## Princeton University

Office of Occupational Health & Safety

James Forrestal Campus Princeton, New Jersey 08544 609-452-5294

September 19, 1986

Nuclear Regulatory Commission, Region I Nuclear Material Section B 631 Park Avenue King of Prussia, PA 19406

Attention: Mr. Jack Davis

Re: License No. 29-05185-25 Docket No. 030-12287 Control No. 105678

Dear Sir or Madam:

This letter requests amendment of Princeton Univeristy's Irradiator License No. 29-05185-25; specifically we request deletion of the phrase "and in the physical presence of the authorized user" first imposed by the Commission in amendment No. 10 (license condition No. 11), signed by Mr. Jack Davis on July 2, 1986.

Under Princeton University's existing radioactive materials authorization procedure (see Radiation Safety Guide Section 5) only persons of senior rank, such as laboratory directors and/or faculty, are authorized (licensed) by the Radiation Safety Committee to use and possess radioactive materials of the magnitude contained in the two irradiators. Both of the individuals so-authorized are members of the faculty with substantial teaching and other academic responsibilities; thus, they cannot be in the irradiator laboratory facilities at all times. For these reasons the restrictions added to the license in amendment No. 10 place an unreasonable burden on the operation of the laboratories and are essentially unworkable in an academic environment. Similarly, a procedure whereby the Radiation Safety Committee would individually authorize all irradiator operators including post-doctoral research staff, technical staff and graduate students would result in an unreasonable and, we believe, unnecessary administrative burden on the Committee and would dilute the responsibility of the authorized user for the continued safe operation of these devices.

At the same time we understand the Commission's concerns and intentions in this matter and agree that only responsible, trained persons should be authorized to operate or supervise the operation of the irradiators. To ensure continued safe operation and to resolve this dilemma we propose the following procedure as a substitute for your requirement that the devices be operated only in the "physical presence of the authorized user."

8702050133 861030 REG1 LIC30 29-05185-25 PDR

FEE EXEMPT

1986 SEP 24 PM 1: 28

06222

ML18

24 SEP 1986

Log S. Kemberly

"OFFICIAL RECORD COPY"

Letter: NRC, Region I Page 2 Re: License No. 29-05185-25 September 19, 1986 1. We will continue the established procedure where one senior individual is designated as the authorized (licensed) user by the University Radiation Safety Committee. Inherent in this procedure is the understanding that this individual is responsible for all aspects of safe operation and use of the irradiator. 2. The authorized user will designate persons whom he or she believes to have the personal and technical qualifications to become irradiator operators. 3. These persons will attend a three hour training course presented by the Health Physics staff which deals with radiation safety and the safety features and the operation of the irradiator. Following the Health Physics training the designees will receive specific training, presented by the authorized user, or in the future experienced irradiator operators, relating to the use and operation of the irradiator, including hands-on training. An outline of the proposed Health Physics training course for irradiator operators is attached as Appendix A. 4. Following completion of the training, the authorized user will inform the Health Physics Office in writing of the names of those individuals who have been approved as an "irradiator operator." The Office of Occupational Health and Safety will inform the Radiation Safety Committee of these appointments. 5. Only persons formally identified in writing as an "irradiator operator" will be permitted to operate or supervise the operation of the devices. We trust this proposal will satisfy the Commission's concerns regarding the safe operation of the irradiators at Princeton University. It eliminates the recently added requirement which is now interferring with the operation of the one existing irradiator facility which has been operated safely for almost 10 years. With respect to the new irradiator authorized in amendment No. 10, we do not now expect delivery of this unit until sometime in November. Please give this request your prompt and favorable consideration. If we can be of any assistance or provide additional information, please do not hesitate to contact Mr. Robert R. Milwicz, the Senior Health Physicist, or the author. Thank you for your cooperation and interest. Very truly yours, Jack C faust Director JCF:1t cc: Radiation Safety Committee Prof. R. M. May L. A. Pyle, Jr., M.D. file 9.16 Attachment as per text

# RADIATION PROTECTION TRAINING FOR IRRADIATOR USERS

## TABLE OF CONTENTS

## PART I. THEORY AND DISCUSSION

## I. RADIATION QUANTITIES IN UNITS

- A. CURIE BECQUEREL ACTIVITY
- B. SPECIFIC ACTIVITY
- C. ROENTGEN EXPOSURE
- D. RAD ABSORBED DOSE
- E. REM DOSE EQUIVALENT
- F. QUALITY FACTOR

## II. CHARACTERISTICS OF CESIUM-137

- A. RADIATIONS EMITTED
  - 1. DECAY SCHEME
  - 2. BETA PARTICLES
  - 3. GAMMA RAYS

#### III. MATHEMATICS

- A. RADIOACTIVE DECAY
- B. HALF-LIFE
- C. INVERSE SQUARE LAW CALCULATIONS
- D. DOSE RATE CALCULATIONS
- E. TIME FOR LETHAL DOSE NEAR LARGE SOURCE
- F. SHIELDING CALCULATIONS
- G. CPM DPM ACTIVITY

## IV. INTERACTION OF RADIATION WITH MATTER

- A. GAMMA RAYS
  - 1. PHOTOELECTRIC EFFECT
  - 2. COMPTON SCATTERING
  - 3. PAIR PRODUCTION
- B. BETA PARTICLES
  - 1. COLLISIONAL LOSSES
  - 2. BREMSSTRAHLUNG

## V. RADIATION SHIELDING

- A. HALF VALUE LAYERS
- B. TENTH VALUE LAYERS
- C. RELATIVE EFFECTIVENESS OF DIFFERENT MATERIALS
- D. DENSITY THICKNESS
- E. TIME
- F. DISTANCE

Page A.2 VI. NONOCCUPATIONAL SOURCES OF RADIATION A. NATURAL BACKGROUND RADIATION B. MANMADE SOURCES VII. OCCUPATIONAL RADIATION EXPOSURE A. MAXIMUM PERMISSIBLE DOSE FOR RADIATION WORKERS B. POPULATION DOSE VIII. BIOLOGICAL EFFECTS OF RADIATION A. SOMATIC 1. PROMPT 2. DELAYED B. GENETIC C. TERATOGENIC IX. RISK FROM RADIATION EXPOSURE X. ALARA - PHILOSOPHY XI. APPLICABLE NRC AND UNIVERSITY REGULATIONS A. TITLE 10, CHAPTER 1, CFR PART 19 B. TITLE 10, CHAPTER 1, CFR PART 20 C. IRRADIATOR LICENSE CONDITIONS D. UNIVERSITY RADIATION SAFETY GUIDE E. NRC FORM - 3 F. OHS EMERGENCY FORMS 12 AND 31. XII. RADIATION MEASUREMENTS TYPES OF MEASURING DEVICES 1. IONIZATION CHAMBER 2. GEIGER COUNTER 3. SCINTILLATION DETECTOR 4. FILM BADGE 5. TLD OPERATION OF INSTRUMENTS 1. TURN ON AND CHECK OUT PROCEDURE 2. DETECTABLE LIMITS 3. RESPONSE TIME 4. DETECTION RANGE 5. SATURATION C. CALIBRATION OF INSTRUMENTS XIII. SURVEY AND AREA MONITORING TECHNIQUES 1. LEAK TESTS 2. INSTRUMENT SURVEYS 3. AREA MONITORS 4. MONITOR BADGES

Page A.3 XIV. PERSONAL MONITORING EQUIPMENT A. PLACEMENT ON PERSONNEL B. EXCHANGE FREQUENCY C. DOSIMETRY REPORTS XV. IRRADIATOR DESIGN XVI. IRRADIATION SAFETY SYSTEM A. SAFETY INTERLOCKS B. OPERATION OF SAFETY INTERLOCKS C. SHIELDING D. CONTINUOUS MONITORING XVII. EMERGENCY PROCEDURES A. SUSPECTED OVEREXPOSURES B. FAILURE OF SOURCE TO RETURN TO SAFE POSITION C. DAMAGED SOURCE E. SUSPECTED CONTAMINATION F. HIGH OR UNUSUAL RADIATION LEVEL XVIII. ADMINISTRATIVE CONTROLS A. RECORDKEEPING INVENTORY REPORT 2. RADIATION SURVEY REPORTS 3. IRRADIATOR USE LOG B. CONTROLLING ACCESS TO IRRADIATOR C. WARNING SIGNS XIX. REASONS FOR CONTACTING HEALTH PHYSICIST OR SUPERVISOR A. FOR PERSONAL EXPOSURE INFORMATION B. IF PROBLEMS ARE SUSPECTED C. IF THERE ARE QUESTIONS ON RADIATION SAFETY D. IF THERE ARE SUSPECTED PROBLEMS WITH THE IRRADIATOR E. FOR REGULATIONS, LICENSE, AMENDMENTS, INSPECTION REPORTS. F. IF PREGNANT XX. DISCUSSION - QUESTIONS AND ANSWERS PART II. PRACTICAL I. FAMILIARIZATION WITH IRRADIATOR II. WARNING SIGNS III. SAFETY DEVICES IV. SURVEY TECHNIQUES V. IRRADIATOR OPERATION

030-12287

BETWEEN: William O. Miller, Chief License Fee Management Branch Office of Administration

John E. Glenn, Chief Nuclear Materials Section B Division of Engineering and Technical Programs

03012287 05510 12/86

# I TOTALE FEE TRANSMITTAL

	ION T	
1.	APPLICATION ATTACHED	
	Applicant/Licensee:	sunceton Universely
	Application Dated:	9-19-86
	Control No.:	106222
	License No.:	29-05185-25
2.	FEE ATTACHED	
	Amount:	
	Check No.:	
3.	COMMENTS	
		Signed SLJ
		Date 10-6-86
LIC	ENSE FEE MANAGEMENT BRANCH	FEE EXEMPT
1.	Fee Category and Amount: 🛆	X3E 170.11614)
2.	Correct Fee Paid. Applicat	ion may be processed for:
	Amendment	
	Renewal	
	License	
		Signed Sander Kinker
	•	Data 11/15/8/

REGION I FORM 213 (MARCH 1983)