FORM NRC-313 I (6-78) 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.

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

- a. NEW LICENSE
- b. AMENDMENT TO LICENSE NUMBER
- c. RENEWAL OF LICENSE NUMBER 24-09236-01

2. APPLICANT'S NAME *(Institution, firm, person, etc.)*
St. Louis College of Pharmacy
Departments of Chemistry Biology
TELEPHONE NUMBER: AREA CODE – NUMBER EXTENSION
314 367-8700

3. NAME OF PERSON TO BE CONTACTED REGARDING THIS APPLICATION
Arthur J. Zimmer
TELEPHONE NUMBER AREA CODE – NUMBER EXTENSION
314-367-8700 43

4. APPLICANT'S MAILING ADDRESS *(Include Zip Code)*
4588 Parkview Pl 63110
St. Louis
Missouri

5. STREET ADDRESS WHERE LICENSED MATERIAL WILL BE USED *(Include Zip Code)*
4588 Parkview Pl. 63110
St. Louis
Missouri

(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.	Lester G. Bruns Ph.D.	Associate Prof. Chemistry
b.	Taylor E. Lindhorst Ph.D.	Prof. Biology
c.	Rodney J. Cooper Ph.D.	Assoc. Prof. Pharmacology

7. RADIATION PROTECTION OFFICER
Lester G. Bruns

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

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)	Iodine 131	Any	N.A.	5 millicuries
(2)	Iodine 125	Any	N.A.	5 millicuries
(3)	Hydrogen 3	Any	N.A.	5 millicuries
(4)	Carbon 14	Any	N.A.	5 millicuries

	E DESCRIBE USE OF LICENSED MATERIAL
(1)	Laboratory experiments in plants and lower animals.
(2)	including metabolic tracer studies and uptake and distribution.
(3)	
(4)	

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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)			
(2)			
(3)			
(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)						
(2)						
(3)						
(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.

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)*: _____		☐ MONTHLY ☐ QUARTERLY ☐ OTHER *(Specify)*:

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.

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.

Item 8

Supplemental Sheet No. 1

	A. Element and Mass Number	B. Chemical Form	C. Manufacturer	D. Maximum millicuries
5)	Phosphorus 32	Any	N.A.	5 millicuries
6)	Strontium 90 (storage only)	any	N.A.	5 millicuries

Supplemental Sheet No. 2

Radiation Detection Instruments

Type of Instruments	Number Available	Radiation Detected	Sensitivity (mr/hr)	Window Thickness (mg/cm^2)	Use Monitoring surveying measuring
Tracerlab laboratory Monitor SU-3D	1	Beta, gamma	0-20,000 cpm	1.9 mg/cm^2	Monitoring
Tracerlab Radiation Survey meter SU 1-H	1	Beta, gamma	0-15 to 0-1.5 R/hr	Beta 0.8 mg/cm^2	Monitoring
Tracerlab Radiation Survey meter SU14	1	alpha, Beta, gamma	0-0.25 to 0-25	30mg/ cm^2	Monitoring
Tracerlab versamatic II Scaler SC-73	2		0-100,000 cpm		
with:					
a) Shielded sample changer and gas flow counter TGC-14	2	Beta		0.9 mg/cm^2	Measuring
b) Crystal well shield SC-46 with P-200 Scintillation detector	2	gamma			Measuring
Nucor Scaler model BC-594	1	alpha Beta	0-256,000 cpm	1.78 mg/cm^2	Measuring
Tricarb Liquid Scintillator Spectrometer	1	alpha beta gamma	0-10^6 cpm		Measuring

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Item 13a

Supplemental Sheet No. 3

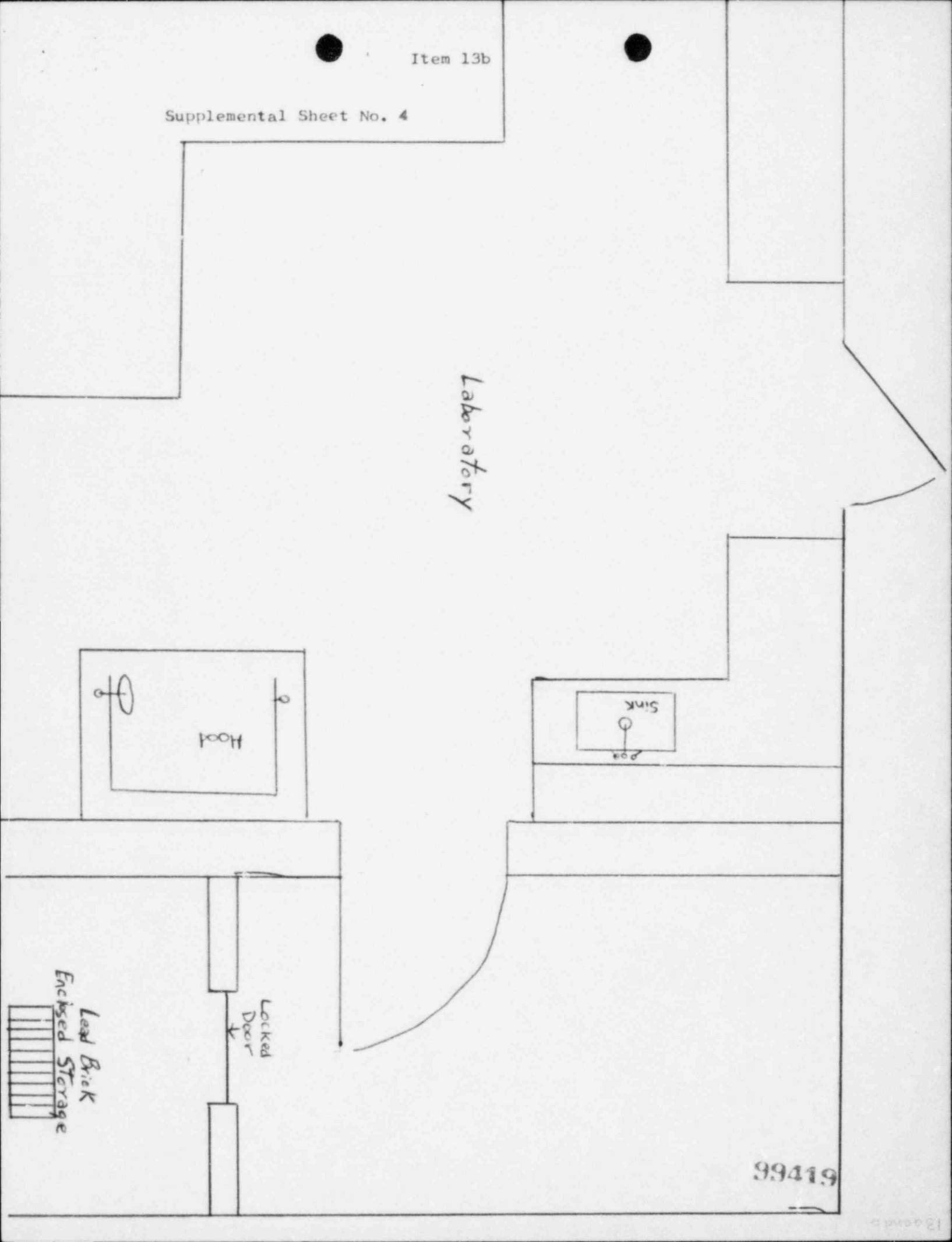
Facilities and Equipment

A storage safe made of lead bricks is located in a closet away from personnel and students. There is no traffic in the storage area. The inside dimensions of the lead safe are 4'' x 4" x 14''. Pipetting bulbs or syringes are used for all transfers of radioactive materials.

The radioisotopes laboratory on the top floor of the building is accessable only through a faculty's office. There is no through traffic in this laboratory. Heating is by hot water radiators. The fume hood is isolated and is vented directly to the outside. It does not intercommunicate with other fume hoods in the building.

Item 13b

Supplemental Sheet No. 4



Item 14b

Supplemental Sheet No. 5

Waste disposal

Short lived (e.g. I-131) and medium lived (e.g. Sr-90) wastes are stored in or behind a lead brick safe until activity has decayed to below levels of detectability as measured by Tracerlab Survey Monitor SU-3D, and /or the measuring equipment, then discarded with trash or into sewage. Carbon-14 waste is divided into very small lots and flushed with a large volume of water into the sink. Only I-131, P-32, and C-14 has been so disposed. Sr-90 waste is currently in storage. Commercial disposal services will be used for any Sr-90 Co-60 and other longer lived isotopes. Animal carcasses contaminated with Carbon-14 are ground, and the ground residue is disposed in small increments into the sewage.

Supplemental Sheet No. 6

Radiation Protection Program

a) Research Activities

The student body is not admitted to laboratory in which isotopes are used, and this laboratory has appropriate warning sign on the door. Selected upper division students are permitted to work with isotopes under supervision of Drs. Lindhorst, Zimmer, or Bruns. During work with isotopes the laboratory monitor is kept on and the student(s) or staff member wears a dosimeter. No one is permitted to eat in the isotopes lab or to smoke while working with radioactive materials. Anyone working with radioactive materials must wash his hands before leaving the laboratory, and check them (dry) with the laboratory monitor; all persons wear lab gowns while working with radioactive materials. Whenever significant amounts of radioisotopes are used, paper is spread over the lab bench as an extra precaution. No glassware or other equipment is permitted to leave the isotopes laboratory. Work area is wiped with cotton swabs which are then read with survey meter or placed and read in liquid scintillation counter for C-14 materials. Any incident or accident is to be reported immediately to Dr. Bruns or Dr. Zimmer. To date no incident has occurred requiring decontamination.

b) Training

As part of our training program students in the Pharmacology course and the Biochemistry course perform Tracer experiments using license exempt quantities of I-131 carbon-14 or phosphorus-32. A class of students is permitted to perform experiments with radioisotopes only after appropriate instruction has been given on the nature of radiation, its hazards, uses, and precautions. Precautions taken are the same as above.

c) Lower Animals

With reference to item 7, animals used for tracer work include: Albino rats, mice and golden hamsters. Any animal receiving radioactive chemicals is maintained in the isotopes laboratory, and is handled only by Dr. Bruns or Dr. Zimmer or by a selected student under direct supervision. These animals are permanently segregated from the animal colony which is located on another floor. Any animal so used is convined in a metabolism cage, and all excreta are collected and saved.

Plants to be used include grasses, legumes, tomatoes, and beans. These are kept in a separate spot in the Preparation Lab or Light Controlled Incubator.

Supplemental Sheet No. 7

Training and Experience

Dr. Lindhorst

Type of training	Where trained	Duration	On the job	Formal Course
a. Principles and practices of radiation protection	University of Washington (Summer Institute in Radiation Biology)	1 week		yes
b. Radioactivity measurements, etc.	,, ,,	1 week		yes
c. Radioactivity mathematics, and calculations, etc.	,, ,,	2 weeks		yes
d. Biological effects of radiation	,, ,,	4 weeks		yes

Lester G. Bruns, Ph.D.

a. Biochemistry 102	St. Louis U. Grad.School	18 weeks		yes
b. Biochemistry 200, Radiobiology	St. Louis University Graduate School	16 weeks (1962-63)		yes
c. Metabolic Tracer Studies in Biochemical Research 297	,, ,,	2 years (1963-64)		yes
d. Biochemistry Thesis Research 299	,, ,,	2 years (1965-66)		yes
e. Medical School Biochemistry Laboratory Teaching	,, ,,	10 months (1963-64)		yes

Experience:

isotope	Maximum Amount	Where Experience gained	Duration	Type of Use
^{32}P	1 mC	St. Louis College of Pharmacy	2 weeks	Quant. Analysis
^{131}I	0.5 mC	St. Louis University	1 week	Clinical Assay
^{14}C	5 mC	St. Louis University, and St. Louis College of Pharmacy	1 year	Metabolic tracer studies
^{35}S	1 mC	St. Louis University	4 weeks	Metabolic tracer studies
^{3}H	20 mC	St. Louis University, and St. Louis College of Pharmacy	1 year	Gas Chromatograph detector and Metabolic studies

R. J. Cooper, Ph.D.

Type of Training	Where trained	Duration	On the job	Formal course
Practices of radiation protection and biological effects of radiation	University of Tennessee and UT-AEC Agricultural Expt. Sta., Oak Ridge	1958-1963	Yes	
Radiation Biology	Texas A&M University	Fall sem. 1966		Yes (audit)

Experience	Where Experience Gained	Duration
Took X-rays of young calves in genetics study	University of Tennessee Ag. Expt. Sta. and UT-AEC Ag. Expt. Sta.	1959-1961 Apx. 12 week/yr.
Shared in planning and initial phases of long-term study of effects of whole-body exposure to gamma radiation on reproduction in cattle.[1]	UT-AEC Ag. Expt. Sta.	1960-1963
Research assistant in Radiation Biology Bibliographic research on biological effects of radiation.[2]	Texas A&M University	1966-1968

Experience with isotopes:

Isotope	Maximum Amount	Where Experience gained	Duration	Type of use
^{131}I	100 mC	St. Louis College of Pharmacy	3 da/year 1968-1972	Tracer Studies (Blood volume determinations)

[1] Visited numerous other studies of radiation effects on livestock and metabolic tracer studies.

[2] Visited studies of effects of chronic low-dose gamma radiation on goats.