NRC Form 313 I (12-81) 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)

RECEIVED MAY 3 1984

a. NEW LICENSE

b. AMENDMENT TO: LICENSE NUMBER

c. RENEWAL OF: LICENSE NUMBER — X — 40-02331-19

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

University of South Dakota

TELEPHONE NUMBER: AREA CODE – NUMBER EXTENSION

605-677-5253

3. NAME AND TITLE OF PERSON TO BE CONTACTED REGARDING THIS APPLICATION

Paul F. Smith, Ph.D., Basic Sciences Coord.

TELEPHONE NUMBER: AREA CODE – NUMBER EXTENSION

605-677-5253

4. APPLICANT'S MAILING ADDRESS (Include Zip Code) (Address to which NRC correspondence, notices, bulletins, etc., should be sent.)

Univ. of So. Dak., Dept. Microbiology
Vermillion, So. Dak. 57069

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

Dakota and Clark Sts.
Vermillion, So. Dak. 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.		
b.	See Attachment, page 3.	
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.

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)				
(2)				
(3)		See Attachment, page 4.		

RECEIVED BY LFMB
Date 5/7/84
Log May 2 II
By Brown
Orig. To
Action Compl 5/7/84

8505290195 B50429
REG4 LIC30
40-02331-19 PDR

DESCRIBE USE OF LICENSED MATERIAL

E

(1) Byproduct material will be used solely for research and teaching purposes
(2) using cell free systems, microbial and cultured tissue cells and small whole
(3) animals (mice, rats, hamsters, chicks, rabbits). No use of humans will be
(4) involved. Item 22 (Cobalt-60) will be used only for instrument calibration. Item 23 (Plutonium) will be used as a source for neutron activation analyses.

NRC FORM 313 I (12-81)

FEE EXEMPT State 60275

9. STORAGE OF SEALED SOURCES

LINE NO.	A. CONTAINER AND/OR DEVICE IN WHICH EACH SEALED SOURCE WILL BE STORED OR USED.	B. NAME OF MANUFACTURER	C. MODEL NUMBER
(1)	Cobalt-60, 5 in. iron shield	ICN Radioisotope Div.	273
(2)	Pu-Be neutron source-Nuclear Chicago Neutron Howitzer	Nuclear Material & Equip. Corp. Appollo, PA	NH3
(3)			
(4)			

10. RADIATION DETECTION INSTRUMENTS

LINE NO.	A. TYPE OF INSTRUMENT	B. MANUFACTURER'S NAME	C. MODEL NUMBER	D. NUMBER AVAILABLE	E. RADIATION DETECTED (alpha, beta, gamma, neutron)	F. SENSITIVITY RANGE (milliroentgens/hour or counts/minute)
(1)						
(2)			See Attachment, page 5.			
(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.

See Attachment, Page 9.

12. PERSONNEL MONITORING DEVICES

A. TYPE (Check and/or complete as appropriate.)	B. SUPPLIER (Service Company)	C. EXCHANGE FREQUENCY
☒ (1) FILM BADGE ☐ (2) THERMOLUMINESCENCE DOSIMETER (TLD) ☒ (3) OTHER (Specify): See attachment page 10.	ICN Dosimetry Service Cleveland, Ohio	☒ 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.

See Attachment, Page 21.

INFORMATION REQUIRED FOR ITEMS 15, 16 AND 17

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)* Joseph Mc Fadden
Exempt 170.11 (9)	c. NAME *(Type or print)* Joseph M. McFadden
(1) LICENSE FEE CATEGORY:	d. TITLE President
(2) LICENSE FEE ENCLOSED: $	e. DATE 4-25-84

NRC FORM 313 I (12-81)

60275

6.	a.	Abraham, Donald	Associate Professor Physics
	b.	Brady, Frank O.	Professor Biochemistry
	c.	Cafruny, William A.	Asst. Professor Microbiology
	d.	Goldman, Max	Professor Biology
	e.	Grotjan, H. Edward, Jr.	Assoc. Professor Physiology/Pharmacology
	f.	Hagen, A. Ainsworth	Prof./Chairman Physiology/Pharmacology
	g.	Hastings, David F.	Asst. Professor Phsiology/Pharmacology
	h.	Hubbard, Christopher J.	Asst. Professor Anatomy
	i.	Johnson, Jeffrey L.	Assoc. Professor Physiology/Pharmacology
	j.	Kauker, Michael L.	Professor Physiology/Pharmacology
	k.	Keel, Brooks A.	Postdoctoral Fellow, Physiology
	l.	Koment, Roger. W.	Assoc. Professor Microbiology
	m.	Langworthy, Thomas A.	Professor Microbiology
	n.	Lynn, Raymond J.	Professor Microbiology
	o.	Marshall, Finley D.	Professor Biochemistry
	p.	Neuhaus, Otto W.	Professor/Chairman Biochemistry
	q.	Quackenbush, Robert L.	Assoc. Professor Microbiology
	r.	Small, Gary D.	Professor Biochemistry
	s.	Smith, Paul F.	Professor/Chairman Microbiology
	t.	Thomas, John A.	Assoc. Professor Biochemistry
	u.	Waller, Stephen	Asst. Professor Physiology/Pharmacology

8.	A. Element and Mass Number	B. Chemical and/or Physical Form	C. Name of Manufactures and Model Number	D. Maximum amount that Licensee may possess at one time under this license
	1. Hydrogen 3	1. Any	1. N/A	1. 500 millicuries
	2. Carbon 14	2. Any	2. N/A	2. 200 millicuries
	3. Sodium 24	3. Any	3. N/A	3. 10 millicuries
	4. Phosphorus 32	4. Any	4. N/A	4. 200 millicuries
	5. Phosphorus 33	5. Any	5. N/A	5. 10 millicuries
	6. Sulfur 35	6. Any	6. N/A	6. 100 millicuries
	7. Chlorine 36	7. Any	7. N/A	7. 10 millicuries
	8. Potassium 42	8. Any	8. N/A	8. 20 millicuries
	9. Calcium 45	9. Any	9. N/A	9. 25 millicuries
	10. Iron 59	10. Any	10. N/A	10. 25 millicuries
	11. Nickel 63	11. Any	11. N/A	11. 10 millicuries
	12. Copper 64	12. Any	12. N/A	12. 20 millicuries
	13. Zinc 65	13. Any	13. N/A	13. 10 millicuries
	14. Copper 67	14. Any	14. N/A	14. 20 millicuries
	15. Rubidium 86	15. Any	15. N/A	15. 20 millicuries
	16. Cadmium 109	16. Any	16. N/A	16. 20 millicuries
	17. Iodine 125	17. Any	17. N/A	17. 150 millicuries
	18. Iodine 131	18. Any	18. N/A	18. 200 millicuries
	19. Europium 152	19. Any	19. N/A	19. 1 millicurie
	20. Mercury 203	20. Any	20. N/A	20. 10 millicuries
	21. Californium 252	21. Electrolytic deposition on a target disc obtained from Oak Ridge National Laboratory	21. N/A	21. 1 microgram
	22. Cobalt 60	22. Sealed Source	22. ICN Radioisotope Division, Instrument Calibration Source, Cat. No. 76141	22. 1 millicurie
	23. Plutonium	23. Encapsulated as Pu-Be neutron sources	23. Nuclear Material & Equip. Corp., Apollo, PA, Nuclear Chicago Model NH-3	23. 32 grams

10. Radiation Detection Instruments

Instrument & Model	No.	Radiation Detected	Range mr/hr	mg/cm^2 window thickness	Use
GM Survey meter, Atomic Accessories Model SM-136A, end window	1	a,b,g	0-100	1.4-2.0	monitoring and surveying
GM Survey meter, Baird Atomic Model 420, end window	1	b,g	0-100	1.4-2.0	monitoring and surveying
Survey meter, Victoreen Model 493, end window	2	b,g	0-100	1.4	monitoring and surveying
Survey meter, Victoreen Model 1 A	1	b,g	0-100	1.4	monitoring and surveying
Survey meter, Nuclear Chicago Model 2650	1	g	0-100	-	monitoring and surveying
Pocket dosimeter, Kelley Koett Model K 125	3				monitoring
Pocket dosimeter, Landsverk L 50 & Charger L-24	2				monitoring
Dosimeter Charging Unit, Kelley Koett Model SK 125	1				monitoring
Dosimeter, Bendix Model 906	1				monitoring

10(cont)2

Instrument & Model	No.	Radiation Detected	Range mr/hr	mg/cm^2 window thickness	Use
Tracerlab SC 50B Automatic windowless Proportional flow counter with SC 70 Compu/Matic V scaler & SC 88 Auto/ computer with printout	1	b	-	windowless	measuring
Tracerlab FD1 shielded flow counter with SC 73 Versa/matic II scaler	1	b	-	0.9	measuring
Tracerlab SC 55AR Auto Step Chromato-gram scanner	1	b	-	windowless	measuring
Packard Liquid Scintillation Counter, Model 3214	1	b	-	-	measuring
Packard Auto Gamma Spectrometer, Model 5019	1	g	-	-	
Atomic Accessories Radiochromatogram scanner Model RSC-363	1	b	-	windowless	measuring
Nuclear Chicago Well Counter Model 4454	2	g	-	-	measuring
Nuclear Chicago Classmaster Ratemeter, Model 1613A	1	g	-	-	measuring

10(cont)3

1 - Well Counter, Nuclear Chicago 3037B, Serial 121	measuring
1 - Radiation Analyzer, Nuclear Chicago 1810	measuring
1 - Scaler, Nuclear Chicago 131A	measuring
1 - Scaler, Nuclear Chicago 181A	measuring
1 - Landsverk Model L-75D electrometer	measuring
1 - Nuclear Chicago 151A scaler and timer and GM tube	measuring
1 - Nuclear Chicago 186 scaler and well-type scintillation crystal	measuring
1 - Package Model 5230 Auto Gamma Spectrometer	measuring
1 - Packard Model 3041 Continuous flow detector unit	measuring
1 - Packard Model 3002 Scintillation Spectrometer	measuring
1 - Packard Model 3255 Tri Carb Scintillation Spectrometer	measuring
1 - Packard Model 3003 Tri Carb Scintillation Spectrometer	measuring

10(cont)4

Packard Liquid Scintillation Counter, Model 3255	1	β	-	-	measuring
Beckman Scintillation Counter, Model 6800	1	β	-	-	measuring
Beckman Gamma Counter, Model 5500	1	γ	-	-	measuring
Micromedic Gamma Counter, Model 588	1	γ	-	-	measuring
Nuclear Chicago DN-3 Neutron probe	1	η	-	-	monitoring
Nuclear Measurements Corp. Model PC C-11A Proportional Counter	1	α,β	-	-	measurement

11. Scintillation and gamma counters are calibrated annually using the following standards supplied by Packard Instrument Corp., ^{14}C, ^{3}H, ^{36}Cl and ^{137}Cs. Other counters are calibrated using $Ba^{14}CO_3$ standard source. Survey meters will be calibrated annually 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 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. Calibration will utilize two points on each scale of the instruments with these points being located approximately 1/3 and 2/3 of full scale. The values obtained will be compared to the calculated value. If these readings do not agree the calibration potintiometer will be adjusted and calibration rechecked.

12. The University of South Dakota, under the aegis of the Radiation Safety Officer, contracts with ICN Dosimetry Service, Cleveland, Ohio for biweekly film badge service to monitor exposure to gamma, beta and x-ray. Each individual user of radioisotopes is required to wear a badge while working in an isotope use area. Reports from the Dosimetry Service are monitored upon receipt by the Radiation Safety Officer to assure that exposure does not exceed the defined limits for safety.

Bioassay procedures are followed in the following specific cases. All personnel handling millicure quantities of Iodine-131 will have monthly thyroid counts performed by the Radiologist, Sacred Heart Hospital, Yankton, SD. Records of such counts will be kept on permanent file by the Radiation Safety Officer. Personnel handling millicure quantities of organic forms of hydrogen-3 will have daily urine counts. Counts will be done by the Radiation Safety Officer on a Liquid Scintillation System. Records of such counts will be kept as permanent records by the Radiation Safety Officer. In the event that a bioassay is positive, the individual will be notified immediately of this fact, be prevented from further use of or exposure to radioisotopes and placed under medical surveillance. The Radiation Safety Officer will immediately determine the specific cause and institute corrective actions.

13. Facilities and Equipment

See attached pages for floor plan diagrams and equipment location.

The following rooms will be designated for use of radioisotopes:

Lee Medicine and Science Building

All receiving; handling of radioisotopes in amounts greater than 1 mCi

Rooms 58 and 237A

Animal holding and work

Room 302B

Experimentation with quantities less than 1 mCi

Rooms 17C, 55, 56, 59 and 63 Basement floor

Rooms 133, 134, 138, 139, 141, 142 First floor

Rooms 211B, 214, 217, 219, 221, 222, 223, 227, 228, 234, 236, 242, 246, 249, 251, 252, 261 Second floor

Churchill-Haines Hall

All isotope activities

Room 139A

Akeley Science Center

Pu-Be source

Room 105

Description of isotope use areas - Lee Medicine & Science Building

All floors are concrete and covered with asphalt tile.

All sinks are equipped with trapped and vented plastic drains newly installed in 1978.

All fume hoods are exhausted directly to the roof.

Room 302B is in the animal quarters. It is separately keyed and controlled by the Radiation Safety Officer. It has a floor drain, a stainless steel sink and a stainless steel filtered hood. Walls are tile which has been sealed and painted.

Room 58 is one of a suite of rooms situated behind a locked gate. It also has a lockable door. It is equipped with a stainless steel radio-isotope hood and a twin stainless steel sink. Contained within this room is a large supply of lead bricks for shielding purposes.

Room 237A also lies behind two locked doors. It has an excellent hood but stone composition sink. This room is used for radioisotope storage in a freezer as well as a locked steel box.

Rooms 55,59,63,133,134,139,211A,214,219,228,234,242,252, and 261 are all equipped with exhaust hoods and stoneware sinks.

The remaining rooms are equipped with stoneware sinks.

Rooms 138,214,223,246, and 251 are restricted for radioisotope counters. Likewise a scintillation counter occupies an area behind the cage in the basement (outside room 58).

Solid radioactive waste is stored temporarily in Rooms 58 and 237A. Isotopes are stored in glass or plastic vials inside cardboard or plastic foam boxes in locked cabinets, refrigerators or freezers. These storage areas are located in Room 214, 237A, 242, 58, 59, and 261. All materials are shielded so as to produce less than 1 mr/hr at 3 feet from the source. These areas are not highly frequented

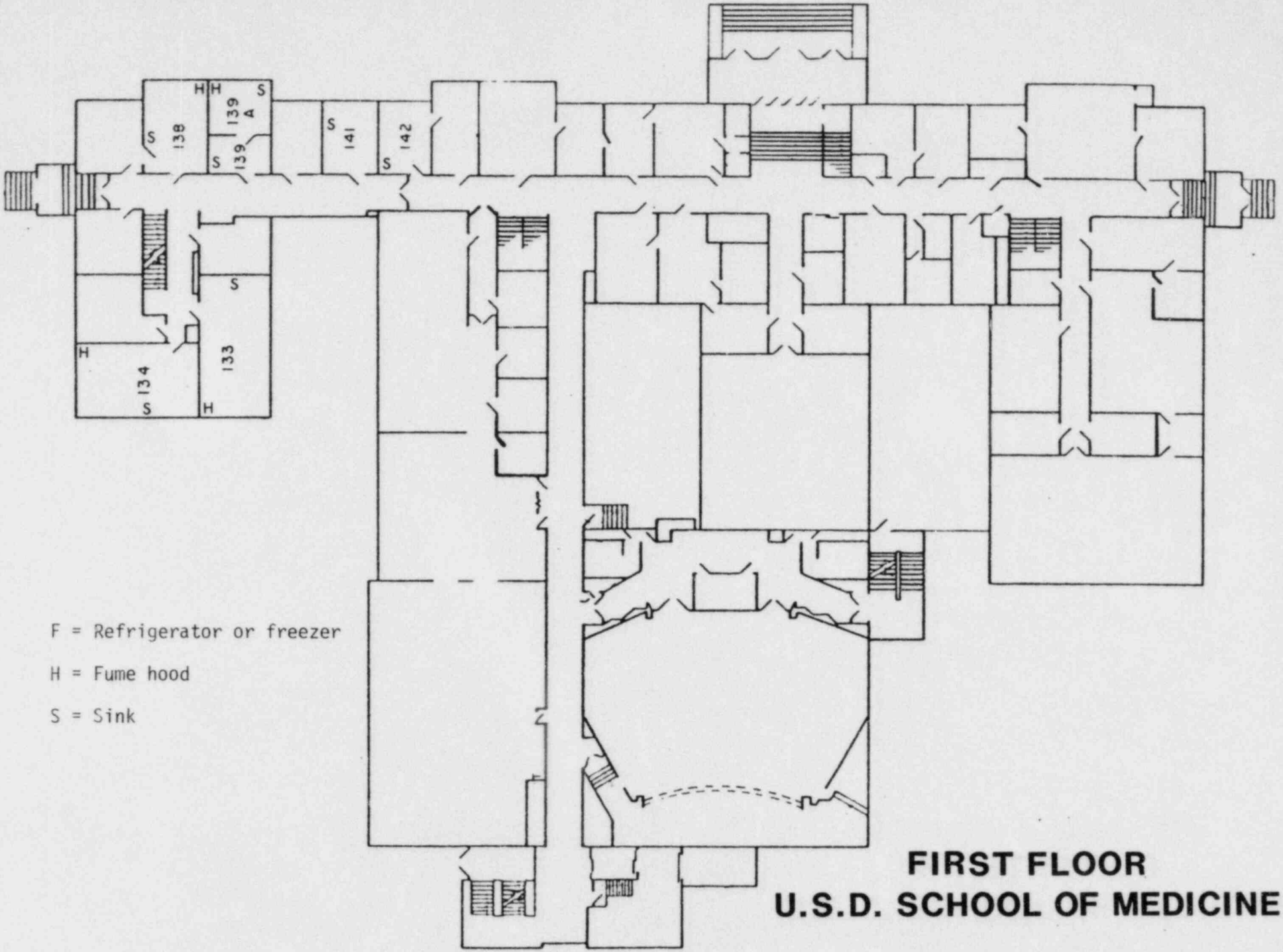
areas except for restricted personnel. All are labeled with radiation hazard signs.

Churchill-Haines Hall

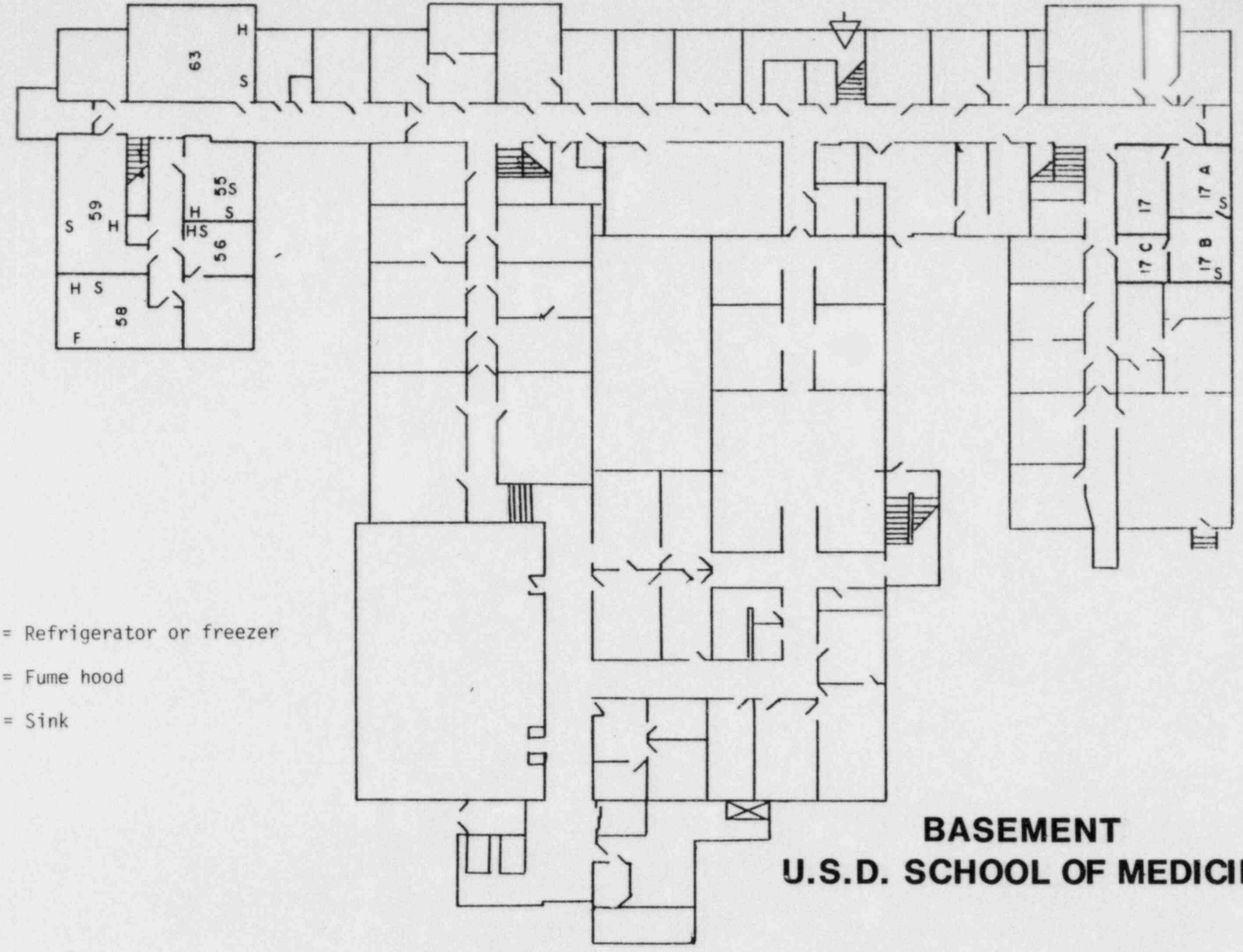
Room 139A is a room, isolated from normal traffic flow, in a building constructed in 1977. This room was specifically designed for radio-isotope work and contains stainless steel fixtures and an isotope hood with filtered exhaust to the roof.

Akeley Science Center

The neutron source is stored and used at all times in the Nuclear Chicago Model NH-3 Neutron Howitzer in Room 105. All walls are constructed of concrete block. A source handling tong (Nuclear Chicago Model TL-16) is a 42 inch long, 3/4 inch diameter stainless steel tool with two fingers and a pistol grip. A spring loaded trigger is squeezed to close the fingers at the other end of the tool around the source.



FIRST FLOOR
U.S.D. SCHOOL OF MEDICINE

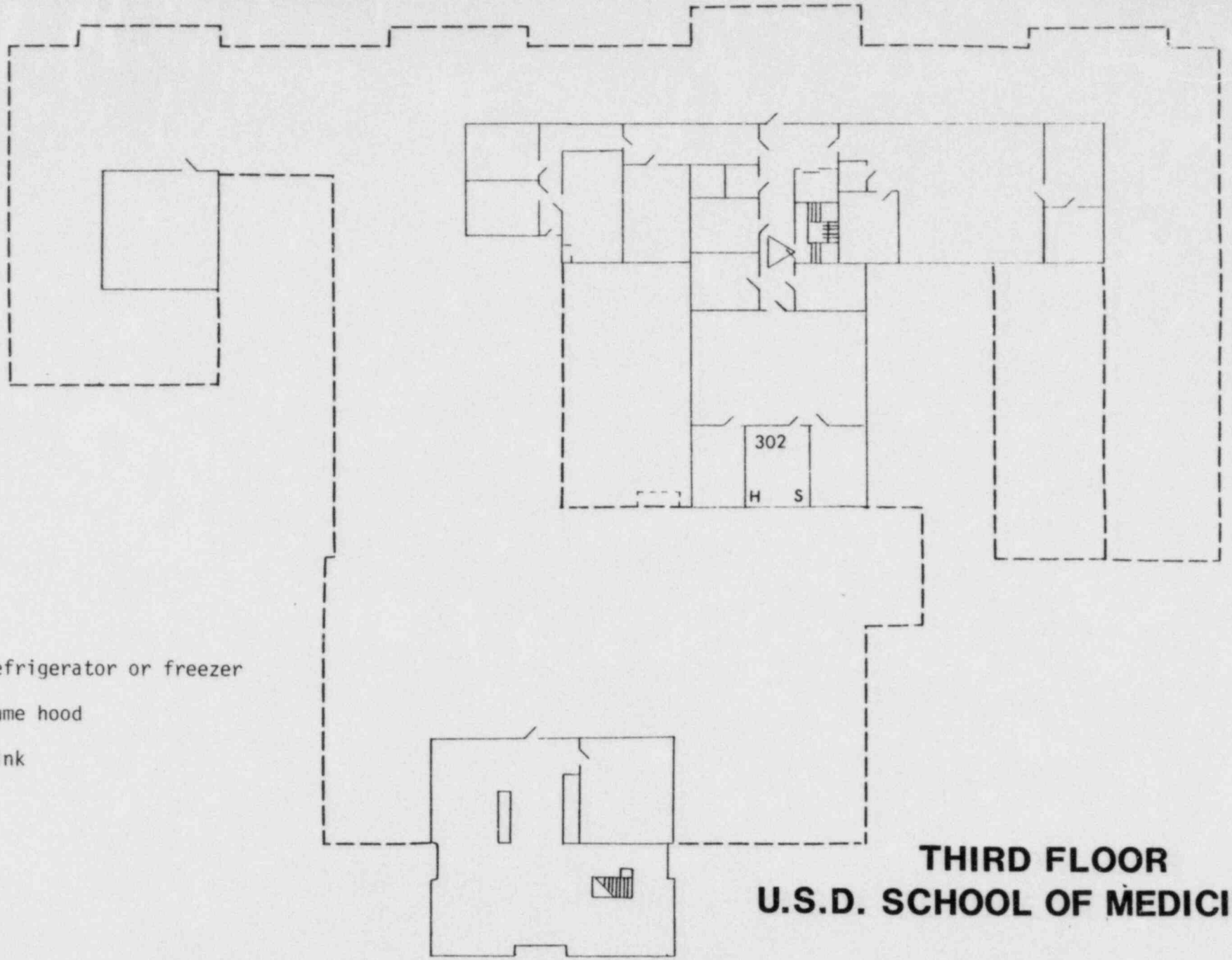


F = Refrigerator or freezer

H = Fume hood

S = Sink

BASEMENT
U.S.D. SCHOOL OF MEDICINE

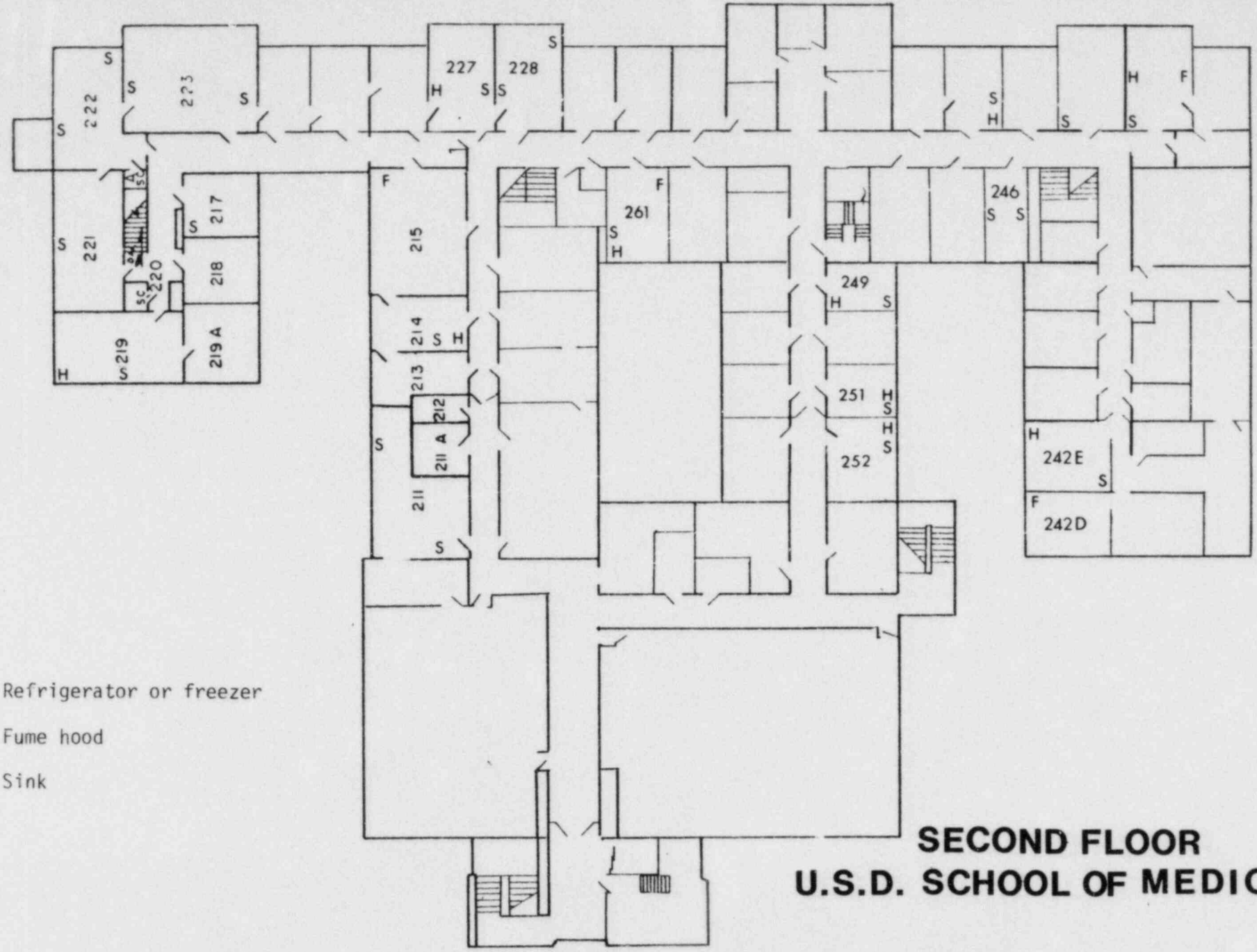


F = Refrigerator or freezer

H = Fume hood

S = Sink

THIRD FLOOR
U.S.D. SCHOOL OF MEDICINE



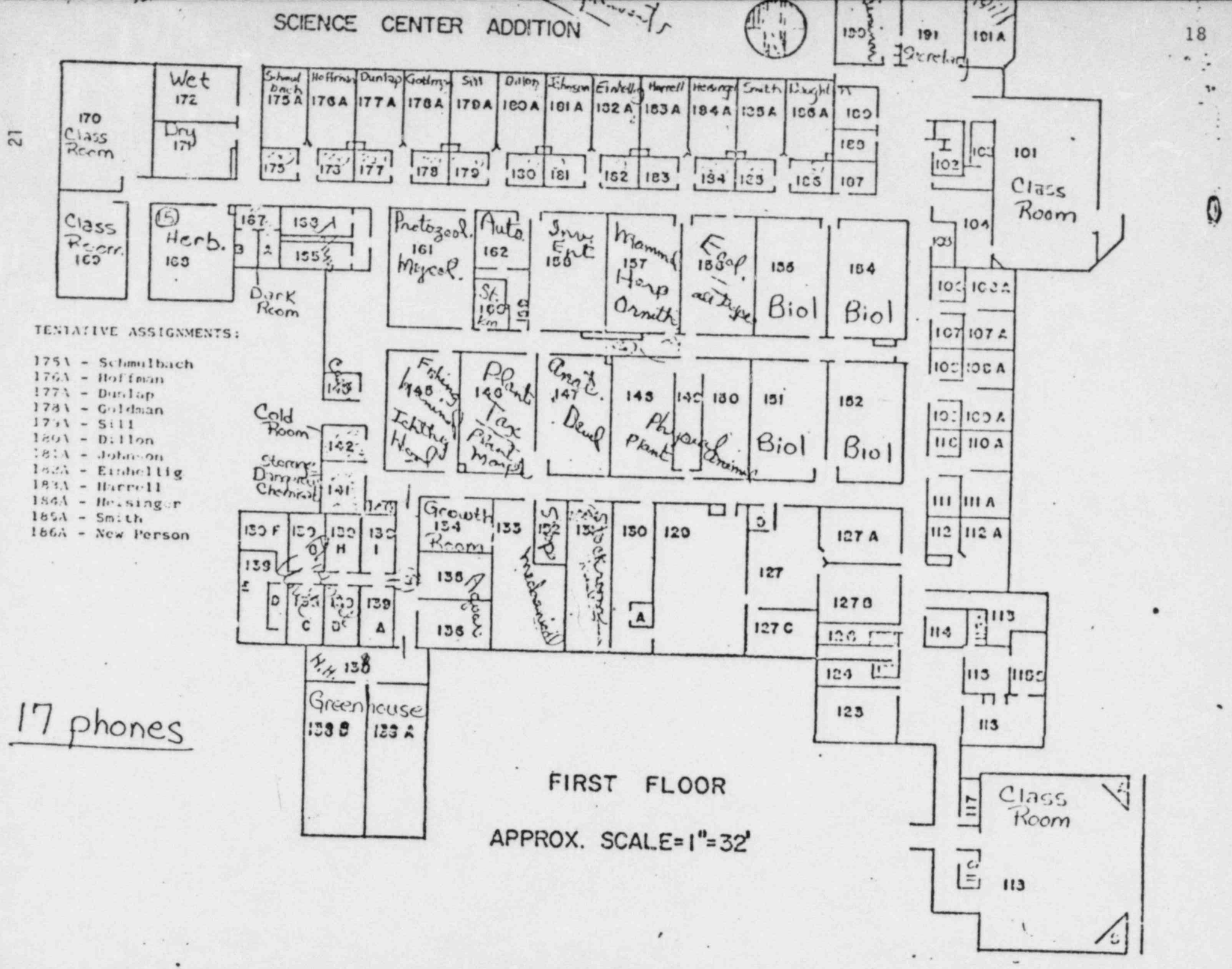
F = Refrigerator or freezer

H = Fume hood

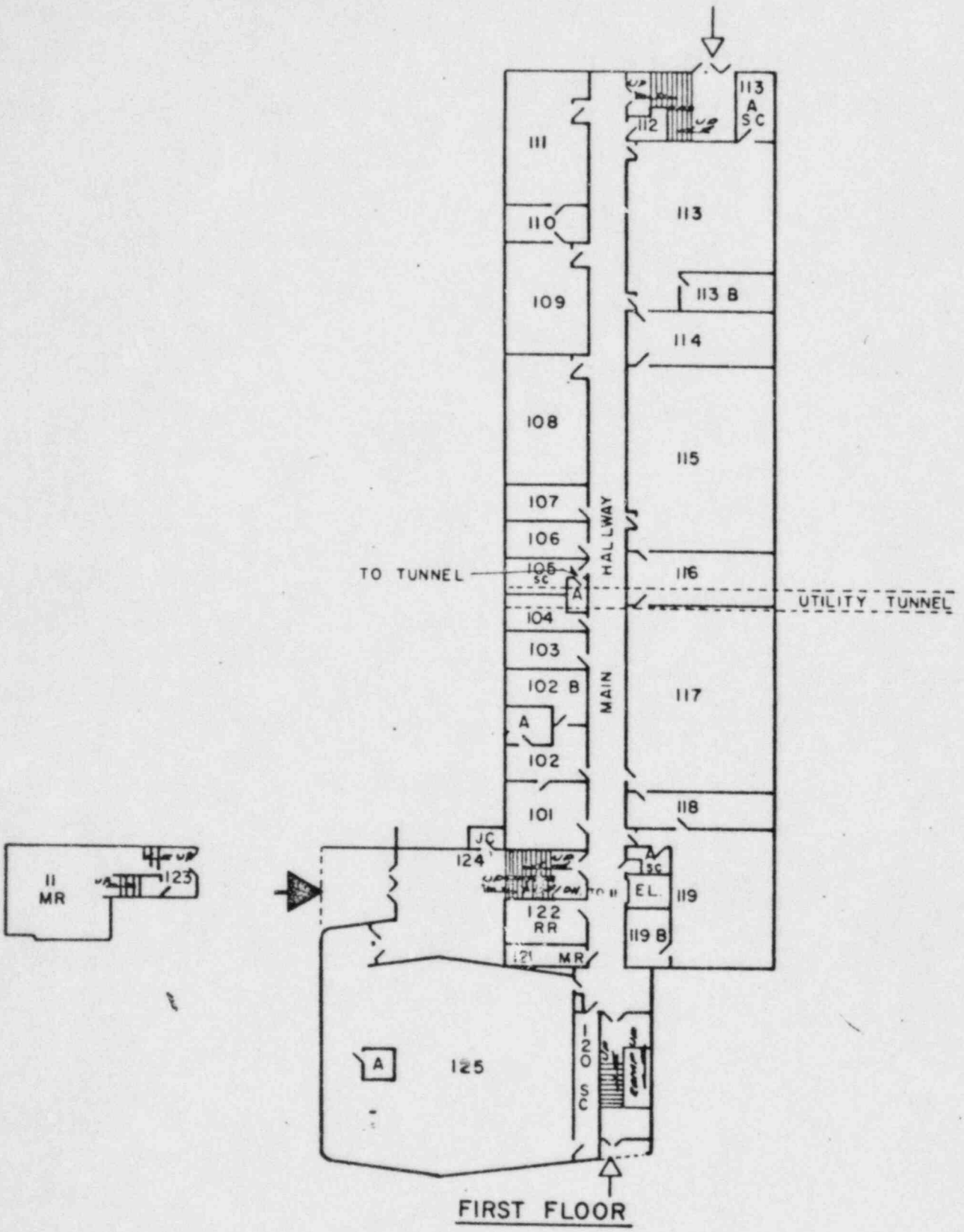
S = Sink

SECOND FLOOR
U.S.D. SCHOOL OF MEDICINE

SCIENCE CENTER ADDITION



LEWIS E. AKELEY SCIENCE CENTER



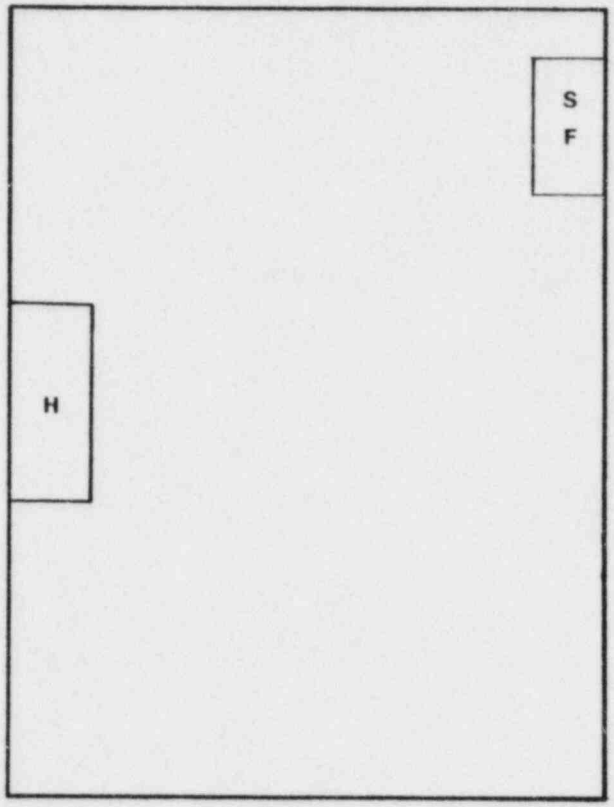
FIRST FLOOR

APPROX SCALE: 1"=32'

60275

CHURCHILL HAINES

(SCIENCE CENTER ADDITION)



F = Refrigerator or freezer

H = Fume hood

S = Sink

139 A

14. Waste Disposal

Disposal of liquid wastes will be through discharge into a sanitary sewer in conformance with Section 20.303 of 10 CFR Part 20. A schedule has been established within the University of South Dakota at Vermillion designating weekdays for each Department when its members can dispose of a maximum of 1 mCi per day. This schedule is as follows:

Physiology/Pharmacology	- Monday
Biochemistry	- Tuesday
Biology	- Wednesday
Microbiology	- Thursday
Open	- Friday

Disposal necessitates entry into the sewer in a water soluble form using a continuous water flush. All short-lived beta and gamma emitters are allowed to decay in lead lined containers or behind appropriate shielding until radiation is less than 0.5 mr/hr, at which time they are flushed down the sewer. All contaminated glassware is soaked in detergent solution for 24-48 hr, then washed in a glassware washer or in a designated isotope use area. Scintillation counting fluid containing volatile solvents (e.g. toluene) is allowed to evaporate in a fume hood. (Rooms 237A and 58). Scintillation vials and residue are soaked in detergent. The detergent is decanted into the sewer with flushing water. The radiation level is monitored and if it is below 0.5 mr/hr the glassware is washed as described above. If radiation levels are too high the process is repeated until levels are low.

Solid wastes are kept to a minimum by holding only those parts exhibiting radiation exceeding 1 mr/hr. They comprise sections of absorbent paper, chromatographic adsorbents and filter paper. Waste contaminated with short-lived isotopes are held in covered

plastic or metal containers, labeled radioactive waste, until radiation levels are below 0.5 mr/hr. This material and waste are packaged in cardboard or paper and disposed as regular trash within the specifications of Section 20.306 of CFR Part 20. Approximately 5 mCi per year in a volume of one cubic meter are disposed periodically in this fashion. All trash, including this miminal radioactive material, is hauled to a sanitary landfill several miles out of Vermillion.

Although no sealed sources have been or are planned to be disposed, these will be returned to the manufacturer if disposal is warranted.

15. Radiation Protection Program

A. Signs and Notices

A copy of the University isotope rules and regulations together with 10-CFR-20 Notice to Employees is posted in a conspicuous spot near the administrative offices of each department in which isotopes are used. Each employee is notified upon entry into employment. A standard radiation hazard sign is posted at the entry and in each room in which radioisotopes are used or stored.

B. Ordering Procedure

Each responsible user, limited to those herein named, shall order radioactive material on standard University purchase order forms. The form shall indicate the radioactive isotope, the amount ordered, and the NRC license number under which authority it is given. After signature by the departmental chairman, the purchase order shall be signed by the Radiation Safety Officer, who records in a logbook the name of the orderer, the type of radioisotope, the amount and the chemical form. In doing so inspection is made to assure possession limits are not exceeded.

C. Handling Procedures upon Receipt

All radioactive materials will be received, inspected and opened by the Radiation Safety Officer. Receipt of radioactive materials during off duty hours is handled via University Security. The central office is notified by the shipper. In turn University Security contacts the Radiation Safety Officer by phone. The Radiation Safety Officer picks up the package. University Security is instructed not to handle such packages. The Radiation Safety Officer monitors the external surface of the package (in Room 237A) for radioactive contamination. If removable radioactive contamination

in excess of 0.01 μCi per 100 cm^2 of package surface is found, the final delivering carrier and the Region IV Office, USNRC will be notified by telephone. Upon opening of the container, the radioisotope and all packing material shall be monitored likewise. The radioisotope will be delivered by the Radiation Safety Officer to the user for proper storage. Packing material will be disposed of properly, i.e. uncontaminated to normal trash and any contaminated to solid disposal containers.

D. Training and Supervision of Laboratory Personnel

All laboratory personnel shall have completed a formal course (e.g. BIOC or MICR 632-Radioisotopes: 4 credit hour elementary course in the theoretical and practical considerations in the use of radioisotopes in biological investigations) or be under the direct physical supervision of an individual having completed such formal instruction. The course offered at this institution is patterned after the one at the Institute of Nuclear Studies, Oak Ridge, TN. It includes (1) principles and practices of radiation protection, (2) radioactive measurement standardization and monitoring techniques and instruments, (3) mathematics and calculations basic to the use of and measurement of radioactivity and (4) biological effects of radiation.

All students are given their initial instruction at the bench by actual demonstration of techniques by authorized individual users. Students are informed prior to using radioisotopes of the quantities, dangers, safety precautions and properties of radioisotopes. Only safe low level quantities are used by students prior to any formal training in radioisotope techniques.

All housekeeping and security personnel are informed by the Radiation Safety Officer of (1) the hazards of radioisotopes, (2) the rooms in which they are used (all marked with appropriate signs), (3) to avoid any specific laboratory section, i.e. bench-work, hoods, etc. in these rooms and (4) not to handle labeled waste disposal containers. All spills are cleaned personally by authorized users.

E. General Instructions for Laboratory Personnel and Students

The appended list of general instructions is given to each user.

F. Procedures for use in Animals

The animal facility for use of radioisotopes is described under item 13. Regular animal caretakers will not be involved in handling animals given radioisotopes. The individual experimenter listed in item 6 is responsible. All precautions detailed in instructions to users apply. Caging and other reusable items will be washed in the room with detergent until decontaminated, as assessed by scanning with a survey meter or appropriate wipe tests. Solid wastes and animal carcases (frozen) contaminated with short-lived isotopes will be held until natural decay renders them disposable by usual means. The amount of ^{14}C and ^{3}H used in animals will be restricted so as to conform with legal disposal limits defined in 10 CFR 20,306 (b).

G. Routine Survey Program

The Radiation Safety Officer or an agent designated by him shall on a routine monthly basis survey each laboratory room assigned for radioisotope use with a standard survey meter. Suspicious areas will be sampled with a cotton applicator which will be counted in a liquid scintillation or gamma counter. Logbooks

covering records of use and disposal will be examined to ensure currency. A control over this record keeping is the logbook kept by the Radiation Safety Officer in which all orders are recorded. These surveys will be supplemented by users who will survey their laboratories for contamination at the end of each workday. Failure to abide by the rules and careless handling of radioisotopes will result in termination of their use by that individual.

Wipe tests will be performed by the user in areas where millicurie quantities of ^{3}H are used. Leak tests will be performed annually on sealed sources. For the ^{60}Co calibration source, appropriate areas will be wiped with moistened cotton swab which in turn will be counted in a liquid scintillation counter. The neutron sources are wiped with absorbent filter paper of high wet-strength and soaked with methanol to remove any traces of plutonium on the outside surface. The filter paper is then reduced to ash and spread on a stainless steel two-inch diameter planchet and fixed to the planchet with a thin cover of lucite dissolved in acetone. When the planchet is dry it is counted for alpha using the NMC-PCC11A gas flow counter with P-10 gas (10% methane and 90% Argon). The Tracerlab alpha standard, R-15, is used for pre-count and post-count to check the performance of the flow counter.

The person making the leak-test wears protective gloves and arranges the steps in handling to keep personal exposure to the gamma and neutron flux to an absolute minimum. To date the wipe-tests have shown only very small traces of alpha-count; the neutron sources appear to be in excellent condition.

GENERAL INSTRUCTIONS FOR LABORATORY PERSONNEL AND STUDENTS

I. Permission for Use

No person other than an individual licensee shall be authorized to make the decision to use radioisotopes. All other individuals must obtain verbal or written permission from a licensee who shall be responsible for assuring the proper use, handling and control of the radioisotope. The names of licensees and their location are as follows:

a. Abraham, Donald, Akeley Science Center, Room 102
b. Brady, Frank O., Lee Medicine & Science, Room 143
c. Cafruny, William A., Lee Medicine & Science, Room 250
d. Goldman, Max, Churchill-Haines, Room 178
e. Grotjan, H. Edward, Jr., Lee Medicine & Science, Room 213
f. Hagen, A. Ainsworth, Lee Medicine & Science, Room 226
g. Hastings, David F., Lee Medicine & Science, Room 229
h. Hubbard, Christopher J., Lee Medicine & Science, Room 17
i. Johnson, Jeffrey L., Lee Medicine & Science, Room 261
j. Kauker, Michael L., Lee Medicine & Science, Room 211
k. Keel, Brooks A., Lee Medicine & Science, Room 215
l. Koment, Roger W., Lee Medicine & Science, Room 243
m. Langworthy, Thomas A., Lee Medicine & Science, Room 232C
n. Lynn, Raymond J., Lee Medicine & Science, Room 232D
o. Marshall, Finley D., Lee Medicine & Science, Room 57
p. Neuhaus, Otto W., Lee Medicine & Science, Room 137
q. Quackenbush, Robert L., Lee Medicine & Science, Room 233
r. Small, Gary D., Lee Medicine & Science, Room 135
s. Smith, Paul F., Lee Medicine & Science, Room 237C
t. Thomas, John A., Lee Medicine & Science, Room 62
u. Waller, Stephen, Lee Medicine & Science, Room 219

60275

II. General Instructions

1. Use of amounts of 1 mCi or greater shall be restricted to Rooms 58 and 237A, Lee Medicine & Science Hall and Room 139A, Churchill-Haines Laboratory. Lower amounts shall be restricted for use in the following rooms:

   Lee Medicine & Science Hall: 55,56,59,63,133,134,138,139, 141,142,211B,214,217,219,221,222,223,227,228,234,236,242, 246,249,251,252,261

   Churchill-Haines Laboratory: 139A and 139H

   Akeley Science Center: 105

2. No smoking or storage and consumption of food and beverages is permitted in these rooms. These rooms and storage containers within are marked with radiation hazard signs.
3. An operating survey meter shall be used to monitor the working area during laboratory manipulations. These are available from any licensee.
4. All users shall wear lab coats.
5. All users shall wear a film badge while present in a room where radioisotopes are being used. Film badges will be collected and renewed monthly.
6. No person shall work with radioactive materials if he has any breaks in the skin on the hands unless he wears protective gloves. All such breaks shall be reported to the individual licensee responsible for the work.
7. Pipetting or the performance of any similar operation shall not be done by mouth suction.
8. Operations in which exposure exceeds 10 mr/hr shall be performed behind lead shielding. All routine users of millicurie quantities of phosphorus-32 will perform such work in a ventilated safety hood behind plastic safety shields. In addition to body badges, such users will wear wrist or finger badges.

9. All operations employing radioisotopes shall be performed on surfaces covered with absorbent paper.
10. Loose and liquid radioactive materials shall be handled in an appropriate fume hood if there is any possibility of aerosolization.
11. Transfer of radioactive materials from one laboratory room to another shall be restricted. Any such transport shall be done in closed containers adequately protected against spillage, i.e. deep trays, carts and absorbent paper must be used.
12. If, in the course of work, personal contamination is suspected, a survey with a suitable survey meter shall be made immediately. This shall be followed by the required cleansing and further survey. Routine precautionary surveys should be made at intervals. All wounds, spills and other emergencies should be reported to the immediate supervisor immediately.
13. Active liquid wastes shall be poured into labeled containers provided. They should never be poured directly into a standard drain. A maximum of 1 mCi of water soluble waste can be disposed to the sewer, using copious water, on designated days:

    Mondays - Physiology and Pharmacology
    Tuesdays - Biochemistry
    Wednesdays - Biology
    Thursdays - Microbiology
    Fridays - Open

14. Active solid wastes, restricted to materials exhibiting radiation of 1 mr/hr or greater, shall be placed in covered, labeled trash cans provided. These will be collected periodically under the supervision of the Radiation Safety Officer.
15. Radioactive materials and co[illegible]ated materials are to be retained within the radioisotope laboratory and at specific points within the laboratory.

16. No apparatus should be washed in the public water-sewage system if, in doing so, waste disposal limits are exceeded or restrictions violated.

17. Good housekeeping is necessary at all times. Spillage should be prevented. In the event of such an accident the following procedure must be followed:

    a. The room should be evacuated of all but necessary personnel. Ventilation systems should be turned off and measures taken to contain the spill. If necessary the room should be completely evacuated and locked and the Radiation Safety Officer notified immediately.

    b. The liquid should be blotted up while wearing protective gloves.

    c. All disposable materials contaminated by the spill and the cleaning process should be placed in a "contaminated" trash can.

    d. The area of the spill and the type of activity (e.g., ^{131}I) should be clearly marked.

    e. Immediately notify the immediate supervisor. If an accident occurs after normal working hours, notify the supervisor at telephone number _____ or if not reached, the Radiation Safety Officer at telephone number 624-8860.

18. Record the day of use, the type of isotope, its chemical form, the type of use and disposal disposition each time an isotope is received, used or disposed in the logbook provided in the laboratory and/or the departmental office.

19. Before a worker leaves the laboratories, the hands must be washed, then checked with a beta-gamma survey meter. Contamination remaining after thorough washing should be reported to the supervisor.
20. DO NOT begin work with radioisotope until definitive plans are established. When in doubt contact your supervisor or the Radiation Safety Officer.

Instructions for Requisition and Receipt of Radioisotopes

Each responsible user, limited to those named herein, shall order radioactive material on standard University requisition forms. The form shall indicate the radioactive isotope, the amount ordered and the NRC license number. After signature by the departmental chairman, the requisition will be signed by the Radiation Safety Officer. Phone orders are discouraged and shall not be made prior to notification of the Radiation Safety Officer. All radioactive materials will be received, inspected and opened by the Radiation Safety Officer prior to delivery to the user.

Documents detailing the rules and regulations of the Nuclear Regulatory Commission are on file and available for inspection in the Office of the Department of Microbiology.

16,17. Training and experience of each individual user named in item 6.

The following format is presented for each user

16. Type of training

	Where Trained	Duration	On the Job	Formal Course
a. Principles & 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 with radiation

Isotope	Maximum amount	Where experience was gained	Duration of experience	Type of use

Abraham, Donald

16.

a.	Oak Ridge National Lab.	3 mo.	yes	yes
b.	Argonne National Lab.	1.5 yr.	yes	no
c.	Los Alamos National Lab.	1 yr.	yes	no
d.	Kansas State Univ.	4 yr.	yes	yes

17.

^{14}C	^{90}Sn			
^{60}Co	^{210}Pb	Oak Ridge, Argonne, Los Alamos and Kansas State Univ.	6 yr.	Accelerator physics
^{137}Cs	^{45}Ca			
^{3}H	^{252}Cf			
Pu-Be				

Brady, Frank O.

16.

a.	Carnegie-Mellon University	4 mo.	yes	yes
	Columbia University	1 mo.	yes	yes
b.	Duke University	4 yr.	yes	no
c.	Carnegie-Mellon University	4 yr.	no	yes
d.	-	-	-	-

17.

^{3}H	1 mCi			
^{14}C	1 mCi	Duke University, Columbia University, Univ. of So. Dak.	19 yr.	Biochemical experimentation
^{35}S	10 mCi			
^{65}Zn	1C mCi			
^{64}Cu	10 mCi			
^{109}Cd	10 mCi			
^{131}I	1 mCi			

Cafruny, William A.

16.

a.	Medical College of Ohio	3 mo.	yes	yes
b.	" " "		yes	yes
c.	" " "		no	yes
d.	" " "		no	yes

17. ^{3}H 2 mCi

Cafruny Cont'd

^{35}S	5 mCi	Medical College Ohio Univ. of Minnesota	4 yr.	Biochemical research
^{125}I	2 mCi			

Goldman, Max

16.

a.	Battelle Northwest Lab.	2 mo.	yes	yes
	Univ. California-Berkeley	2 yr.	yes	no
	Oak Ridge, TN	2 mo.	no	yes
b.	"	"	"	"
c.	"	"	"	"
d.	Lovelace Foundation Richland, WA	2 mo.	yes	yes

17.

^{125}I	50 mCi	Univ. of California-Berkley Oak Ridge Richland, WA	23 yr.	Thyroid Metabolism
^{131}I	50 mCi	Univ. of So. Dak.		

Grotjan, H. Edward, Jr.

16.

a.	Kansas Univ. Med. Center	3.5 yr.	yes	yes
b.	"	"	yes	yes
c.	"	"	yes	yes
d.	"	"	yes	yes

17.

^{125}I	5 mCi			
^{3}H	2 mCi	Kansas Univ. Med. Center Univ. Texas-Houston	12 yr.	Radioimmunoassays and metabolic studies
^{14}C	2 mCi			
^{35}S	2 mCi			

60275

Hagen, A. Ainsworth

16.

a.	Univ. Tennessee		18 yr.	yes	yes
	Univ. Utah		2 yr.	yes	no
	Univ. So. Dak.		2 yr.	yes	yes
b.	Univ. Tennessee		18 yr.	yes	yes
	Univ. So. Dak.		2 yr.	yes	yes
c.	Univ. Tennessee		18 yr.	yes	no
	Univ. Utah		2 yr.	yes	no
	Univ. So. Dak.		2 yr.	yes	no
d.	Univ. Tennessee		18 yr.	yes	yes
	Univ. Utah		2 yr.	yes	yes
	Univ. So. Dak.		2 yr.	yes	yes

17.	$^{14}_{6}C$	5 mCi	Univ. Tenn. Univ. Utah Univ. So. Dak.	18 yr.	Biological research
	$^{3}_{1}H$	10 mCi	Sweden		

Hastings, David F.

16.

a.	Duke University	3 yr.	yes	yes
b.	Duke Univ. & Univ. Aarhus, Denmark	10 yr.	yes	no
c.	Duke Univ. & Univ. Aarhus, Denmark	5 yr.	yes	yes
d.	Duke Univ. & Univ. Aarhus, Denmark			yes

17.	$^{86}_{40}Rb$ $^{40}_{82}K$ $^{82}_{35}Br$ $^{35}_{137}S$ $^{137}_{42}Cs$ $^{42}_{}K$	$^{3}_{238}H$ $^{238}_{36}Pu$ $^{36}_{14}Cl$ $^{14}_{24}C$ $^{24}_{32}Na$ $^{32}_{35}P$ $^{35}_{}Ca$	2.5 mCi each	Duke Univ. Univ. Aarhus Univ. So. Dak.	15 yr.	Biological research

Hubbard, Christopher J.

16.

a.	Hiram College, Ohio	1 semester	no	yes
b.	"	"	no	yes
c.	"	"	no	yes
d.	"	"	no	yes

Hubbard Cont'd

17.	^{125}I	1 mCi			
	^{3}H	1 mCi	Univ. Kansas-Med. Center	3 yr.	Hormone research
	^{35}S	5 mCi	Univ. So. Dak.		

Johnson, Jeffrey L.

16.

a.	Indiana Univ. Med. Center	5 yrs.	yes	yes
b.	"	"	yes	yes
c.	"	"	yes	yes
d.	"	"	yes	yes

17.	^{32}P	1 Ci			
	^{3}H	10 mCi	Indiana Univ.-Med. Center	15 yr.	Biological research
	^{14}C	5 mCi	Univ. So. Dak.		

Kauker, Michael L.

16.

a.	Univ. Alabama	3 mo.	no	yes
b.	Univ. Ala, Univ. No. Car.	2.5 yr.	yes	yes
c.	Univ. No. Carolina	2 yr.	yes	no
d.	Univ. Alabama	3 mo.	no	yes

17.	^{3}H	25 mCi			
	^{14}C	15 mCi	Univ. No. Carolina Univ. Tennessee	14 yrs.	Biological research
	^{23}Na	2 mCi			

Keel, Brooks A.

16.

a.	Medical College Georgia	4 yrs.	yes	no
b.	"	"	yes	no
c.	"	"	yes	no
d.	"	"	yes	no

60275

17. ^{125}I 10 mCi; ^{131}I 10 mCi; ^{3}H 2 mCi — Medical College of Georgia — 4 yr. — Radioimmunoassays

Koment, Roger W.

16.

a.	Penn. State Univ. Med. Center	3 yr.	yes	yes
b.	"	"	yes	yes
c.	"	"	yes	no
d.	"	"	yes	no

17. ^{3}H 5 mCi — Penn. State Univ. & Univ. of Miami — 10 yr. — Biological research

^{14}C 1 mCi — Penn. State Univ. & Univ. of Miami — 5 yr. — Biological research

Langworthy, Thomas A.

16.

a.	University of Kansas	4 yr.	yes	no
b.	"	4 yr.	yes	no
c.	"	4 yr.	yes	no
d.	"	6 mo.	yes	yes

17. ^{14}C 0.1 mCi; ^{32}P 2 mCi; ^{35}S 1 mCi — University of Kansas & Univ. of So. Dak. — 15 yr. — Biological research

Lynn, Raymond J.

16.

a.	Oak Ridge Inst. Nuclear Studies	2 wk.	yes	yes
b.	"	2 wk.	yes	yes
c.	"	1 wk.	yes	yes
d.	"	1 wk.	no	yes

17. ^{3}H 0.5 mCi; ^{14}C 0.5 mCi — Univ. of So. Dak. — 20 yr. — Microbiological and immunological research

Lynn Cont'd

^{35}S	0.5 mCi	Univ. of Pittsburgh	1 yr.
^{125}I	0.1 mCi	Univ. of Pittsburgh	1 yr.
^{32}P	0.5 mCi	Univ. of South Dakota	1 yr.
^{131}I	0.1 mCi	Univ. of Pittsburgh	1 yr.

Marshall, Finely D.

16.

a.	University Missouri	2 yr.	yes	no
	University of Iowa	2 yr.	yes	no
b.	Nuclear Chicago	1 wk.	no	yes
	University Missouri	2 yr.	yes	no
	University of Iowa	2 yr.	yes	no
c.	University Missouri	2 yr.	yes	no
	University of Iowa	2 yr.	yes	no

17.

^{14}C	1 mCi	University Missouri		
^{3}H	1 mCi	University Iowa and	25 years	Biochemical research
^{32}P	1 mCi	Univ. of South Dakota		
^{35}S	1 mCi			

Neuhaus, Otto W.

16.

a.	Oak Ridge Inst. Nuclear Studies	4 wk.	no	yes
b.	Oak Ridge Inst. Nuclear Studies	4 wk.	yes	yes
c.	Wayne State Univ. & Univ. of South Dakota	19 yr.	yes	no
d.	Wayne State Univ. & Univ. of South Dakota	9 yr.	yes	no

17. Experience with Radiation (Otto W. Neuhaus, Ph.D.)

ISOTOPE	MAXIMUM AMOUNT	WHERE EXPERIENCE GAINED	DURATION	TYPE OF USE
^{14}C	40 mc	Wayne State University Detroit, Michigan	8 years	Metabolic studies and
^{59}Fe	59 mc	"	"	teaching; assays
^{131}I	100 mc	"	"	"
^{125}I	100 mc	"	"	"
^{32}P	100 mc	"	"	"
^{3}H	50 mc	University of So. Dak. Vermillion, So. Dak.	16 years	"
^{45}Ca	10 mc	"	"	"
^{35}S	10 mc	"	"	"

Quackenbush, Robert L.

16.

a.	Indiana University	1 semester	no	yes
b.	"	1 semester	no	yes
c.	"	1 semester	no	yes
d.	"	1 semester	no	yes

17.	^{3}H	1 mCi		5 yr.	
	^{14}C	1 mCi	Indiana Univ. & Univ. of So. Dak.	2 yr.	DNA and protein labeling in microorganisms
	^{35}S	1 mCi		6 yr.	
	^{32}P	5 mCi		1 yr.	

Small, Gary D.

16.

a.	Western Reserve Univ.	6 yr.	yes	no
b.	Univ. Washington,	2 yr.	yes	no
c.	Brookhaven Nat'l Lab	1 yr.	yes	no
d.	Univ. of South Dakota	15 yr.	yes	no

17.	^{32}P	15 mCi	Western Reserve Univ. Univ. Washington Brookhaven Nat'l Lab & Univ. of So. Dakota	15 yr.	Nucleic acid research
	^{3}H	10 mCi			
	^{14}C	1 mCi			

60275

Smith, Paul F.

16.

a.	Philadelphia College Pharmacy & Science, Philadelphia, PA			yes	yes
b.	Philadelphia College Pharmacy & Science, Philadelphia, PA		Total of 130 hours	no	yes
c.	"	"		no	yes
d.	"	"		no	yes

17.

^{14}C	50 mCi	Univ. South Dakota, Univ. Pennsylvania Phila. Coll. Pharmacy	25 yr.	Biochemical experimentation
^{3}H	1 Ci	Univ. South Dakota, Univ. Pennsylvania Phila. Coll. Pharmacy	25 yr.	Biochemical experimentation
^{131}I	5 mCi	"	5 yr.	Biochemical experimentation, remote handling
^{60}Co	5 mCi	Phila. Coll Pharm.	5 yr.	Remote handling and calibration
^{32}P	50 mCi	Univ. South Dakota Phila. Coll. Pharmacy	20 yr.	Remote handling and biochemical experimentation
Ra(DEF)	5 mCi	Phila. Coll. Pharmacy	3 weeks	Calibration
^{125}I	1 mCi	Univ. South Dakota	1 yr.	Biochemical experimentation
^{35}S	5 mCi	Univ. South Dakota	10 yr.	Biochemical experimentation
^{59}Fe	1 mCi	Univ. South Dakota	1 yr.	Biochemical experimentation
^{45}Ca	1 mCi	Univ. South Dakota	1 yr.	Biochemical experimentation
^{36}Cl	1 mCi	Univ. South Dakota	1 yr.	Biochemical experimentation

Thomas, John A.

16.

a,b,c,d.	University of Illinois		1 mo.	yes	yes

17.

^{36}Cl	0.1 mCi	Univ. Illinois	4 yr.	Biochemical experimentation
^{14}C	0.2 mCi	Univ. Illinois & Cornell University & Univ. South Dakota	10 yr.	Biochemical experimentation
^{3}H	0.5 mCi	Univ. South Dakota & Cornell University	7 yr.	Biochemical experimentation

Waller, Stephen

16.

a.	Univ. Maryland	1 semester	no	yes
b.	Univ. Maryland	1 semester	no	yes
c.	Univ. Maryland	1 semester	no	yes
d.	Univ. Maryland	1 semester	no	yes

17.

^{3}H	5 mCi			
^{14}C	5 mCi			
^{32}P	1 mCi	Univ. Maryland & N.I.H.	7.5 yr.	Biological research
^{125}I	1 mCi			
^{40}K	1 mCi			