0307

FORM NRC-313 I (1-79) 10 CFR 30

U.S. NUCLEAR REGULATORY COMMISSION

APPLICATION FOR BYPRODUCT MATERIAL LICENSE
INDUSTRIAL

See attached instructions for details.

Completed applications are filed in duplicate with the Division of Fuel Cycle and Material Safety, Office of Nuclear Material Safety, and Safeguards, U.S. Nuclear Regulatory Commission, Washington, DC 20555 or applications may be filed in person at the Commission's office at 1717 H Street, NW, Washington, D. C. or 7915 Eastern Avenue, Silver Spring, Maryland.

APPLICATION FOR: *(Check and/or complete as appropriate)*

I 7

	a. NEW LICENSE
	b. AMENDMENT TO: LICENSE NUMBER
X	c. RENEWAL OF: LICENSE NUMBER 40-02331-17

2. APPLICANT'S NAME *(Institution, firm, person, etc.)*

The University of South Dakota

TELEPHONE NUMBER: AREA CODE – NUMBER EXTENSION
605-677-5237

3. NAME OF PERSON TO BE CONTACTED REGARDING THIS APPLICATION

Otto W. Neuhaus

TELEPHONE NUMBER: AREA CODE – NUMBER EXTENSION
605-677-5237

4. APPLICANT'S MAILING ADDRESS *(Include Zip Code)*

Division of Biochemistry, Physiology & Pharmacology, School of Medicine
Vermillion, South Dakota 57069

5. STREET ADDRESS WHERE LICENSED MATERIAL WILL BE USED *(Include Zip Code)*

School of Medicine, Room 60
Dakota and Clark Streets
Vermillion, South Dakota 57069

(IF MORE SPACE IS NEEDED FOR ANY ITEM, USE ADDITIONAL PROPERLY KEYED PAGES.)

6. INDIVIDUAL(S) WHO WILL USE OR DIRECTLY SUPERVISE THE USE OF LICENSED MATERIAL
(See Items 16 and 17 for required training and experience of each individual named below)

	FULL NAME	TITLE
a.	Otto W. Neuhaus, Ph.D.	Professor and Chairman
b.	Charles L. Soliday, Ph.D.	Assistant Professor
c.		

7. RADIATION PROTECTION OFFICER

Paul F. Smith, Ph.D.

Attach a resume of person's training and experience as outlined in Items 16 and 17 and describe his responsibilities under Item 15.
Attached

8. LICENSED MATERIAL

LINE NO.	A ELEMENT AND MASS NUMBER	B CHEMICAL AND/OR PHYSICAL FORM	C NAME OF MANUFACTURER AND MODEL NUMBER *(If Sealed Source)*	D MAXIMUM NUMBER OF MILLICURIES AND/OR SEALED SOURCES AND MAXIMUM ACTIVITY PER SOURCE WHICH WILL BE POSSESSED AT ANY ONE TIME
(1)	Cesium 137	Ramco-50-ORNL	Radiation Machinery Corporation	840 curies (2 sources of 420 curies each)
(2)		Sealed Source	Gammator Model M (M38 Series)	
(3)		(Cesium Chloride)		
(4)				

	E DESCRIBE USE OF LICENSED MATERIAL
(1)	Sealed source used in "small animal/sample" irradiating unit--Gammator Model M (M38 series). Unit is used for educational demonstration and for research. Exam-
(2)	ple: Used in course on Radioisotope Techniques to demonstrate a) chemical cali- bration of dosage, b) metabolic effects of whole-body irradiation. Used in research
(3)	programs for study of metabolic consequences of whole-body irradiation on rats. Primary program involved is effect of irradiation on hepatic amino acid transport
(4)	and consequent gluconeogenic state. 13PP

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9. STORAGE OF SEALED SOURCES

LINE NO.	CONTAINER AND/OR DEVICE IN WHICH EACH SEALED SOURCE WILL BE STORED OR USED. A.	NAME OF MANUFACTURER B.	MODEL NUMBER C.
(1)	Sealed source is permanently "mechanically" locked and welded in place in a	Radiation Machinery Corp. Gannator (Now Isomedix)	Model M (M38)
(2)	main biological shield of 2000 lbs of lead encased in a protective steel		
(3)	shell.		
(4)			

10. RADIATION DETECTION INSTRUMENTS

LINE NO.	TYPE OF INSTRUMENT A	MANUFACTURER'S NAME B	MODEL NUMBER C	NUMBER AVAILABLE D	RADIATION DETECTED (alpha, beta, gamma, neutron) E	SENSITIVITY RANGE (milliroentgens/hour or counts/minute) F
(1)	Radiation Leak Test-Wipe Test	Isomedix	NA	Performed biannually	Gamma	$< 5 \times 10^{-3}$ μCi
(2)	End window Survey Meter	Victoreen	493	2	Beta, Gamma	0-100 mr/hr
(3)	CONTINUED					
(4)						

11. CALIBRATION OF INSTRUMENTS LISTED IN ITEM 10

☐ a. CALIBRATED BY SERVICE COMPANY

NAME, ADDRESS, AND FREQUENCY

☒ b. CALIBRATED BY APPLICANT

Attach a separate sheet describing method, frequency and standards used for calibrating instruments.

SEE ATTACHMENT

12. PERSONNEL MONITORING DEVICES

TYPE (Check and/or complete as appropriate.) A	SUPPLIER (Service Company) B	EXCHANGE FREQUENCY C
☒ (1) FILM BADGE ☐ (2) THERMOLUMINESCENCE DOSIMETER (TLD) ☐ (3) OTHER (Specify): _____	ICN Dosimetry Service, Cleveland Ohio	☐ MONTHLY ☐ QUARTERLY ☒ OTHER (Specify): Biweekly

13. FACILITIES AND EQUIPMENT (Check were appropriate and attach annotated sketch(es) and description(s).

☐ a. LABORATORY FACILITIES, PLANT FACILITIES, FUME HOODS (Include filtration, if any), ETC.
☐ b. STORAGE FACILITIES, CONTAINERS, SPECIAL SHIELDING (fixed and/or temporary), ETC.
☐ c. REMOTE HANDLING TOOLS OR EQUIPMENT, ETC.
☐ d. RESPIRATORY PROTECTIVE EQUIPMENT, ETC. SEE ATTACHMENT

14. WASTE DISPOSAL

a. NAME OF COMMERCIAL WASTE DISPOSAL SERVICE EMPLOYED

b. IF COMMERCIAL WASTE DISPOSAL SERVICE IS NOT EMPLOYED, SUBMIT A DETAILED DESCRIPTION OF METHODS WHICH WILL BE USED FOR DISPOSING OF RADIOACTIVE WASTES AND ESTIMATES OF THE TYPE AND AMOUNT OF ACTIVITY INVOLVED. IF THE APPLICATION IS FOR SEALED SOURCES AND DEVICES AND THEY WILL BE RETURNED TO THE MANUFACTURER, SO STATE.

SEE ATTACHMENT

INFORMATION REQUIRED FOR ITEMS 15, 16 AND 17

03C7

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

15. RADIATION PROTECTION PROGRAM. Describe the radiation protection program as appropriate for the material to be used including the duties and responsibilities of the Radiation Protection Officer, control measures, bioassay procedures *(if needed)*, day-to-day general safety instruction to be followed, etc. If the application is for sealed source's also submit leak testing procedures, or if leak testing will be performed using a leak test kit, specify manufacturer and model number of the leak test kit.

16. FORMAL TRAINING IN RADIATION SAFETY. Attach a resume for each individual named in Items 6 and 7. Describe individual's formal training in the following areas where applicable. Include the name of person or institution providing the training, duration of training, when training was received, etc.

    a. Principles and practices of radiation protection.

    b. Radioactivity measurement standardization and monitoring techniques and instruments.

    c. Mathematics and calculations basic to the use and measurement of radioactivity.

    d. Biological effects of radiation.

17. EXPERIENCE. Attach a resume for each individual named in Items 6 and 7. Describe individual's work experience with radiation, including where experience was obtained. Work experience or on-the-job training should be commensurate with the proposed use. Include list of radioisotopes and maximum activity of each used.

18. CERTIFICATE

(This item must be completed by applicant)

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

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

a. LICENSE FEE REQUIRED *(See Section 170.31, 10 CFR 170)*	b. CERTIFYING OFFICIAL *(Signature)* Charles D. Lein
	c. NAME *(Type or print)* Charles D. Lein
(1) LICENSE FEE CATEGORY:	d. TITLE President
(2) LICENSE FEE ENCLOSED: $	e. DATE February 8, 1980

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10. RADIATION DETECTION INSTRUMENTS (CONTINUED)

The irradiator is checked monthly with a survey meter for the purpose of detecting unusual radiation levels that might indicate shielding failure, source disconnection or major contamination. The portable survey meter is calibrated on a regular schedule using a standard source. It is one of two meters used by us in monitoring all areas where radioisotopes are used.

11. CALIBRATION OF INSTRUMENTS LISTED IN ITEM 10

Survey meters are calibrated using the following procedure. A 1 mCi standard calibration source (ICN Radioisotope Division, catalog no. 76141, Instrument calibration Source ^{60}Co, 5^{11} iron shield, 1 mCi activity) will be positioned in line with the survey meter end window probe. The probe will be aimed at the source at a distance (d) from the source. This distance will be measured to the center of the ionization chamber and not to the window of the chamber. After turning the meter on, the zero setting and battery sufficiency will be checked. The meter will be switched to one range, the source lifted from its shielded container and meter reading observed. Each range on the meter will be checked. The values obtained will be compared to the calculated value. If these readings do not agree the calibration potentiometer will be adjusted and calibration rechecked.

13. FACILITIES AND EQUIPMENT

Evaluated Nuclear Regulatory Commission: Model 38-1, Series #1107; purchased from Radiation Machinery Corporation which is now ISOMEDIX.

14. WASTE DISPOSAL

a) Disposal of sealed source in the event of rupture:

1) Call Nuclear Engineering Company, 9200 Shelbyville Road, Louisville, Kentucky. Phone: 502-426-7160; person to contact is ARVIL CASE. If office is closed, there is an answering service that will give further instructions for a number to contact.

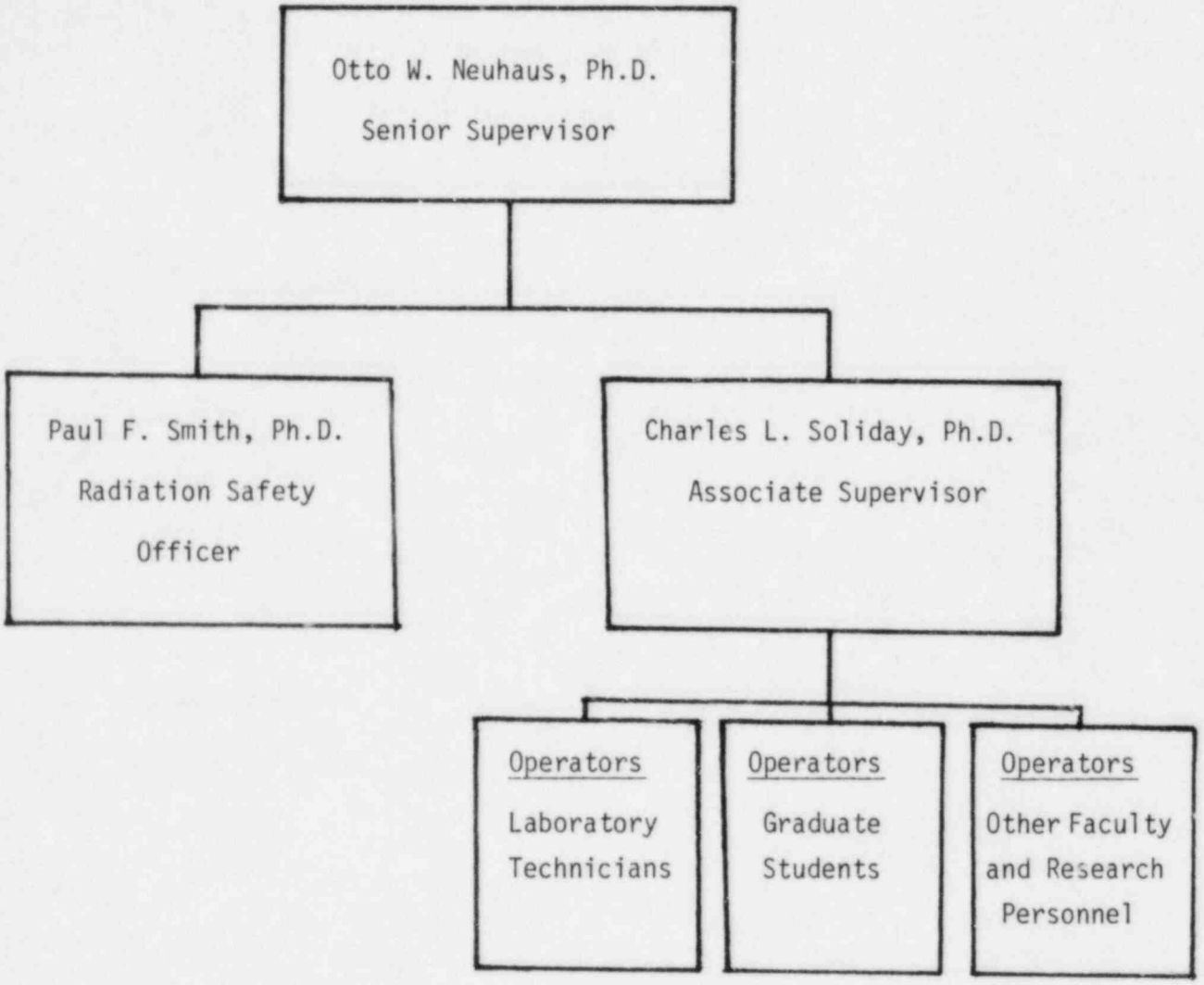
or

2) Call Chem Nuclear Company, P.O. Box 726, Barnwell, North Carolina. Phone: 803-259-1781; person to contact is JOHN OTT. They also have an answering service at night.

Item 15. RADIATION PROTECTION PROGRAM

a. Organization and Administrative Procedure

1) Personnel Organizational Chart



Item 15 (Continued)

2) Administrative procedures regarding safe use of the irradiator

The Gammator M38 irradiator is kept in an isolated room (66 square feet). All walls are cement block; ceiling and floor are concrete. This room is for limited use only. It is keyed so that only faculty members and University Security have access.

1. Operator of Gammator must request room key and Gammator key and operating handle from Associate Supervisor.

2. Only trained operators are allowed use of Gammator.

3. Other users are supervised by the Associate Supervisor or a known trained operator.

4. Any deviation from normal operating procedure is reported to the Senior Supervisor and Radiation Safety Officer.

5. The Associate or Senior Supervisor monitors area on a regular basis (monthly) with a portable survey meter. Wipe tests are conducted semiannually.

6. The leak test kit used is: ISOMEDIX Model GK Leak Test Kit, Isomedix, Inc., 25 Eastmans Road, Parsippany, New Jersey 07054. Leak test samples are taken biannually according to the instructions included in the Leak Test Kit.

b. Operating and Emergency Procedures

1) Long term operating procedures. Any unusual or long-term operating protocols will be reported directly to the Senior Supervisor and Radiation Safety Officer. A monitoring procedure has been initiated using a portable survey meter.

2) Emergency procedure. To be initiated should the survey meter indicate more than 0.05 microcuries of activity.

(a) Senior Supervisor and Radiation Safety Officer will be notified immediately.

Senior Supervisor: 677-5237 (Office)
624-2941 (Home)

Radiation Safety Officer: 677-5253 (Office)
624-8860 (Home)

(b) The area in which radiation can be detected will be cordoned off; all personnel in affected area will be evacuated. Appropriate signs prohibiting access will be prominently displayed.

(c) University Security Office will be notified. Phone: 677-5341

Item 15 (Continued)

(d) Region IV Office of Inspection and Enforcement, Nuclear Regulatory Commission, Arlington, Texas will be contacted. Phone: 817-334-2841.

(e) Isomedix Inc., Parsippany, New Jersey. Phone: 201-887-4700 Mr. George Gates or Mr. Bill Owen will be contacted for advice.

(f) If disposal is required, one of the following will be contacted:

Nuclear Engineering Co.
9200 Shelbyville Road
Louisville, Kentucky 40207

Person to contact: Arvil Crase Phone: 502-426-7130 day or night

Chem Nuclear Company
P.O. Box 726
Barnwell, North Carolina

Person to contact: John Ott Phone: 803-259-1781 day or night

c. Training Program

All operators are required to complete a course in Radioisotope Techniques such as provided for graduate students by the Division of Biochemistry, Physiology and Pharmacology. This is a 4 semester hour course involving both lectures and laboratory experiments. A copy of the course schedule is appended. This course is taught by the Senior (applicant) and Associate Supervisors described in this application (Item 15 a). Training documentation for both Senior and Associate Supervisor is included in this application (Item 16). As indicated in the course outline one experiment covers the "Use and Calibration of the Gammator Whole-Body Irradiator". Competency of students is tested by examination.

Non-student operators (e.g., laboratory technicians) either take the Radioisotope course by audit or receive specific on-the-job training by a Supervisor. Until they have demonstrated their competency in operating the Gammator, they are supervised by a designated, trained operator.

16. FORMAL TRAINING IN RADIATION SAFETY

a. Otto W. Neuhaus, Ph.D., Senior Supervisor

(1) Type of Training

(a) Oak Ridge Institute of Nuclear Studies, Special Training Course 4 weeks duration, formal course

(b) Oak Ridge Institute of Nuclear Studies, Training Course in Radioisotope Techniques, 4 weeks formal course, as well as on-the-job training

(c) Wayne State University and University of South Dakota, 19 years experience on-the-job radioactivity measurement standardization and monitoring techniques and instruments, mathematics and claculations.

(d) University of South Dakota, 9 years experience, on-the-job biological effects of radiation

ISOTOPE	MAXIMUM AMOUNT	WHERE EXPERIENCE GAINED	DURATION	TYPE OF USE
^{14}C	40 mc	Wayne State University Detroit, Michigan	8 years	Metabolic studies and teaching; assays
^{59}Fe	59 mc	"	8 years	
^{131}I	100 mc	"	8 years	"
^{125}I	100 mc	"	8 years	"
^{32}P	100 mc	"	8 years	"
^{3}H	50 mc	Univ. of So. Dakota Vermillion, S.D.	11 years	"
^{45}Ca	10 mc	"	11 years	"
^{35}S	10 mc	"	11 years	"
^{137}Cs	840 Ci (Gammator Irradiation)	"	11 years	"

Item 16 (Continued, FORMAL TRAINING IN RADIATION SAFETY)

a. Charles L. Soliday, Ph.D., Associate Supervisor

(1) Whitworth College, Spokane, Washington
4 hour course, one semester, lecture and laboratory

(2) One semester formal course as well as on-the-job training

(3) On-the-job experience, Montana State University, Washington State University and University of South Dakota, 1968-present (11 years)

(4) "

ISOTOPE	MAXIMUM AMOUNT	WHERE EXPERIENCE GAINED	DURATION	TYPE OF USE
^{3}H	10 mCi	Montana State University	5 years	Biochemical incorporation studies and enzymatic assays
^{14}C	1 mCi	Montana State University	5 years	
^{32}P	0.2 mCi	Montana State University	5 years	"
^{3}H	100 mCi	Washington State University	5 years	"
^{14}C	5 mCi	Washington State Univ.	5 years	"
^{131}I	2 mCi	University of So. Dak.	1 years	Laboratory instruction
^{32}P	2 mCi	University of So. Dak.	1 year	"
^{60}Co	2 mCi	University of So. Dak.	1 year	"
^{137}Cs	2 mCi	University of So. Dak.	1 year	"
^{137}Cs	840 mCi	University of So. Dak.	1 year	Gamma irradiation

16. (FORMAL TRAINING IN RADIATION SAFETY, Continued)

a. Paul F. Smith, Ph.D., Radiation Safety Officer

(1) Philadelphia College Pharmacy and Science, Philadelphia, Pennsylvania
130 hr formal course and on-the-job training

(2) Philadelphia College Pharmacy and Science, on-the-job training

(3) "

(4) "

ISOTOPE	MAXIMUM AMOUNT	WHERE EXPERIENCE GAINED	DURATION	TYPE OF USE
^{14}C	50 mCi	Univ. South Dakota Univ. Pennsylvania Phila. Coll. Pharmacy	20 years	Biochemical experimentation
^{3}H	1 Ci	Univ. So. Dakota Univ. Pennsylvania Phila. Coll. Pharmacy	20 years	" " "
^{131}I	5 mCi	"	5 years	Biochemical experimentation, remote handling
^{60}Co	5 mCi	Phila. Coll. Pharm.	3 weeks	Remote handling & calibration
^{32}P	50 mCi	Univ. So. Dakota Phila. Coll. Pharm.	15 years	Remote handling & biochemical experimentation
Ra(DEF)	5 mCi	Phila. Coll. Pharm.	3 weeks	Calibration
^{125}I	1 mCi	Univ. So. Dakota	1 year	Biochemical experimentation
^{35}S	5 mCi	Univ. So. Dakota	5 years	"
^{59}Fe	1 mCi	"	1 year	"
^{45}Ca	1 mCi	"	1 year	"
^{36}Cl	1 mCi	"	1 year	"

DBPP 632 RADIOISOTOPE TECHNIQUES
Room 210 - 3:30 - 5:00 P.M.
SECOND QUARTER: 1979 - 1980

LECTURE SCHEDULE

DATE	LECTURE
Tuesday November 13 Neuhaus	Introduction Elements of Atomic Structure
Thursday November 15 Neuhaus	Radioactivity Methods of Decay Nuclear Stability
Tuesday November 20 Neuhaus	Radioactivity Decay Schemes Half Life
Thursday November 22	THANKSGIVING DAY
Tuesday November 27 Neuhaus	a. Alpha Part b. Beta Part c. γ-Rays Properties of Some Ionizing Radiations and Their Interactions with Matter
Thursday November 29 Neuhaus	Radiation Detection and Measurements I
Tuesday December 4 Neuhaus	Radiation Detection and Measurements II
Thursday December 6 Cerreta	Radiation Detection and Measurements III: Liquid Scintillation
Tuesday December 11 Cerreta	OPEN DAY FOR LIQUID SCINTILLATION LABORATORY
Thursday December 13 Cerreta	Radioimmunoassay: Lecture and Laboratory
Tuesday December 18	OPEN

DATE	LECTURE
Thursday December 20	OPEN
Tuesday January 8 Soliday	Radiation Detection and Measurements IV: γ-Spectrometry; Lecture and Laboratory
Thursday January 10 Neuhaus	Radiation Dose and Exposure
Tuesday January 15 Read	Health Physics I Dosimetry
Thursday January 17 Read	Health Physics II Allowable Exposure
Tuesday January 22 Read	Health Physics III
Thursday January 24 Smith	Health Physics IV a. Obtain a License b. Purchase isotopes (record keeping) c. Basic Safety Precautions d. Monitor Samples and Work Areas e. Disposal of Waste
Tuesday January 29 Soliday	Radioautography
Thursday January 31 Neuhaus	Effects of Radiation at the Molecular Level
Tuesday February 5 Soliday	Use and Calibration of the Gammator Whole-Body Irradiator
Thursday February 7 Neuhaus	Effects of Radiation at the Cellular Level
Tuesday February 12	Fission and the Preparation of Isotopes
Thursday February 14	EXAMINATION

LABORATORY SCHEDULE

WEEK OF:	
11/13-11/15	Sample preparation and operation of Geiger counter
11/27-11/29	Graphic determination of half-life
12/4-12/6	Inverse square law; absorption of beta and gamma radiation
12/11-12/13	Liquid scintillation spectrometry; quenching; efficiency determination
12/18-12/20	Liquid scintillation counting: Radioimmunoassay
1/8-1/10	Liquid scintillation counting--double isotope
1/15-1/17	Gamma spectrometry
1/22-1/24	Use of Gamma Counter
1/29-1/31	Radioautography
2/5-2/7	Use and calibration of the Gammator whole-body irradiator