 2, 1993

CONTROL NO. 95502

RADIATION SURVEY METER PRACTICAL

1. Can you detect the tritium source with the end-window G.M. Counter? ________

   If yes, what reading (mR/hr) do you obtain? ________________________________

2. Can you detect the Technetium 99 source with the survey meter? ____________

   If yes, what reading (mR/hr) do you obtain with the end-window cap on? ______

   With the end-window cap off? ____________________________________

3. Determine the radiation level (mR/hr) one inch from the top of the Cesium 137 source. ________________________________mR/hr

   Determine the radiation levels with the following items placed between the source and survey meter probe.

Paper	__________________________	mR/hr
Aluminum	__________________________	mR/hr
Lead	__________________________	mR/hr

   Which material blocks out the most radiation?

   ____

4. Does the lantern mantle contain radioactive material? ______________________

   If yes, what radiation level (mR/hr) did you obtain at the surface of the source

   with the end-window cap on? ____

   with the end-window cap off? ______________________________________

   What type(s) of radiation do you think are present.

   alpha's
   beta's
   gamma's
   neutron's

5. Which plate contains radioactive material? ______________________________

   What was the Radiation reading at the surface of the plate? __________mR/hr

   If this plate was being stored in a radioisotope laboratory, would it require shielding to abe placed around it? ______________________________

   (Does the radiation level exceed 5.0 mR/hr)

6. Determine the radiation level (mR/hr) from top of wrist watch _______mR/hr.

1993 - RADIOLOGICAL SAFETY TRAINING COURSE -- PROBLEM SET ANSWERS

1. $\frac{6.9 \times 10^8 \text{dpm}}{2.22 \times 10^9 \frac{\text{dpm}}{\text{mCi}}} = 0.31 \text{ mCi}$ $\frac{6.9 \times 10^8 \text{dpm}}{2.22 \times 10^6 \frac{\text{dpm}}{\text{uCi}}} = 310.8 \text{ uCi}$

2. $1.09 \text{ mCi} \times 2.22 \times 10^9 \frac{\text{dpm}}{\text{mCi}} = 2.42 \times 10^9 \text{ dpm}$

   $1.09 \text{ mCi} \times 3.7 \times 10^7 \frac{\text{dps}}{\text{mCi}} = 4.03 \times 10^7 \text{ dps}$

   1 bq = 1 dps therefore $1.09 \text{ mCi} \times \frac{3.7 \times 10^7 \text{bq}}{\text{mCi}} = 4.03 \times 10^7 \text{ bq}$

3. 625 uCi - after 1 half - life - $\frac{625}{2} = 312.5$ uCi

   - after 2 half - lives - $\frac{317.5}{2} = 156.25$ uCi

4. $8.5 \text{ mCi } e^{-\frac{.693}{60}(49)} = 8.5 \text{ mCi } e^{-.566} = 8.5 \text{ mCi } (.567) = 4.8 \text{ mCi}$

5. Beta's & Bremsstrahlung Radiation Beta Radiation Only

6. Cataracts (clouding of the lens)

7. Hair follicles

8. 1.05 rads x 5 = 5.25 rems

9. Yes, Yes, Yes

10. 0.5 rem/gestation period

11. R S
    S S
    R R
    R S

12. Critical or Target

13. a

14. a. $\frac{1000 \text{ mR/R } (0.7)\ 5.0 \text{ mCi}}{(50\text{cm})^2} = 1.4\text{mR/hr}$ $\frac{1000 \text{ mR/R } (0.7)\ 5.0 \text{ mCi}}{(100\text{cm})^2} = 0.35\text{mR/hr}$

    b. $\frac{1000 \text{ mR/R } (0.7)\ 7.5 \text{ mCi}}{(10\text{cm})^2} = 52.5 \text{ mR/hr}$ $\frac{1000 \text{ mR/R } (0.7)\ 7.5 \text{ mCi}}{(50\text{cm})^2} = 2.1 \text{ mR/hr}$

15. $\frac{75{,}000 \text{ cpm} - 4800 \text{ cpm}}{1 \text{ uCi/ml} \times 0.1 \text{ ml}} = 702{,}000 \frac{\text{cpm}}{\text{uCi}}$ $\frac{4800 \text{ cpm} - 50 \text{ cpm}}{712{,}000 \text{ cpm/uCi}} = 6.7 \times 10^{-3}$

16. c. 17. 1% 18. a.

19. d. (No dosimeter can efficiently detect the weak beta's from ^3H and ^{14}C)

20. $\frac{10.0 \text{ mR}}{4.0 \text{ mR/hr}} = 3.33$ hr. $\frac{4.0 \text{ mR}}{60 \text{ min}} \times 20$ min. = 1.00 mR

21. $\frac{18.5 \text{ mR/hr } (0.5\text{m})^2}{(2\text{m})^2} = .938$ mR/hr $\frac{15.0 \text{ mR/hr } (40 \text{ cm})^2}{(10\text{cm})^2} = 320$ mR/hr

22. $60 \text{ mR/hr } e^{-\frac{.693}{14.3}(42.9)} = 60 \text{ mR/hr } (.125) = 7.5$ mR/hr & 5 T 1/2's

23. d.

24. c. (b. is an acceptable method to keep your exposure as low as reasonably achievable).

25. c.

26. 5.0 mR/hr

LAB PRACTICAL

1. No - BKG Reading 0.02 mR/hr

2. Yes - with end-window cap on - 0.02 to 0.03 mR/hr

   - with end-window cap off - 0.2 to 0.5 mR/hr

3. 0.2 to 0.3 mR/hr 1.5

   paper in between - 0.2 to 0.3 mR/hr 1.5

   aluminum in between - 0.18 to 0.2 mR/hr 1.0 * Lead best shield.

   lead in between - 0.08 to 0.09 mR/hr 0.5

4. Yes - with end-window cap on - 0.2 to 0.5 mR/hr

   - with end-window cap off - 0.7 to 0.8 mR/hr

   The end-window cap blocks out Beta's, therefore, with higher readings with cap off than with cap on indicates you are detecting both.

   Beta's and Gamma's

5. Orange Plate

   - 1.5 to 3.0 mR/hr

   - No shielding required.

6. With cap-off - 1.7 to 2.5 mR/hr

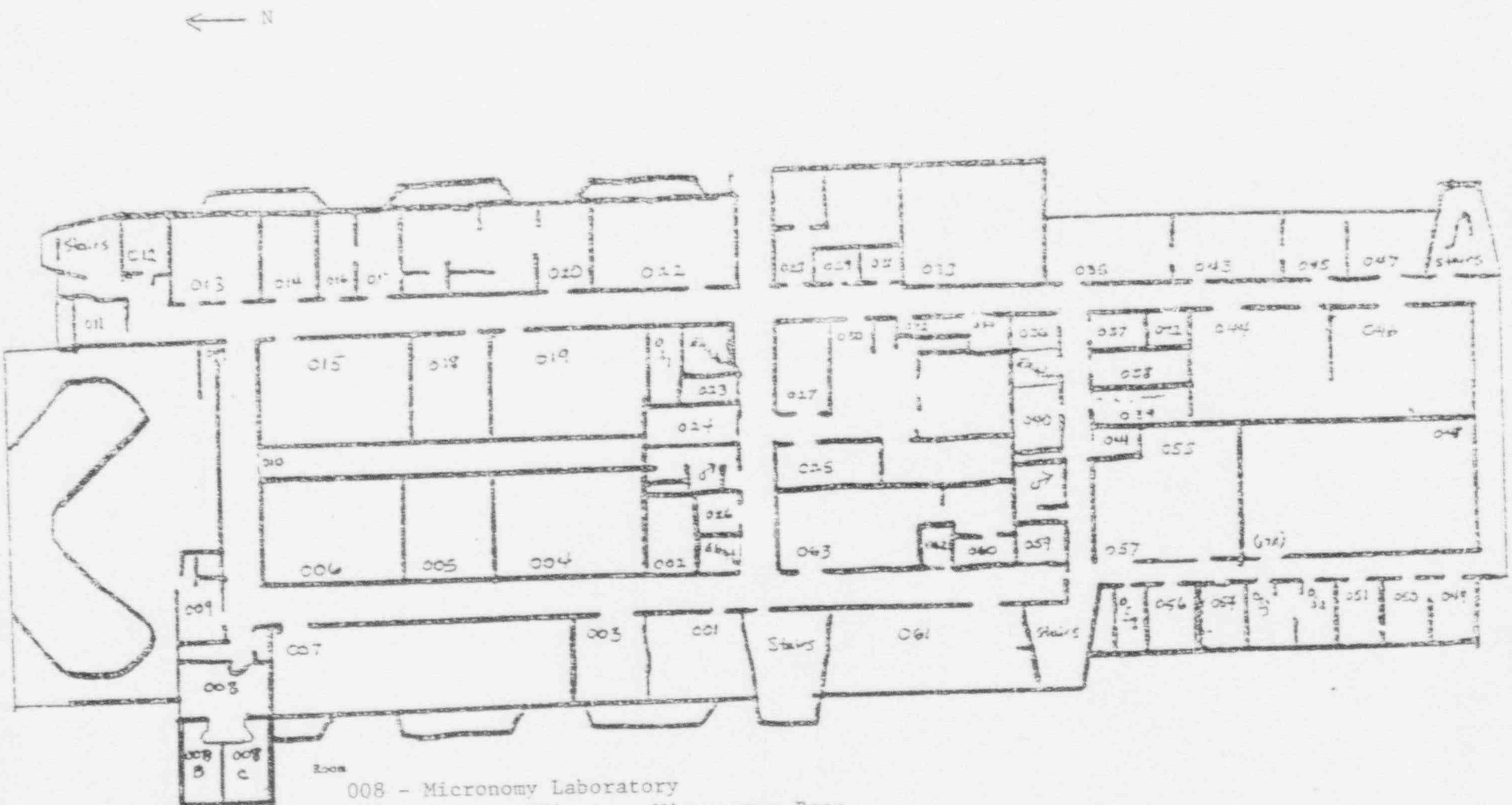
Item 9 - Facilities and Equipment

The irradiator is located in Room 008c, first level, basement floor of the Galvin Life Science Center (see attached building floor plan). Room 008c was built specifically for the use and storage of this irradiator. The room walls are 12 inches of concrete with dirt outside the south and west walls and floor. Approximately 18 inches of dirt cover the ceiling. The adjacent room, 008b was designed for use of an x-ray machine but is presently used to house a scanning election microscope.

Room 008 is a micronomy laboratory and is routinely used by 1 to 3 individuals daily.

The door to the irradiator room (008c) is always locked. Individuals approved by the Radiation Control Committee can obtain keys to this door from an Irradiator Safety Officer, the Radiation Safety officer, the Health Physicist, or the manager of the Department of Biological Sciences. A key to unlock the irradiator itself is obtainable through an Irradiator Safety Officer, the Radiation Safety Officer or the Health Physicist.

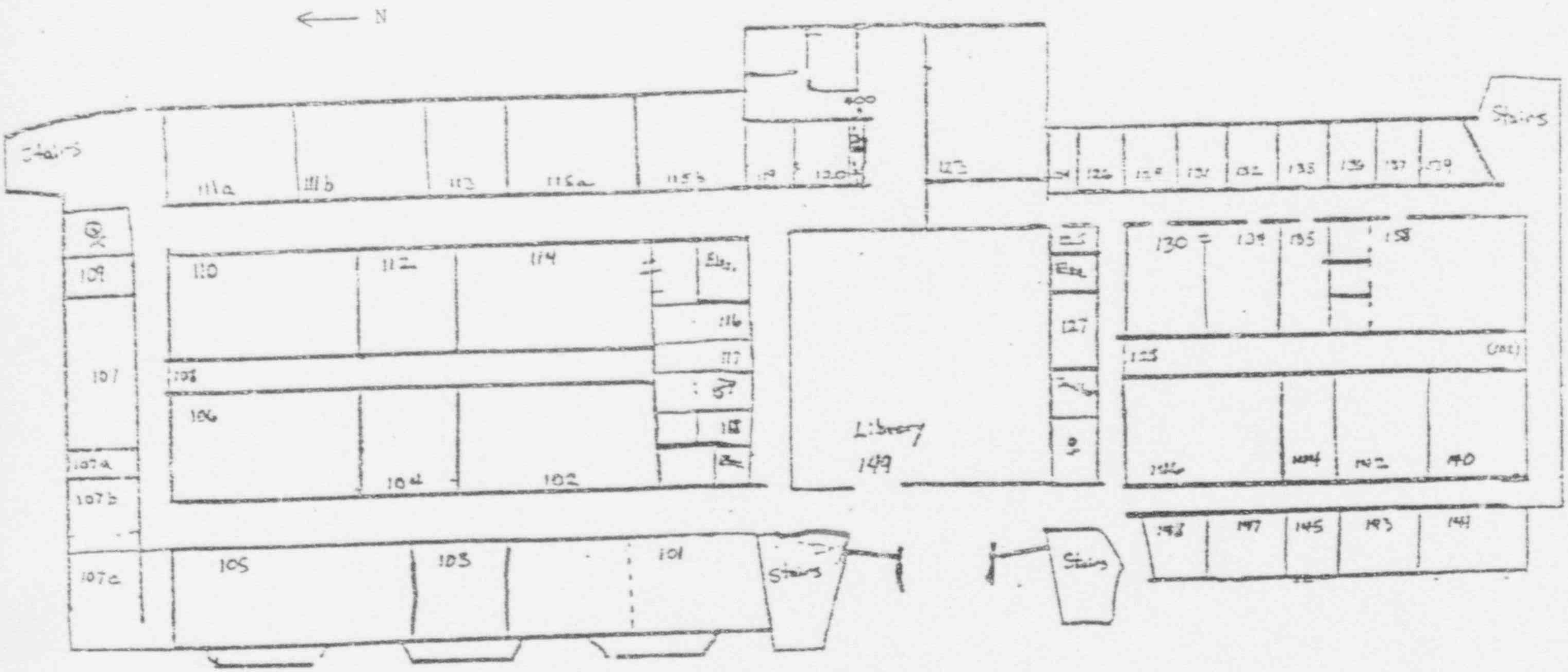
GALVIN LIFE SCIENCE CENTER
BASEMENT FLOOR PLAN



008 - Micronomy Laboratory
008b- Scanning Electron Microscope Room
008c- Cesium 137 Irradiator Room

CONTROL No. 395502

GALVIN LIFE SCIENCE CENTER
1ST FLOOR PLAN



GALVIN LIFE SCIENCE CENTER
2ND FLOOR PLAN

CONTROL NO. 395502

GALVIN LIFE SCIENCE CENTER
3RD FLOOR PLAN

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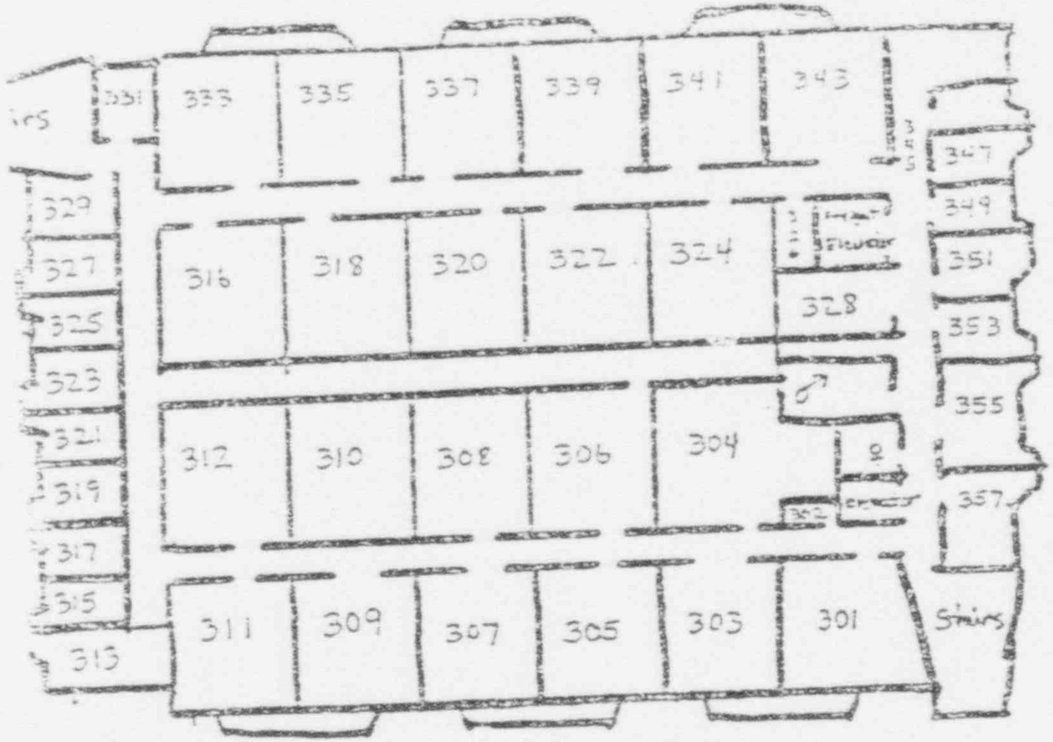


Item 10 - Radiation Safety Program

The radiation safety program is under the supervision of the University Radiation Control Committee whose members are appointed by the President of the University for two-year terms. The Committee meets quarterly and more frequently, if necessary, to conduct the affairs of the radiation protection program. A majority of the Committee constitutes a quorum and is empowered to act for the Committee.

I. Organizations for Radiation Control

A Chart of Organization (Attachment 1) establishes the relationship among the different groups that compose the radiation safety program for the Biological Sciences Department Cesium 137 irradiator. Regulating the use of the Cesium 137 irradiator shall be the ultimate responsibility of the Radiation Control Committee. Administration of certain responsibilities of this Committee shall be delegated, as outlined in subsequent sections of these regulations, to the Radiation Safety Officer and Health Physicist, who shall be qualified by training and experience in radiation safety and members of the Risk Management and Safety Department. Also, certain functions and responsibilities shall be delegated to the Irradiator Safety Officers and to Responsible Investigators.

A. <u>The Radiation Control Committee</u>

This Committee shall be appointed by the President of the University. It shall consist of at least 8 members, to include representatives from the Administration, the Office of Risk Management and Safety and from each of the major areas employing radioactive materials or radiation devices.

The duties of the Radiation Control Committee are:

1. To establish regulations pertaining to the use of radioactive material and radiation-producing devices at the University.
2. To review and act on applications of individuals who wish to become Responsible Investigators.
3. To define the conditions and requirements for the safe use of the Cesium 137 irradiator.
4. To receive the reports of the Radiation Safety Officer and to consider additional regulations in accordance with his recommendations.
5. To assure the maintenance of adequate records concerning exposure of personnel.

6. To review reports of noncompliance with these regulations and to take such action as may be necessary to assure the provisions of these regulations are being met.
7. To serve as the University's sole liaison with the Nuclear Regulatory Commission in matters of licensing and radiological control.
8. To annually review and approve or disapprove applications from Responsible Investigators for continued use of the Cesium 137 irradiator. This continued use application form is enclosed (Attachment 2).
9. To maintain written records of all Committee meetings, actions, recommendations and decisions.

The Chairman of the Radiation Control Committee, the Radiation Safety Officer or their duty authorized representatives, are authorized to act for the Committee between meetings. Actions taken will be reported to the Committee for review at appropriate intervals.

B. Radiation Safety Officer

The Radiation Safety Officer shall be approved by the Committee and shall be a person who has training in radiological health. The responsibilities of the Radiation Safety Officer and his authorized representatives are:

1. To maintain radiation exposures at the lowest feasible level by the supervision or operation of an effective and appropriate radiation safety program.
2. To provide a training course in radiological safety to new users of the Cesium 137 irradiator.
3. To assure that personnel monitoring devices are used and records are kept of the results of such monitoring.
4. To investigate each case of excessive or abnormal exposure to determine the cause and take steps to prevent its recurrence.
5. To perform leak tests on the most accessible surfaces of the source housing every six months and maintain records of such tests.
6. To perform inspections every six months of the irradiator facility checking the operation of the irradiator and the associated safety equipment.

C. Irradiator Safety Officers

Up to three Responsible Investigators from the Biological Sciences and other University Departments may be designated Irradiator Safety Officers. These individuals may be designated by the Radiation Control Committee after agreement with the Chairman of the Biological Sciences Department. Currently there are two Irradiator Safety Officers from the Biological Sciences Department. The duties of the Irradiator Safety Officers are:

1. To maintain keys to the door of the irradiator room and keys to unlock the irradiator and to ensure that only authorized persons (Responsible Investigators) are allowed use of these keys.
2. To ensure that all Responsible Investigators and users who request use of the irradiator have obtained personnel monitoring devices.
3. To periodically check the irradiator to make sure the facilities are secure and all safety equipment is working properly.

D. Responsible Investigators

Faculty members of the University of Notre Dame who make application to the Radiation Control Committee and provide evidence of training and experience with radioactive material or radiation-producing devices shall be designated Responsible Investigators. The responsibilities of Responsible Investigators are:

1. To comply with all applicable regulations for the safe use of the Cesium 137 irradiator.
2. To ensure that all users of the irradiator working under their supervision comply with all applicable regulations.
3. To instruct users of the operational procedures of the Cesium 137 irradiator and of the emergency procedures in the event of an accident.
4. To keep the Radiation Safety Officer informed of changes in the operational schedule of the irradiator.
5. To advise all female radiation users of child-bearing age orally and in written form of the increased risks of prenatal radiation exposure. New female users shall be so advised before beginning work with the irradiator.

E. Users

No person shall use the Cesium 137 irradiator who has not been appropriately trained in the safe use of this irradiator.

Each person at the University who uses this irradiator has a responsibility to:

1. Wear the recommended personnel monitoring devices, film badges or pocket dosimeters.
2. Keep his/her exposure at the lowest feasible value.
3. Be aware of and work in accordance with NRC and University regulations concerning the safe use of the irradiator.
4. Report immediately to the Radiation Safety Officer or Irradiator Safety Officer of the details of an overexposure accident or mechanical malfunction in the irradiator.

F. Application for Approval as a Responsible Investigator

All individuals wishing designation as Responsible Investigator in the use of the Biological Sciences Department Cesium 137 irradiator must submit the appropriate form (Attachment 3) directly to the Radiation Safety Officer. The application forms may be obtained from the Risk Management and Safety Office. The Radiation Control Committee will rule on the qualifications of the individual to operate the irradiator in a safe manner on the basis of previous experience and training. A written letter indicating disapproval or approval will be returned to the investigator by the Committee.

The Chairman of the Radiation Control Committee, after it is ascertained that the applicant is fully qualified and upon the recommendation of the Radiation Safety Officer, may grant temporary approval to use the irradiator pending official action by the Radiation Control Committee at the next regular meeting.

II. NRC and University Regulations Governing the Use of the Cesium 137 Irradiator.

10.1 A. Personnel Monitoring Equipment

All individuals entering the irradiator facility are required to wear a film badge. Film badges used are described below:

Supplier: Tech/Ops Landauer, Inc.
Type: G1 - Whole Body Badge
Frequency of change: Monthly

10.2 B. Radiation Detection Instruments

The Radiation Safety Officer has available at all times a calibrated, operable survey meter that can measure up to one roentgen per hour for surveys to evaluate the extent of radiation hazards that may be present.

All survey meters will be calibrated by the Radiation Safety officer and a Safety Specialist from the Risk Management and Safety Department. Calibration of survey meters shall be performed with radionuclide sources such that:

1. The source activities are traceable within 5% accuracy to the U.S. National Bureau of Standards (NBS) Calibrations.
2. The frequency shall be at least annually and after servicing.
3. Two readings shall be taken on each scale separated by at least 50% of the scale.
4. The exposure rate measured by the meter does not differ from the true exposure rate by more than 20% of full scale.
5. The records of calibration will be maintained for a minimum of 2 years by the Radiation Safety Officer.
6. The Certificate of Calibration of radiation levels at specific distances provided by the manufacturer, the inverse square law and the Cesium 137 constant will be used to determine exposure rates for specific calibration points.
7. If the exposure measured by the instrument differs by greater than 10% from the true exposure rate, then the survey instrument will be adjusted. If the instrument cannot be adjusted and the reading falls within 20% of the true exposure rate, then a calibration chart or graph will be prepared and attached to the instrument.

The sources to be used in calibrating the survey meter are:
- 1.46 uCi of Cesium 137
  Serial Number S-2007
  Eberline Instrument Corp.-Manufacturer

- 100 mCi of Cesium 137
  Serial Number 10014
  J.L. Shepherd Company-Manufacturer

10.3 C. Leak Testing

Tests to determine if there is any leakage from the sealed sources in the irradiator will be performed at 6-month intervals. Whatman filter papers will be used by the Radiation Safety Officer to smear the closest accessible areas to the sealed sources.

Smears will be measured for radioactivity using a Wm. B. Johnson Scaler, Model LS 5A, Single Channel Analyzer, with a NaI probe. The detector will be calibrated using the 1.46 uCi Cesium 137 source described above. The formula used to convert measurement date to microcuries is:

$$\frac{\text{CPM of Smear}}{\text{Efficiency of Detector}} = \text{DPM} \times 4.505 \times 10^{-7} = \text{microcuries}$$

10.4 D. Operating and Emergency Procedures

1. Operating Procedures

At least two individuals are required for operation of the irradiator. One must be a Responsible Investigator. These individuals must obtain the following material before proceeding to the irradiator facility:

a. Keys to the door of the irradiator room and to the lock on the irradiator from an Irradiator Safety Officer.
b. A radiation survey meter from an Irradiator Safety Officer if they do not have their own.
c. Radiation film badges from the Biological Sciences Stockroom if they do not have their own.

Once inside the irradiator room, the procedures of operation are as follows:

1. Turn on the switch for the red warning light, which is located outside the irradiator room door and then check to see that it is on, not burned out.
2. Place material into the irradiator chamber at appropriate place on grid. Note Coordinates.
3. Unlock padlock on left side of the irradiator sliding top.
4. Slide top over irradiator chamber.
5. Insert rotating handle into holes on exposed cylinder surface.
6. Lift finger latch on right of cylinder.
7. Hold rotating handle down firmly and rotate entire cylinder 180° clockwise. Window to source is now open to the chamber.
8. While the cylinder is being rotated, the second person, with a survey meter, should be observing the radiation levels at the top of the irradiator. In the open position, a radiation level of approximately 7.5 mR/hr should be observed at the line between the sliding top and the stationary top.
9. If irradiation time is short, stand behind the yellow line marked on the floor of the irradiator room and wait until irradiation is complete.
10. If irradiation time is long (greater than 15 minutes), leave the room, lock the door and wait until irradiation is complete.
11. At the end of irradiation, rotate handle 180° counterclockwise.
12. The second person should be observing the radiation levels at the top of the irradiator to ensure the levels return to those observed with the irradiator in the closed position approximately 0.02 mr/hr.
13. If the observed radiation levels do not return to closed position radiation levels, leave the room, lock the door and contact an Irradiator Safety Officer. (See the posted Emergency Procedures.)
14. If radiation levels return to closed position levels, drop finger-latch into slot and remove rotating handle.
15. Pull sliding top back completely.
16. Lock top in place with padlock.
17. Record date, names of both individuals using the irradiator, material irradiated and time of irradiation in the Cesium 137 Irradiator Log Book.
18. Turn off red warning light switch and lock the Irradiator room door as you leave.
19. Return keys and survey meter to the Irradiator Safety Officer you obtained them from. Also, inform the Irradiator Safety Officer if the warning light is burned out or if any other irregularities in the operation of the source or facilities were noticed.

2. Emergency Procedures

If any of the following situations exist:

a. The irradiator cylinder remains in the open position, will not close, or
b. You think you have been accidentally exposed to radiation, or
c. Abnormal radiation levels around the irradiator are detected, personnel should
   - immediately leave the irradiator room
   - lock the door and
   - contact one of the individuals listed below:

Robert Zerr	
Campus Security Bldg.	631-5037
or home phone number	674-4154
Andrew Welding	
Campus Security Bldg.	631-5037
or home phone number	272-0450
Kenyon Tweedell	
351 Galvin Life Science Center	631-6624
or home phone number	232-4589
Howard Saz	
215 Galvin Life Science Center	631-5543
or home phone number	272-8045
John Lucey	
371 Fitzpatrick Hall of Engineering	631-7381
or home phone number	232-4481
24 Hour Emergency Number	**631-5555**

NOTE:

Responding individuals are required to survey the area outside the irradiator room door with a survey meter to determine whether further restriction of the area is necessary. If the radiation level exceeds 2.0 milliroentgens per hour outside the irradiator room door, measures must be taken to ensure no one enters the irradiation room. These include:

- Posting the door - "No Admittance"
- Inform all Irradiator Safety Officers not to release Irradiator keys to Responsible Investigators
- Have the lock on irradiator room door changed to further restrict access.

10.5 E. Plans for Installation and Special Repairs

Any repair work involving removal of shielding or access to the licensed material will be done only by persons specifically licensed by the NRC for such work.

Item 11

11.1 Waste Management

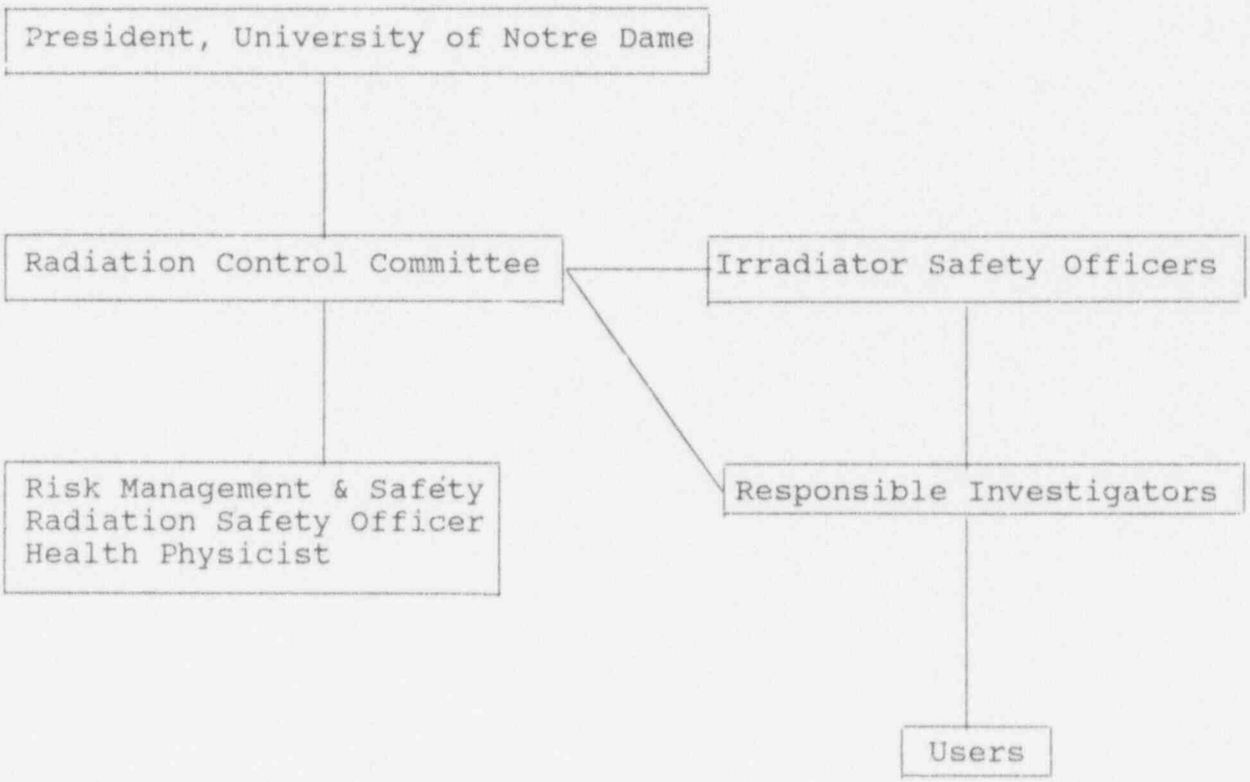
When disposal of the irradiator is deemed necessary, the unit will be transferred to a licensee specifically authorized to accept it. Authorized recipients may be a commercial firm licensed by the NRC or an Agreement State, to accept radioactive waste from other persons or another specific licensee authorized to possess the material.

11.2 Transportation

Any transportation of the irradiator will be done in accordance with 10 CFR 71, "Packaging and Transportation of Radioactive Material." If any section of Part 71 cannot be met, a request will be made for a one-time shipment in accordance with 10 CFR 71.7 and 10 CFR 71.41 (c).

Attachment 1

Radiation Safety Program
Chart of Organization
Cesium 137 Irradiator



Application for Continued Use of the Biology Department Cesium 137 Irradiator

Name: ______________________ Date: ______________

Your authorization as a Responsible Investigator to use the Biological Sciences Department Cesium 137 Irradiator expires ______________

1. Do you wish to renew your authorization to use the Cesium 137 Irradiator?

   Yes __________ No __________

2. Please list individuals under your supervision who may use the gamma irradiator in your presence during the course of the year.

   ______________________ ______________________

   ______________________ ______________________

   ______________________ ______________________

3. Briefly state below any significant changes that are anticipated in the use of the Cesium 137 Irradiator.

   ____

   ____

   ____

   ____

   ____

The undersigned agrees to comply with all University and Nuclear Regulatory Commission Regulations concerning this gamma irradiator and assumes responsibility for ascertaining that employees, students and associates working under his/her direction shall comply with these regulations.

Signed: ______________________________ Date: ______________

Attachment 3

APPLICATION FOR APPROVAL AS A RESPONSIBLE INVESTIGATOR IN THE USE OF THE BIOLOGICAL SCIENCES DEPARTMENT CESIUM 137 IRRADIATOR

1. Name: ______________________ Department: ______________

Office: ______________ Lab: __________ Telephone: ______________

2. Type of Training:

Type	Where Trained	Duration of Training	Formal	On the Job
(a) Principles and Practices of Radiation Protection			Y N	Y N
(b) Radioactive measurement, monitoring techniques, and instruments			Y N	Y N
(c) Mathematics and calculations basic to the use and measurement of radioactivity.			Y N	Y N
(d) Biological effects of radiation.			Y N	Y N

3. Formal Courses:
(List all courses pertaining to radioisotopes, atomic and nuclear structure, radiochemistry, radiobiology, etc.)

Title of Course	Where Trained	Duration
(a)		
(b)		
(c)		
(d)		

4. Experience: (Actual use of radionuclides or radiation-producing machines)

Radionuclide	Maximum Amount (mCi)	Where Experience gained	Duration

Type of use: ______________________________

5. Statement of intended application(s) of the Cesium 137 Irradiator: Give full explanation of use(s). Use reverse if necessary.

6. Statement of Agreement:

The below-named individual signifies that he/she has read and is willing to abide by the University of Notre Dame regulations governing the use of the Biological Sciences Department Cesium 137 Irradiator. The undersigned agrees to comply strictly with all such rules and regulations and hereby waives any right or recourse against the University of Notre Dame for any damage whatsoever resulting from any failure to conform with said regulations. He/she further assumes responsibility for ascertaining that employees, students and associates working under his direction shall comply with the regulations of the University of Notre Dame governing the use of the Cesium 137 Irradiator.

Signed___________________________________ Date ____________

Approval shall be for a period of no more than one year. The expiration date shall be __________________.

Approximately 30 days prior to expiration, current Responsible Investigators shall be notified by the Risk Management and Safety Department.