FORM NRC-313 I (3-80) 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)*

- [X] a. NEW LICENSE
- [ ] b. AMENDMENT TO: LICENSE NUMBER
- [ ] c. RENEWAL OF: LICENSE NUMBER

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

E. I. Du Pont de Nemours & Co., Inc.

TELEPHONE NUMBER: AREA CODE – NUMBER EXTENSION

(302) 774-1011

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

Gary L. Sontchi

TELEPHONE NUMBER: AREA CODE – NUMBER EXTENSION

(302) 366-2814

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

1007 Market Street
Wilmington, DE 19898

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

Glenolden Laboratory
500 South Ridgeway Avenue
Glenolden, PA 19036

(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.	Radioactive materials are to be used by	or under the direct supervision of
b.	individuals designated by the Radiation	Safety Committee (See attached).
c.		

7. RADIATION PROTECTION OFFICER

George W. Moncrief
Margit H. Böer (alternate)

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)		SEE ATTACHED		
(3)				
(4)				

RECEIVED BY LFMB Date 9/23/81 Log Sept. 1981 By Brown Orig. To Action Copy 9/24/81

Applicant's Check No. 381-6958 Amount $ 150.00 Application Fee Category 3K Type of Fee Application Case Check Received 9/23/81 By Brown

LINE NO.	E DESCRIBE USE OF LICENSED MATERIAL
(1)	
(2)	SEE ATTACHED
(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)	NOT	APPLICABLE	
(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)			SEE	ATTACHED		
(3)						
(4)						

11. CALIBRATION OF INSTRUMENTS LISTED IN ITEM 10

☒ a. CALIBRATED BY SERVICE COMPANY

NAME, ADDRESS, AND FREQUENCY

SEE ATTACHED

☒ 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): Ring Badges, Urine Assay, Thyroid Monitoring	SEE ATTACHED	☒ MONTHLY or as specified in Attachments for Items 12 & 15 ☐ 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.

SEE ATTACHED

14. WASTE DISPOSAL

a. NAME OF COMMERCIAL WASTE DISPOSAL SERVICE EMPLOYED

Teledyne-Isotopes, Inc., Westwood, NJ

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 ATTACHED

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)* $190.00	b. CERTIFYING OFFICIAL *(Signature)*
	c. NAME *(Type or print)* Lawrence J. Rasero
(1) LICENSE FEE CATEGORY: 3K Byproduct material for research.	d. TITLE Site Manager
(2) LICENSE FEE ENCLOSED: $ development $190.00	e. DATE 9/16/81

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ATTACHMENTS

ITEM 8

	A	B	C	D
(1)	Hydrogen - 3	Any	Not Applicable	5000 mCi
(2)	Carbon - 14	Any	Not Applicable	500 mCi
(3)	Sulfur - 35	Any	Not Applicable	500 mCi
(4)	Iodine - 125	Any	Not Applicable	100 mCi
(5)	Iodine - 131	Any	Not Applicable	100 mCi
(6)	Chromium - 51	Any	Not Applicable	200 mCi
(7)	Chlorine - 36	Any	Not Applicable	100 mCi
(8)	Phosphorus - 32	Any	Not Applicable	500 mCi
(9)	Calcium - 45	Any	Not Applicable	100 mCi
(10)	Cesium - 137	Any	Not Applicable	50 mCi
(11)	Nickel - 63	Foil & GC	Not Applicable	Not to Exceed 15 mCi each source
(12)	Any other byproduct with atomic No. 3-83, excluding strontium-90 and alpha emitters.	Any	Not Applicable	10 mCi each

Total for all of the above not to exceed fifteen curies.

E - For receipt, acquisition, ownership, possession, use and transfer of above byproducts for basic research and development of pharmaceuticals at Glenolden Site, 500 S. Ridgeway Avenue, Glenolden, PA. Radioactive materials will not be used in or on human beings or in field applications where activity is released into the environment. Although most planned uses are in vitro experimentation, these materials may also be used for animal feeding or injection in connection with studies on drug metabolism or drug action.

ITEM 9 Not Applicable.

ITEM 10 A. The radiation protection office and/or the medical office will possess at least the following radiation detection instruments:

(1) Survey meter, Eberline Model E120 with HI-270 Probe, 0-50 m R/hr

(2) Survey meter, Ludlum Model 5 (Geiger Tube), 0-2R/hr

(3) Single channel scintillation scaler and rate meter (Ludlum Model 2200 with a low energy gamma scintillation probe, Ludlum Model 44-3 or other probe suitable for isotope in use).

Three Du Pont Constant Flow Samplers (e.g., Model P-4000A) will also be retained for air samplings in Laboratories, air hoods, and hood exhaust stacks. (Cartridges from these tests will be analyzed in gamma scintillation spectrometers or liquid scintillation spectrometers listed below.)

B. The following instruments are to be used primarily for other purposes, but will be available for necessary health physics use:

(1) Liquid Scintillation Spectrometers - (two) Packard "Tri-carb" 460 C Liquid Scintillation Systems.

(2) Scintillation Gamma Counters - (one) Packard Auto-Gamma 800 C Scintillation Counter.

(3) Survey Meters - (three) Two Ludlum Model 3 "Geiger Counters" equipped with either a GM detector or a low energy gamma scintillation probe. One Eberline Model SK-1 Survey Meter with a GM detector.

C. In addition, other portable and non-portable instruments assigned for research will be available if needed. Instruments could also be obtained "on loan" from the Du Pont Experimental Station Site in Wilmington, DE.

ITEM 11 Calibration of Instruments

The portable instruments in Item 10A will be calibrated in accordance with Regulatory Guide 8.21.1.12 using an appropriate NBS traceable source. Survey meters will be calibrated by Teledyne Isotopes, Inc., 50 Van Buren Ave., Westwood, NJ, at 6 month intervals. The single channel scintillation scaler and rate meter for thyroid monitoring will be calibrated by use of an Iodine-129 standard when Iodine-125 is used and a Barium-133 standard when and if Iodine-131 is used. These standards will be purchased prior to the use of Iodine-125 and 131, respectively from New England Nuclear Corporation, Boston, MA and placed within an NBS approved "thyroid phantom" purchased from Nuclear Associates, Carle Place, NY.

The calibration procedure will be as follows: The scintillation scaler will be operated according to the manufacturers directions. A 3 minute background count will be used to calculate average background cpm. The calibrated source in the thyroid phantom will be counted for 1 minute and corrected for background. This cpm value will be used to calculate a correction factor to convert experimental net cpm to μCi Iodine-125. The right and then the left thyroid will be located and counted, (1 minute each) and net cpm will be used to calculate μCi Iodine-125 in each lobe.

Scintillation Counters (Item 10B) will be calibrated by using appropriate NBS traceable sources. Internal standards will be used at 6 month intervals to test the counting efficiency for Hydrogen-3 and Carbon-14 in urine samples.

Commercially available calibrated "check sources" will be kept in the Radioisotope Laboratory for "as used" testing and calibration of all other portable instruments.

ITEM 12 Personnel Monitoring Devices

(A) [X] TLD Badges

[X] Others: Ring Badges
Urine Assay
Thyroid Monitoring

(B) Supplier of TLD badges and ring badges: Teledyne Isotopes
TLD Badge Service
50 Van Buren Avenue
Westwood, NJ

(C) Exchange Frequency: Monthly or as specified below in Item 12, and in Item 15.

A. External Dosimetry

TLD badges will be used by all persons having access to the "Radioisotope Laboratory" (Room 172B, a strictly controlled area), or to any other individual who it appears might receive a dose in any calendar quarter in excess of 10% of applicable limits of whole body radiation specified in paragraphs (a) of 10 CFR20.101 (i.e., 0.125 Rems per quarter). Ring badges will be used by all individuals while working with mCi levels of Phosphorus-32, Iodine-125, Iodine-131, or any level of any isotope which might conceivably produce an exposure to the hands of greater than 10% of applicable limits specified in 10 CFR20.101(a) (1.87 rems) per calendar quarter during the course of its use.

B. Internal Dosimetry

(1) Urine Samples

All persons working with quantities equal to or greater than 1 mCi per month (or 10 mCi per month if used in a vented hood) of tritium, Carbon-14, Sulfur-35, Phosphorus-32, or other isotopes (except Iodine-125 or Iodine-131) shall be required to submit a urine sample at intervals of two weeks. I-125 and I-131 users will have their thyroids scanned as described below in Item 12B (2). An aliquot of 1 ml. shall be counted on-site in a liquid scintillation counter with appropriate settings for tritium, Carbon-14, and Phosphorus-32. If gross counts are in excess of 2000 cpm, 600 cpm, or 200 cpm in each of these channels, the sample will be further examined to establish identity and quantify the presence of a radioisotope. Results of these tests shall be communicated to the employee and also kept with the employee's permanent records. Evidence for the presence of contamination in urine indicating exposure of the whole body of an individual to 5 rems or more irradiation during the biological lifetime of the isotope shall be reported in writing to the NRC in accordance with 10 CFR 20.403.

Any person working in a controlled or strictly controlled area shall submit a urine sample upon a request from the RPO.

(2) Thyroid Measurements

The RPO at the Du Pont Glenolden site will have at his disposal a single channel scintillation scaler-ratemeter fitted with a low energy gamma scintillation

probe (Ludlum model 2200 with a model 44-3 probe).

This has an efficiency greater than 0.5% for thyroid-bound Iodine-125. This will be calibrated as described in Item 11. Any employee who worked with quantities of volatile radioactive Iodine (as I^- or I_2) in excess of 100 µCi or with quantities of chemically combined iodine in excess of 1 mCi shall have their thyroids checked for radioactivity within 6-72 hours, or at two week intervals if there are repeated exposures. The results of these tests will be communicated to the employees and will also be placed in their permanent record. If the thyroid burden of Iodine-125 exceeds 0.12 µCi or of Iodine-131 exceeds 0.04 µCi, actions specified by Regulatory Guide 8.20.5 shall be instituted.

ITEM 13

A. General

The facility is a chemical laboratory complex (See Appendix 1) purchased by Du Pont from Atlantic Richfield Company in Jan. 1981, for pharmaceutical research. The three story main building (See Appendices 2A-2C) is being reconditioned for biochemical and biological laboratory use. It contains approximately 20,000 square feet of laboratory space and 13,000 square feet for animal facilities. It is located in the Borough of Glenolden, Delaware County, Pennsylvania. The site has been used continuously for over 40 years for chemical, and previously pharmaceutical, research and development.

Three laboratory configurations are typical of the research laboratories. The first case (See Appendix 3) represents a room with both a Class I externally vented biohood and a conventional chemical laboratory hood. Variations may include one or more additional hoods of either type; however, there would be at least one biohood and one chemical hood in each room.

The second configuration (See Appendix 4) showing two chemical fume hoods is representative of laboratories with one or more chemical fume hoods but no biohoods. The third configuration (See Appendix 5) showing one biohood only, is representative of a group of laboratories which do not have chemical laboratory hoods but will have the single biohood vented externally. All laboratories represented by these three cases may be used for radioisotopes, generally in microcurie or few millicurie quantities (See 15.C.9). These will be considered controlled laboratories as defined in the Glenolden Site Radiation Manual (See Item 15.C.9). Additionally, there will be three strictly controlled areas as defined in the Glenolden Site Radiation Manual (See Item 15).

A "Gammacel-40" irradiation unit manufactured by Atomic Energy of Canada, Ltd., containing 4000 Ci of Cesium-137 is also planned to be located in this building (Room 054) and a separate license has been obtained from NRC in Washington, D.C. (License No. 07-00455-36).

B. Strictly Controlled Areas

The following locations have been designated Strictly Controlled Areas. Other areas may be designated strictly controlled only by approval of the Radiation Safety Committee:

1. Radioisotope Laboratory - The bulk of the radioisotope used under this license will be kept in a strictly controlled Radioisotope Laboratory (Room 172B) (See Appendix 6). This room will be posted as a Radiation Area (10 CFR 20.202 and 10 CFR 20.203). Amounts needed for individual operations will be taken from this room into other controlled laboratories, those amounts will generally be in the microcurie or a few millicurie quantities. The strictly controlled "Radioisotope Laboratory" will have access limited to employees issued TLD badges. Doors to this room will be locked after normal working hours (to permit exit only) and a key will be available from a guard who will be on continuous duty in the building. A survey meter will be available and protective clothing will be required at all times in this room (See 15.C.9, below).

   There will be three chemical hoods in the "Radioisotope Laboratory". One of these will be fitted with a HEPA filtration system and will be designed to provide 60 linear feet per minute face velocity. This will be used for chemical synthesis or other operations that may give rise to radioactive particles. In general, calculations will be made to determine if there is a possibility of release of radioisotopes and the effluent air will be monitored intermittently when levels in the exhaust air could approach those permitted in 10 CFR 20, Appendix B., Table II. For purposes of compliance, concentrations in exhaust air will be averaged over a period of one year.

   Laboratory air will also be monitored intermittently when calculations show any possibility of release of radioisotopes approaching those permitted in 10 CFR 20, Appendix B., Table I. Monitoring of air will use portable pumps (Du Pont P4000-A or equivalent) at 0.5 to 4.0 liters per minute with appropriate filters (selected with reference to the N.I.O.S.H. Manual of Analytical Methods, 2nd Edition, Volume 1-5). For example, "charcoal tubes" for industrial hygiene sampling will be used to detect volatile iodine and the contents will be counted directly in a gamma scintillation spectrometer (See Methods of Air Sampling and Analysis, 2nd Edition, Chapter 603, published by the American Public Health Association).

   A second hood in room 172B will be fitted with a negative pressure "Iodination Box" (Model RM-1, Radiation Physics, Inc., Silver Spring, MD) exhausted via a carbon filter and blower. This design has been used successfully at the Du Pont Experimental Station Site for several years for experiments employing radioactive iodine for labeling of proteins. It will also be used for work with levels of 1 mCi or greater of volatile organic compounds which are otherwise likely to escape into the hood air. Intermittent monitoring of air in the outer hood will be used to establish the effectiveness of the carbon filter.

2. Waste Collection Area - Cell 2 - One of four barricaded explosion cells used by the previous owner of the site will be dedicated as a radioactive waste collection area (See Appendix 8). This will be designated as a strictly controlled area and will be posted as a Radiation Area in accordance with 10 CFR 20.203. The cell will be locked after regular working hours. The cell is heavy concrete and metal wall construction and will be protected by an automatic Halon-1301 fire extinguishing system. An adjoining cell will be designated for storage of shipping materials such as drums, vermiculite and other non-radioactive materials.

3. Animal Facility - Room A39 (See Appendix 7) in the animal facility will be designated a strictly controlled area and will be locked. Animals injected with Chromium-51, Iodine-125, or Iodine-131 will be housed in Room 39 of the animal care facility in a portable containment unit such as the Hazelton Systems PCS-80. The low velocity HEPA filtered air in the PCS-80 unit meets or exceeds Federal Standard 209-B for Class 100 clean rooms and maintains air 99.97% particle free in the 0.3 micron range. The ventilated cage rack system includes curtains and cage barriers to isolate animal cages from each other as well as from the invesitgator and room air.

   Room A39 will also be equipped with a Class II Type B stainless steel total exhaust hood with an easily removable HEPA filter. The hood has a separate exhaust system with provisions for adequate dispersion of allowable amounts of radionuclide into the atmosphere. A minimum linear inward air velocity of 50 ft/min is maintained across the face of the hood. Effluents from the hood will be intermittently monitored to assure exhaust will be in compliance with 10 CFR 20.106 Appendix B, Table II, Column 1 for venting to unrestricted areas.

   Every attempt will be made to maintain effluents as low as reasonably possible. Wipe tests of hood interior will be performed after each use of labeled materials.

   The technical personnel working in this area will be responsible for handling animals, the disposal of the animal waste, and removal of carcasses as well as cage decontamination. Animals will be handled only when the investigator is equipped with two layers of protective gloves, eye protection, protective boots and designated lab clothing. Lab coats shall be buttoned and the sleeves worn extended to cover the arms and wrists. Animal carcasses will be packaged separately in the waste room as indicated by Teledyne or other commercial waste disposal service, and disposed of commercially.

   The following information is submitted relative to our procedures for cage decontamination:

   a. Cage surfaces will be wiped with a solution containing 0.1 M NaI, 0.1 M NaOH, and 0.1 M $Na_2S_2O_3$.

b. Cages will be rinsed with "Isoclean" or other appropriate decontaminating liquid.

c. Fluid will then be combined in a holding tank for disposal as liquid waste.

d. The disposable trays will then be lined with suitable absorbant for the remaining liquid, and trays disposed of as dry solid waste.

e. Wipe tests will be performed on each cage to insure decontamination.

A survey meter (Technical Associates Model Pug-1, or similar instrument) will be available at all times in this room to check personnel for contamination.

C. Controlled Areas

Laboratory areas where low levels of isotopes are used (See Glenolden Site Radiation Manual) are to contain non-porous bench tops and floors, and adequate ventilation.

D. Ventilation

Of the three control laboratories selected as representative of the various 400 sq. ft. laboratories on the site, Room 229 (representing those labs with chemical fume hoods only) has the highest air exchange rate of 2040 cfm or one complete air change every two minutes, exhausted to the outside with no recirculation.

Laboratory 131 representing labs with one Class I biohood and one chemical fume hood would have an air exchange rate of 1200 cfm or one complete air change every 3 minutes. The biohood exhaust (260 cfm) will be directly to outdoors after passing through HEPA filters.

Laboratory 225 is representative of labs with one biohood only. These biohoods are vented directly to outside at an exhaust rate of 390 cfm providing a room air exchange once every 10 minutes.

All hoods will be designed to meet Du Pont standards and will have at least 60 fpm inward face velocity when sashes are set at the maximum opening.

ITEM 14 - Waste Disposal

A. Teledyne Isotopes
50 Van Buren Avenue
Westwood , NJ

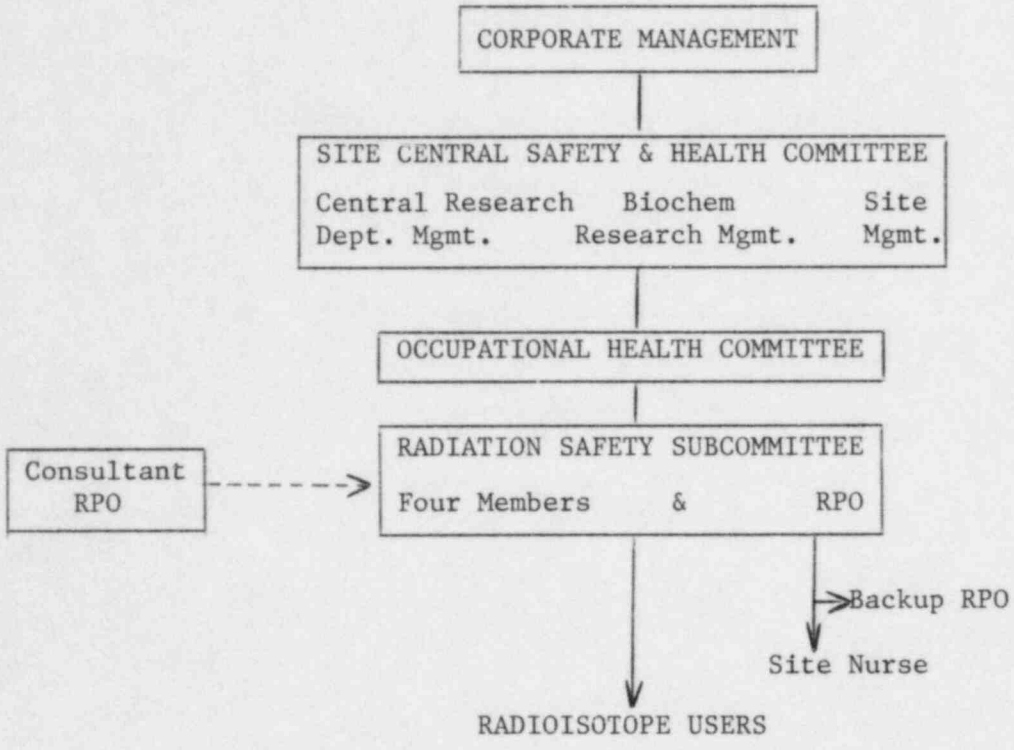
NRC License No.: 29-00055-14

B. Scintillation fluids and animal carcasses containing less than 0.05 uCi C-14 or H-3 per gram of scintillation fluid or gram of animal tissue averaged over weight of animal will be incinerated at the Du Pont Experimental Station, Wilmington, DE. All other wastes to be sent to Teledyne in accordance with current regulations for disposal. Sealed sources will be disposed of according to NRC regulations.

ITEM 15 - RADIATION PROTECTION PROGRAM

A. Radiation Safety Committee (RSC)

The following chart shows the relationship of the radiation committee in the corporate and site safety administration structure.



1. The composition of the five-member committee includes two principal investigators from the Central Research & Development Department, two principal investigators from the Biochemicals Department, and the RPO. The chairperson shall rotate on a yearly basis:

   K. R. Gans-Brangs (Biochemicals) Chairperson
   D. J. Ganfield (CR&DD)
   K. K. Lonberg-Holm (CR&DD)
   W. Galbraith (Biochemicals)
   G. W. Moncrief (Site RPO)

   Additionally, J. F. Viskocil, RPO for Du Pont Experimental Station, Wilmington, DE, will be available as a consultant RPO for Glenolden Laboratory making visits every 6 weeks for the first year. His experience appears in license 07-00455-02.

2. The experience of each of the above is summarized as follows:

Kathleen R. Gans-Brangs, Committee Member

Training & Experience

B.A. Biology/French, University of Delaware, 1971; Ph.D. Pharmacology, Philadelphia College of Pharmacy & Science, 1980. Postdoctoral training in Pharmacology and Enzymology, 1980-1981. Joined Du Pont April, 1981.

At Philadelphia College of Pharmacy & Science:

Formal training included a semester course each on radioisotope techniques and radiobiology. Included 4 hours of lab per week on radioactivity measurements, monitoring techniques and instruments. Calculations, biological effects of radiation, and radiation protection were also taught. In 1977, took intensive courses in Radioimmunoassay and Liquid Scintillation Counting sponsored by the Clinical Radioassay Society (Delaware Vally) and Philadelphia College of Pharmacy & Science; taught portions of this course in 1978.

Practical experience with isotopes during the past 6 years included work with:

- ^{125}Iododeoxyuridine in vivo in rats, approximately 10 mCi/yr., 1978-1980
- ^{3}H-thymidine in vitro, approximately 1 mCi/yr., 1975-1981
- ^{60}Cobalt irradiation of rats on 3 occasions, 1979
- Various isotopes for instrument standardization and experimentation including ^{137}Cesium, ^{14}Carbon, ^{129}Iodine.

K. Karl Lonberg-Holm, Committee Member

Training & Experience

B.A. Biochemistry, Harvard University 1953; Ph.D. Biochemistry, Univ. Calif. Berkeley 1962. Postdoctoral training molecular biology and virology (special fellowship), University of Uppsala, Sweden, 1967-1969.

Employment:

1959-1960	Fundamental Research Co., Berkeley, CA, Research Chemist
1960-1962	Univ. of Calif. Lawrence Radiation Laboratory, Graduate Assistant
1962-1967	Du Pont Central Research Department, Research Chemist
1969-1975	Du Pont Central Research Department, Research Chemist
1976	Temple University School of Medicine, Associate Professor of Microbiology
1977-Present,	Du Pont Central Research Department, Research Chemist

During the past 27 years, made extensive use of radioisotopes for in vivo and in vitro preparation of labeled biochemicals.

^{125}I - Approximately 100-200 mCi/year at peak periods (1970-1980)

^{14}C - Approximately 100 mCi/year during peak periods of the Lawrence Radiation Laboratory (this includes CO_2)

^{32}P - Approximately 200 mCi/year during peak periods (1964-1975)
^{3}H - Approximately 100 mCi/year during peak periods (1970-1980) (this includes labeled acetic anhydride)
^{35}S - Approximately 100 mCi/year during peak periods ususally as ^{35}S - Methionine
^{42}K - 250 uCi maximum delivery
^{203}Hg - 1 mCi maximum delivery

No formal training in radiation safety has been taken. However, has provided on-the-job training in safe use of isotopes at Du Pont (for technicians) and for students at Temple University School of Medicine. Has assumed the major responsibility for establishing safety procedures for handling of I-125 in CR&D Department. Has a patent on a radiation detection device (U.S. Patent 3200252, 1965), and has about forty publications involving use of radioisotopes.

David J. Ganfield, Committee Member

Training & Experience

B.S. Chemistry, Parsons College 1963. Ph.D. Biochemistry Iowa State Univ. Ames, 1971. Postdoctoral training: HEW trainee in Immunology 1971-74 at Jefferson Medical College of Thomas Jefferson Univ., Philadelphia, PA.

Employment:
1963-1971 Chemist, National Animal Disease Center, USOA Ames, Iowa.
1971-1974 Postdoctoral Trainee, Jefferson Medical College.
1974-1977 Assistant Professor, Dept. of Biochemistry Jefferson Medical College, Philadelphia, PA.
1977-Present - Research Chemist Du Pont Central Research Dept. (also adjunct appointment, Dept. of Biochemistry Jefferson Medical College).

During the last 10 years, his research has involved the extensive use of radioisotopes for the radiolabeling of living cells as well as the preparation of radiolabelled biochemicals and the development of radioisotope techniques. The majority of his radioisotope work has involved the following isotopes:

^{125}I - Approximately 250 mCi/year (1974-1981)
^{131}I - Approximately 50 mCi/year (1975-1977)
^{3}H - Approximately 100 mCi/year (1974-1981)
^{51}Cr - Approximately 50 mCi/year (1976-1977)
^{14}C - Approximately 10 mCi/year (1975-1977)
^{35}S - Approximately 10 mCi/year (1975-1981)

No formal course on radiation safety has been taken, however, a formal course on the uses of radioisotopes including discussion on safety were taken in the Dept. of Biochemistry and Biophysics which was taught by a professor with an appointment with the Ames Laboratory of the NRC. From 1974 to 1977 was responsible for the radioiodination of samples for the Dept. of Biochemistry, Jefferson Medical College of Thomas Jefferson University, Philadelphia, PA.

William Galbraith, Committee Member

Training & Experience

B.A. Chemistry, Western Reserve University 1966; M.S. and Ph.D. Biological Chemistry, University of Michigan 1968, 1971. Post-doctoral training, Biochemistry, Harvard Medical School.

Employment: 1971-1979 Riker Laboratories, 3M Company, Research Specialist - Biochemical Pharmacology.
1979-Present - Biochemicals Department, E. I. Du Pont Senior Research Pharmacologist.

Graduate training included both lecture and laboratory work with radioisotopes. Practical experience since 1971 includes tracer studies in vitro with ^{14}C and ^{3}H labeled carbohydrates, fatty acids, amino acids, and catecholamines. The tracer studies usually utilized about 1 mCi per year of each isotope. Synthesis of ^{3}H labeled cerebrosides utilized 100 mCi levels of isotopes.

George W. Moncrief, Radiation Protection Officer

Training & Experience

Bachelor of Science Degree in Chemical Engineering Northeastern University 1960. Undergraduate cirriculum included courses in nuclear physics and nuclear engineering.

Employed by Factory Mutual Engineering Division from 1960 to 1965 as loss prevention engineer. Fire protection training from Factory Mutual included protection of special hazards such as radioisotopes.

Employed by Du Pont from 1965 to present as safety engineer, specifically in chemical laboratory safety from 1967 to 1981 which included X-Ray diffraction safeguards including a film badge monitoring program. From April, 1981 to present as safety and health specialist for Du Pont Glenolden Laboratory.

Formal training course - Du Pont Engineering Division five-day course "Safe Handling of Radioactive Materials" which included:

a. Principles and practices of radiation protection at Du Pont Engineering Service Division.

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.

Margit H. Böer (Back-up RPO)

Training & Experience

1953-1956 College for Medical Technology equivalent of B.S.. Major: Clinical Chemistry. Minor: Bacteriology and serology Berlin, Germany.

Margit H. Boer (Back-up RPO) (Continued)

Employment: 1956-1959 Institute for Viral Vaccines, Berlin, Germany
Medical Technologist
1959-1961 Humboldt University, Berlin, Germany
Special Assistant to Chief of Staff
1964-1965 Wilmington Medical Center, Wilmington, DE
Medical Technologist
1965-Present - Du Pont Stine Laboratory, Newark, DE
Medical Technologist, Pharmacologist

During 1977-1980, handled small amounts of ^{3}H-Thymidine for lymphocyte cell cultures, about 20 mCi/year. In 1981, completed an intensive one-week course on "Safe Handling of Radioactive Materials" which included:

a. Principles and practices of radiation protection.

b. Radioactivity measurement standardization.

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

d. Biological effects of radiation.

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3. Functions of the Radiation Safety Committee:

A five-person Radiation Safety Committee will have the duty of administering all uses of radioisotopes at the Glenolden site including purchases and disposal. Since the site is relatively small, formal meetings will not be required more frequently than once every three months. A quorum shall consist of four members. The purpose of committee meetings will be to inspect and review all required records of isotope purchase, their use and disposal, and all required records of periodic personnel monitoring, of instrument calibration, and of the radiation protection program.

The duty of the Radiation Safety Committee will be to insure that all uses of radioisotopes at the Clenolden site comply with 10 CFR 10 and 10 CFR 20, and that exposure of personnel and the public to radioisotopes shall be kept as low as is reasonably achievable (Regulatory Guide 8.10). Most of the work of the Committee will be done by circulation of purchase and use requests to each member individually. Any single member shall have veto power over proposed uses and at least four members will be required to approve any purchase or use of radioisotopes. The procedure for controlling and maintaining inventories of radioisotopes will be as follows:

- Users must be approved by the Committee. A file will be kept on users. Approval requires appropriate prior experience or direct supervision by an approved user.
- A written explanation of prosposed isotope usage must accompany the initial purchase requisition. This explanation must indicate the methods, facilities, and precautions which will be used. This information will be kept on file for all proposed uses and will be available in the office of the Radiation Protection Officer.
- The Radiation Safety Committee will then issue a use permit which will state the maximal possession limit for the individual.
- Approvals will be reviewed every two years.

B. The duties of the RPO (or his/her designate) shall include:

1. Claiming all radioactive packages at the receiving department in accordance with 10 CFR 20.205 (no later than three hours after receipt during regular working hours or 18 hours after receipt at other times), testing or monitoring arriving packages as required by 10 CFR 20.205 and delivering the radioactive material to the user who shall sign a receipt.

2. Maintaining an inventory of all radioactive material at the Site. Order and receiving inventory will be maintained via computer.

3. Conducting required personnel monitoring and contamination surveys and maintaining all records of these activities (see Item 12). Surveys may also be conducted by licensed subcontractors.

4. Supervising disposal or transfer of all radioactive waste and maintenance of complete disposal records.

5. Notify individuals and their supervisors of exposure approaching maximal permissable amounts.

6. Respond to requests for information concerning radiation safety of materials in use.

7. Maintain proceedings from the Radiation Safety Committee meetings.

8. Training of all personnel exposed to radioisotopes on the procedures for safe use in accordance with the guidelines of the Site Radiation Safety Manual and in compliance with all relevant Federal or State Guidelines. This training will include a discussion of:

   - Nature of Du Pont's business; why we are using radioisotopes.
   - Strictly controlled, controlled and non-controlled areas and supplementary rules specific to these areas as defined in Item 15 C.10 and .11.
   - Regulatory agencies that relate to all uses of radioisotopes.
   - Basics of radiation instrumentation.
   - Information on risk from occupational radiation exposure.
   - Precautions and procedures to minimize exposure to radiation.
   - Workers' participation in dosimetry program:

     Bioassays
     Thyroid counting
     Use of TLD where applicable

C. Glenolden Site Manual for Radiation Safety

The purpose of this manual is to insure that all uses of radioisotopes are in accordance with Federal guidelines and to protect the individual worker and also the community.

1. The Radiation Safety Committee (RSC) shall be composed of four members appointed by Research Management and also the Radiation Protection Officer appointed by the Site Manager. The Committee shall:

   - Establish a Radiation Protection Program that will provide a high level of radiation protection and full compliance with pertinent regulations.
   - Every effort shall be made to maintain radiation exposures and releases of radioactive materials in effluents to unrestricted areas as low as is reasonably achievable.
   - Make safety evaluations of proposed uses of the radioactive materials which have already been approved by management. Evaluation should include considerations of the adequacy of appropriate supplemental rules; facilities and equipment; operating, handling and emergency procedures; the experience and training of the proposed users.
   - Review reports of above-action-level incidents and infractions of any rules or regulations. Review should result in recommendations for appropriate and timely corrective action.

2. The Radiation Protection Officer (RPO) shall:

   - Administer the Radiation Protection Program and also serve as an active member of the RSC.
   - Implement and maintain radiation protection services.
   - Maintain all records required by the Radiation Protection Program.
   - Make reports to the Nuclear Regulatory Commission as required by 10 CFR 19 and 20 or equivalent State regulations.
   - Notify individuals and their supervisors of exposure approaching maximal permissable amounts.
   - Provide training and information to personnel relative to radiation health and safety. Appropriate training concerning radiation health and safety will be determined on an individual basis relative to the potential for exposure and usage.

- Coordinate refresher training courses scheduled once each year and/or whenever admendments to the site license require explanations to users. The meetings will be incorporated into the regular safety meeting schedule and will include discussions of isotope problems at the site and changes in the license or Federal regulations.

- Supervise radiation emergencies and special decontamination procedures.

3. Users of radioisotopes must be approved by the entire RSC. They must:

   - Register with the RPO and obtain his/her approval. The RPO will consult with the RSC for this approval.

   - Comply with Site safety rules and procedures and the regulations of the Nuclear Regulatory Commission.

   - Require any individual participating in an experiment including isotopes to undergo training under the supervision of the RPO.

   - Perform his/her work in a manner that will minimize his/her exposure, exposure to fellow workers and to the general public.

   - Report to his/her immediate supervisor and to the Radiation Protection Officer any condition that may have caused or threatens to cause any exposure to radiation or release of radioactive materials in excess of any limits set forth by the U.S. Nuclear Regulatory Commission or by the RPO. Any employee may also report violations of license conditions directly to the United States Nuclear Regulatory Commission at 631 Park Avenue, King of Prussia, Pennsylvania 19406 (Region I). A copy of the Site License and of the relevant Federal regulations (10 CFR 10) shall be available for inspection by any employee.

4. In the event of a radiation incident:

   The Radiation Protection Officer, or the Chairman of the Radiation Safety Committee will take appropriate action in one or more of the following ways:

   - Investigate and document the degree and cause of contamination and/or exposure.

   - Post and isolate the contaminated area or equipment.

   - Evaluate the degree of exposure (internal and external) and/or contamination.

   - When indicated, suspend operations in a laboratory area and/or suspend work of an individual.

   - Schedule and supervise appropriate decontamination procedures.

4. In the event of a radiation incident: (Continued)
The user shall do the following:

For Minor Spills

- NOTIFY: Notify persons in the area that a spill has occurred.
- PREVENT THE SPREAD: Cover the spill with absorbent paper.
- CLEAN UP: Use disposable gloves and remote handling tongs. Carefully fold the absorbent paper and pad. Insert into a plastic bag and dispose of in the radioactive waste container. Also insert into the plastic bag all other contaminated materials such as disposable gloves.
- SURVEY: With a low-range, thin-window G-M survey meter, check the area around the spill, hands, and clothing for contamination.
- REPORT: Report incident to the Radiation Safety Officer.

For Major Spills

- CLEAR THE AREA: Notify all persons not involved in the spill to vacate the room.
- PREVENT THE SPREAD: Cover the spill with absorbent pads, but do not attempt to clean it up. Confine the movement of all personnel potentially contaminated to prevent the spread.
- SHIELD THE SOURCE: If possible, the spill should be shielded, but only if it can be done without further contamination or without significantly increasing your radiation exposure.
- CLOSE THE ROOM: Leave the room and lock the door(s) to prevent entry.
- CALL FOR HELP: Notify the Radiation Safety Officer immediately.
- PERSONNEL DECONTAMINATION: Contaminated clothing should be removed and stored for further evaluation by the Radiation Safety Officer. If the spill is on the skin, flush thoroughly and then wash with mild soap and lukewarm water.

RADIATION SAFETY OFFICER: G. W. Moncrief
OFFICE PHONE: (215) 237-7735
HOME PHONE: (215) 436-9220

ALTERNATE NAMES AND TELEPHONE NUMBERS DESIGNATED BY RADIATION SAFETY OFFICER:

Marget Boer (302) 366-8071
Kathleen R. Gans-Brangs (302) 738-6405

5. Orders for Radioisotopes:

All users and uses of radioisotopes must be approved by the Radiation Safety Committee (RSC) as well as by management. A form obtained from the Radiation Protection Officer must be completed and must accompany a purchase requisition for all radioactive substances. This form will be circulated among the members of the RSC for their individual approvals before an individual user permit can be authorized. Subsequent orders covered by the permit can then be approved by the RPO. Note that all isotopes must be delivered first to the RPO (whose location should be given on the purchase requisition). All incoming radioisotope shipments shall be inspected by the RPO according to Federal requirements (10 CFR 20.205). Records of all incoming radioisotope shipments shall be maintained by the Radiation Protection Officer.

6. Disposal of Radioactive Waste:

To assure the safe transfer, packaging, and transport of radioactive waste, the Du Pont Company must comply with many regulations and requirements. Among these are:

- Regulations of the United States Nuclear Regulatory Commission
- Regulations of the United States Department of Transportation
- Requirements of Waste Disposal Sites
- Requirements of Waste Disposal Contractors

Rules for handling radioactive waste will probably change from time to time depending upon the above requirements.

IT IS YOUR RESPONSIBILITY TO KNOW, UNDERSTAND, AND FOLLOW CURRENT INSTRUCTIONS AND OPERATING PROCEDURES PROVIDED BY THE RPO CONCERNING WASTE DISPOSAL.

General rules are that all waste shall be placed in the radioactive waste collection room and each item shall have the user's name and room number, the date, the isotope(s) and quantities contained. In addition, solid and liquid waste shall be kept separate. Different isotopes shall be combined only for purposes of disposal and by direct approval of the RPO or designate. Radioactive animal carcasses will be packed separately in accordance with instructions supplied by a properly licensed waste disposal service.

7. Protective Clothing:

Lab coats or other designated lab clothing shall be worn at all times inside a strictly controlled area or when working with nonexempt quantities of isotopes (see Table I). The lab coats shall be buttoned and the sleeves worn extended to cover the arms and wrists. When worn in a strictly controlled area, lab coats are to be monitored daily

for contamination. A lab coat shall not be worn if it is contaminated. Plastic disposable gloves shall be worn by all personnel handling quantities of radioisotopes greater than 1/10 exempt quantities (Table I) or greater than 1 uCi, whichever is greater.

8. General Safety Precautions:

- Dosimetry badges shall be worn as assigned by the RPO.
- Bioassay (urine samples or thyroid monitoring) shall be done upon request by the RPO.
- Mouth pipetting is prohibited.
- Eye protection is required in all laboratory work in accordance with Du Pont safety procedures.
- There shall be no eating, drinking, or smoking in controlled or strictly controlled areas.
- Isotopes transported on site will be in shielded containers whenever possible.
- Isotope work areas shall be cleaned before the end of each day. When it is necessary to postpone cleanup at the end of the work day, an appropriate sign shall be posted. Decontamination must be completed prior to starting a new operation. Intermittent surveys will be made by the user and survey data will be kept for two years.
- As much radioactive work as possible should be performed in an appropriate vented enclosure. Operations which may give rise to airborne contamination must be performed in an appropriate vented enclosure. Any operation that may cause a particulate or volatile discharge in excess of allowable limits into the stack system must be absorbed or trapped in an appropriate medium to prevent discharge into the environment.
- Every attempt shall be made to shield sources of radiation so that the workers and other laboratory inhabitants will not be unnecessarily exposed to radiation. Appropriate shielding should be used, e.g. acrylic shields for high energy beta particles and lead shielding for gamma radiation.
- Strictly controlled area and controlled area doors shall be closed at all times except for entering and exiting, unless otherwise authorized by the RPO.
- All radioactive materials and operations must be properly labeled with a standard radioactive warning sign (10 CFR 20.203) and the user's name, date and the radioactive contents.

- On leaving the "Radioisotope Laboratory" (a strictly controlled area), an employee must monitor hands, personal clothing, shoes, and any portable equipment being removed.

- Any radiation instrumentation found to be defective or suspected to be malfunctioning shall be reported immediately to the Radiation Protection Officer or corrected.

9. Definition of Strictly Controlled Areas:

Areas containing a quantity of byproduct material exceeding the following limits:

Isotope	Chemical Form	Amount
Carbon-14	Any	1 mCi
Chromium-51	Any	5 mCi
Hydrogen-3	Any	10 mCi
Iodine-125	I^- or I_2	0.01 mCi
Iodine-125	Any except above	0.5 mCi
Iodine-131	I^- or I_2	0.01 mCi
Iodine-131	Any except above	0.5 mCi
Phosphorous-32	Any	1 mCi
Sulfur-35	Any	5 mCi
Other	Any	1 mCi

Only persons authorized by the RPO may enter or work in these areas. All portable equipment must be monitored with a G.M. Counter for contamination before being removed from strictly controlled areas. Shoes, lab coats and hands must also be monitored before leaving. (An exception to this is the radioactive waste collection room which may be entered for purposes of depositing wrapped waste without subsequent monitoring).

10. Definition of Controlled Areas:

Laboratories or other areas in which radioisotopes are stored or used but which contain less than the quantities contained in strictly controlled areas. Areas with less than or equal to maximal exempt quantities of isotope need not be under constant surveillance and immediate control if such containers are properly labelled and located in a clearly defined area. All non-exempt quantities of licensed materials shall be locked when unattended.

11. Contamination Surveys:

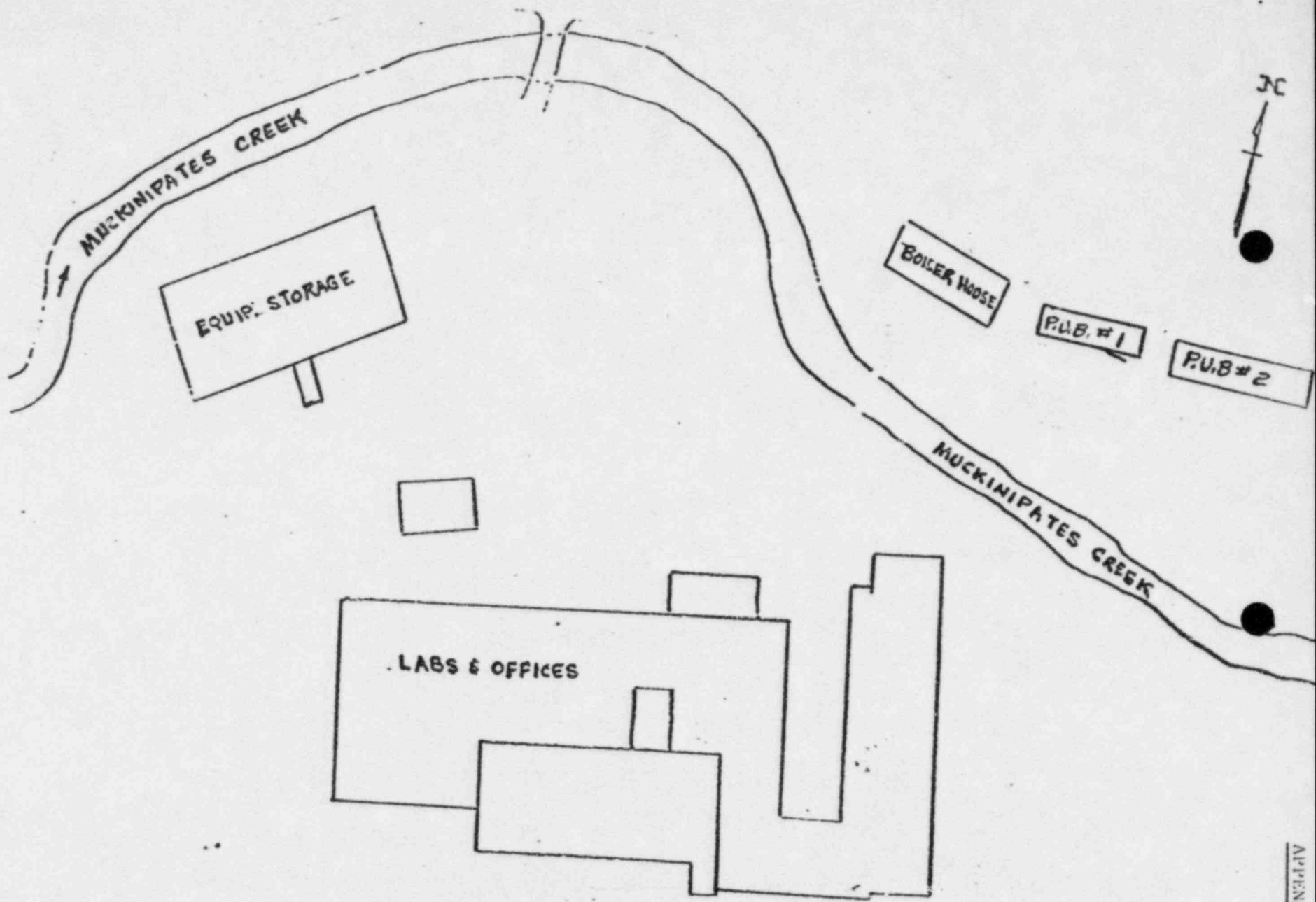
The RPO will make surveys for contamination in strictly controlled and controlled areas at three month intervals. These will include wipe tests of floors, bench surfaces, sinks, and other objects as appropriate. The areas will also be scanned with a G.M. monitor. Individual workers are urged to make more frequent surveys, and may be requested to do so by the RPO.

TABLE I

Exempt quantities of commonly used isotopes.
(Check with the RPO for data on other isotopes.)

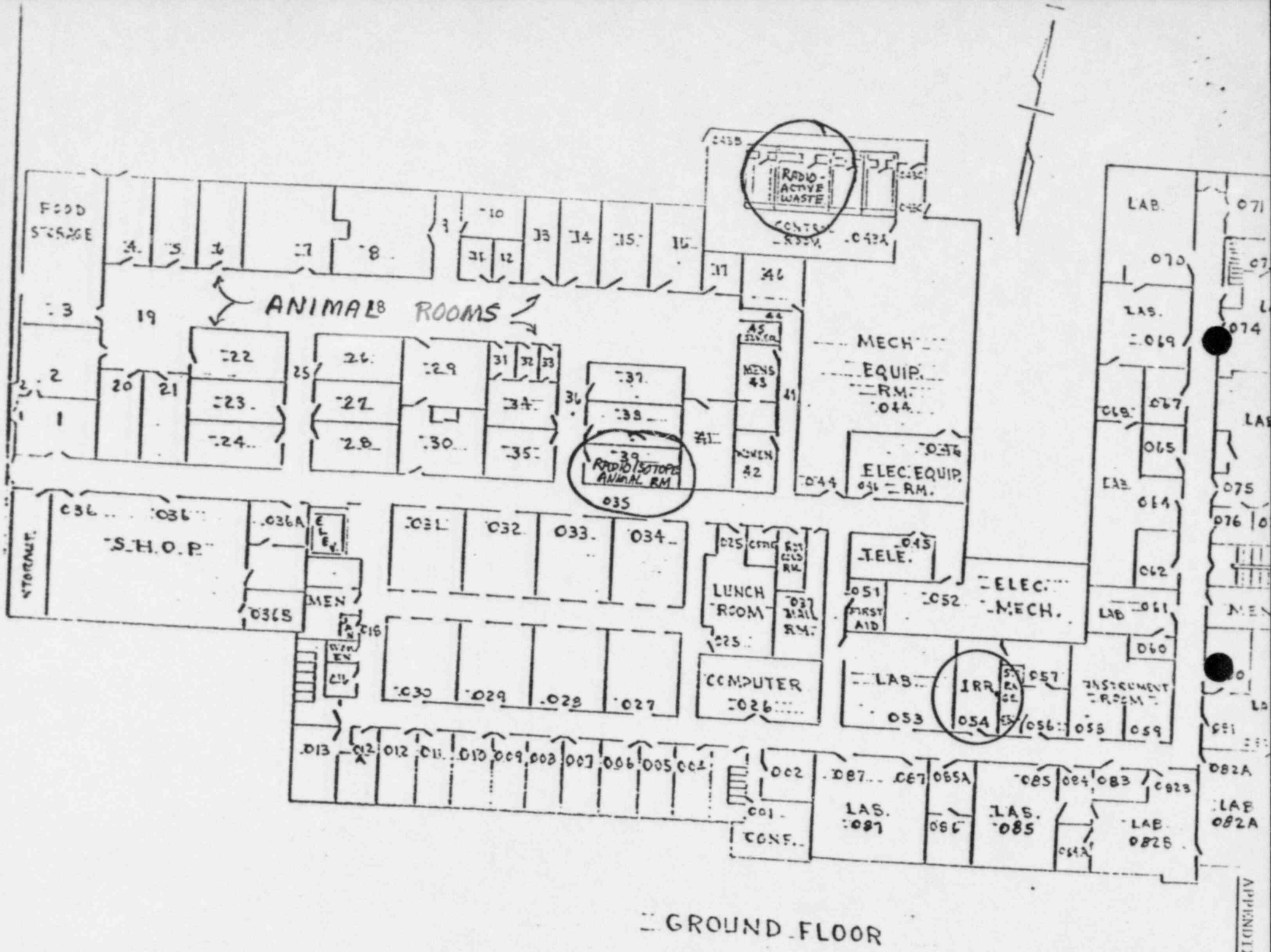
Carbon-14	100 µCi
Cesium-137	10 µCi
Chlorine-36	10 µCi
Chromium-51	1000 µCi
Hydrogen-3	1000 µCi
Iodine-125	1 µCi
Phosphorous-32	10 µCi
Sulfur-35	100 µCi

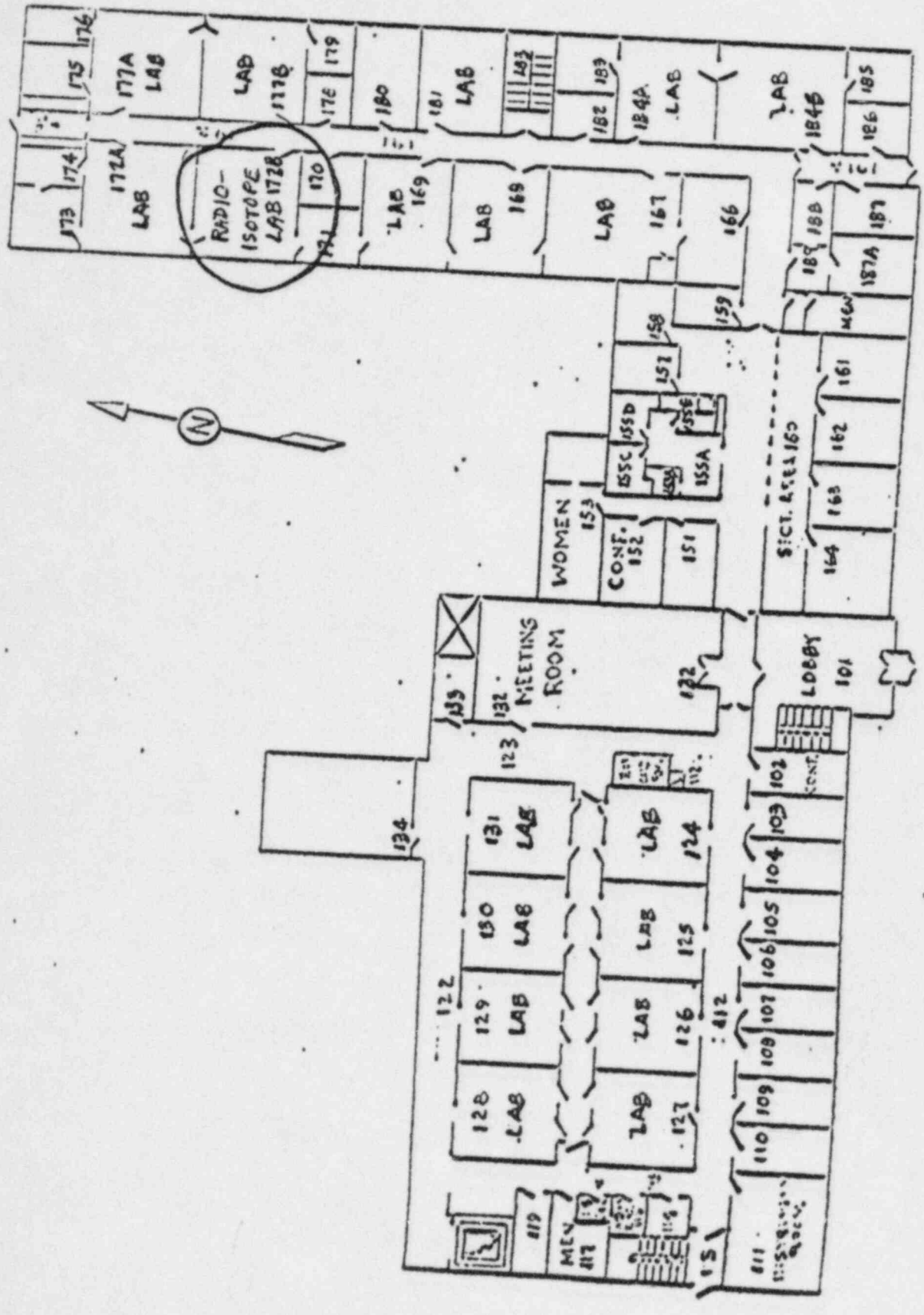
APPENDICES



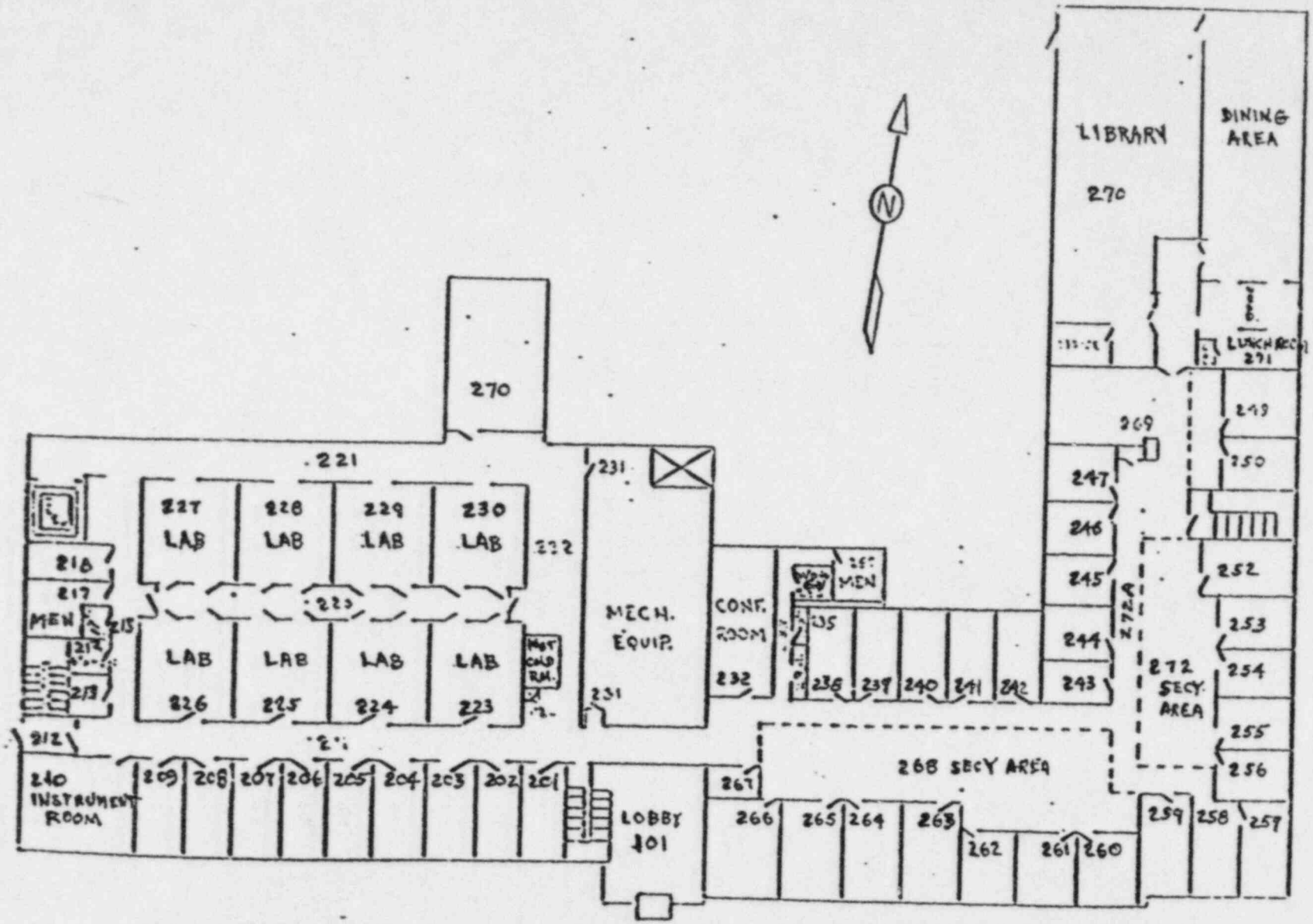
500 South Ridgeway Avenue

APPENDIX I


FOOD STORAGE
ANIMAL ROOMS
RADIO-ACTIVE WASTE
MECH. EQUIP. RM. 044
ELEC. EQUIP. RM.
RADIOISOTOPE ANIMAL RM
035
MENS 43
WOMEN 42
STORAGE
SHOP
MEN
LUNCH ROOM
COMPUTER
TELE.
ELEC. MECH.
FIRST AID
LAB
IRR.
INSTRUMENT ROOM
CONF.
LAS. 087
LAS. 085
LAB 082B
LAB 082A
GROUND FLOOR
APPENDIX 2A

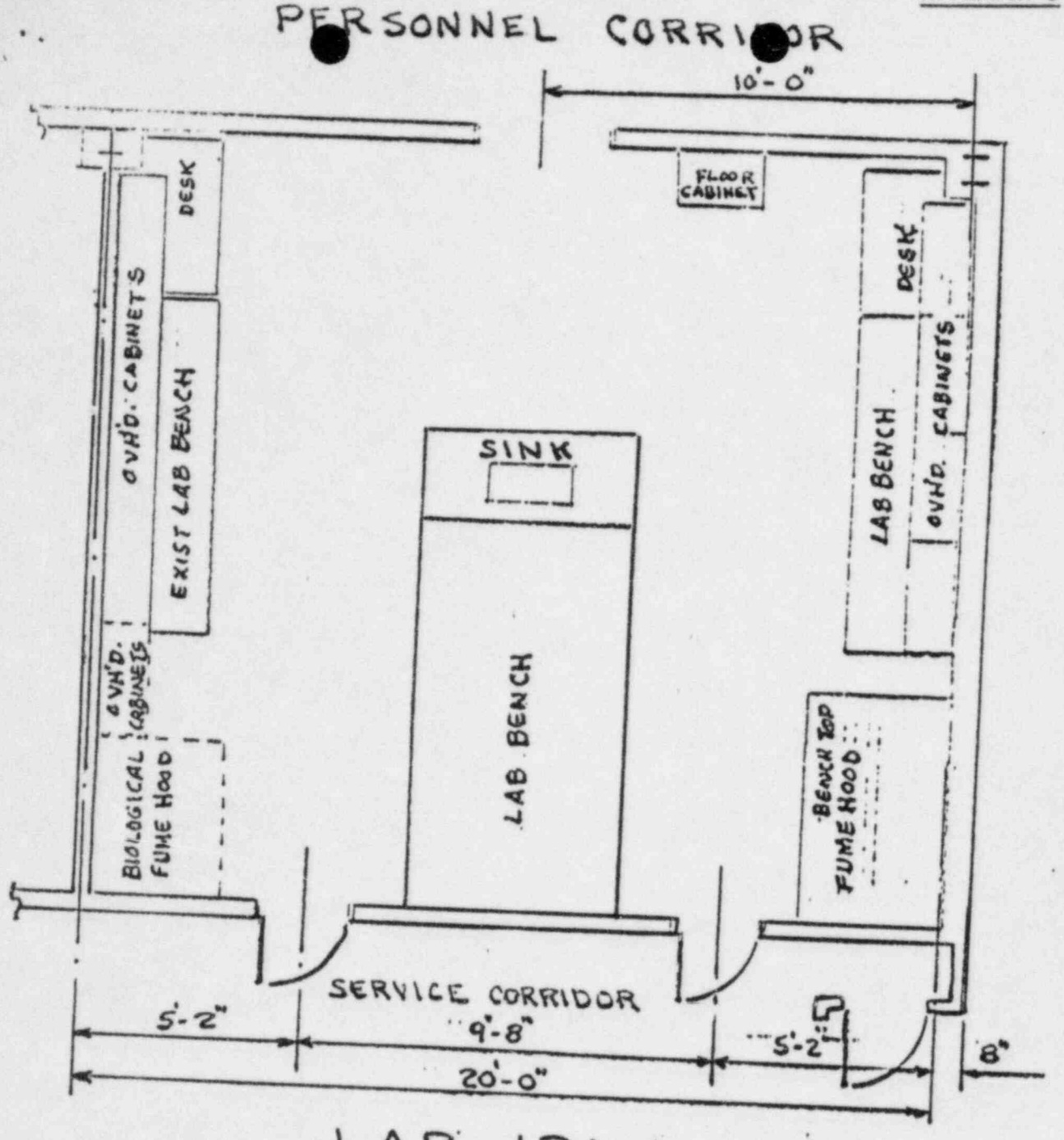

RADIO-ISOTOPE LAB 172B
MEETING ROOM
WOMEN
CONF.
LOBBY
SECT.
LAB
N

FIRST FLOOR



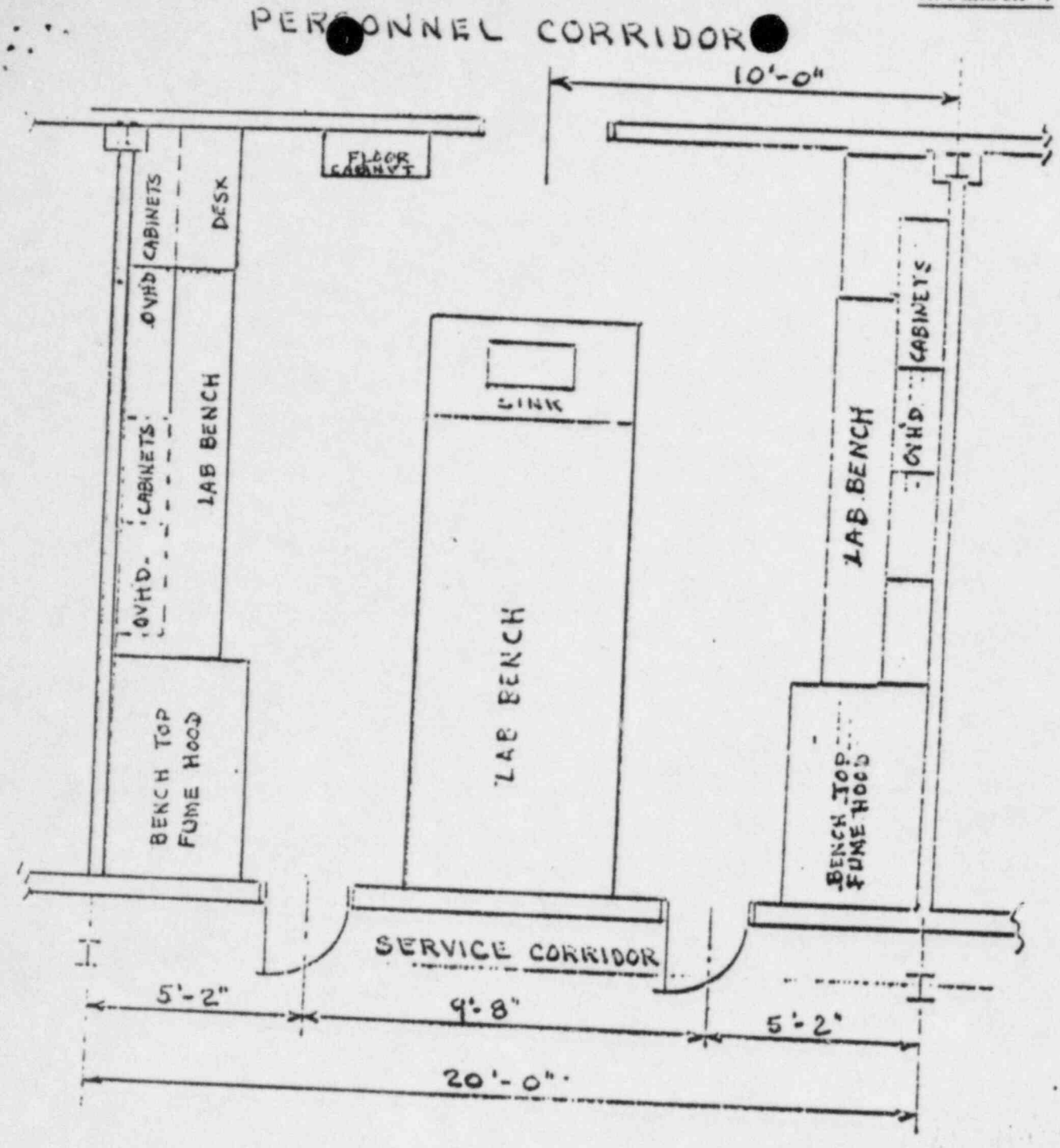
SECOND FLOOR

APPENDIX 2G



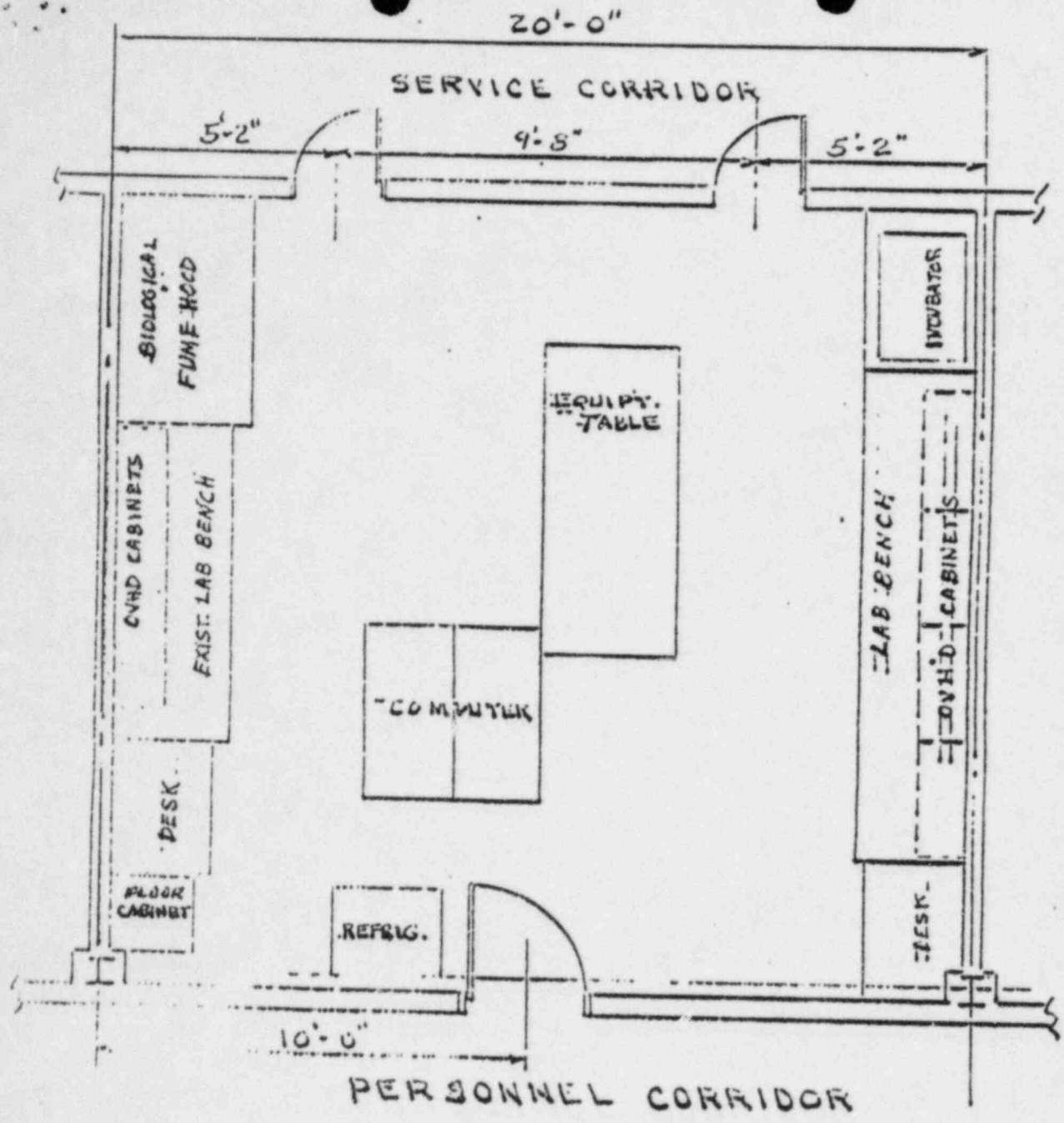
LAB-131

TYPICAL-ONE BIO HOOD & ONE CHEMICAL FLUME HOOD



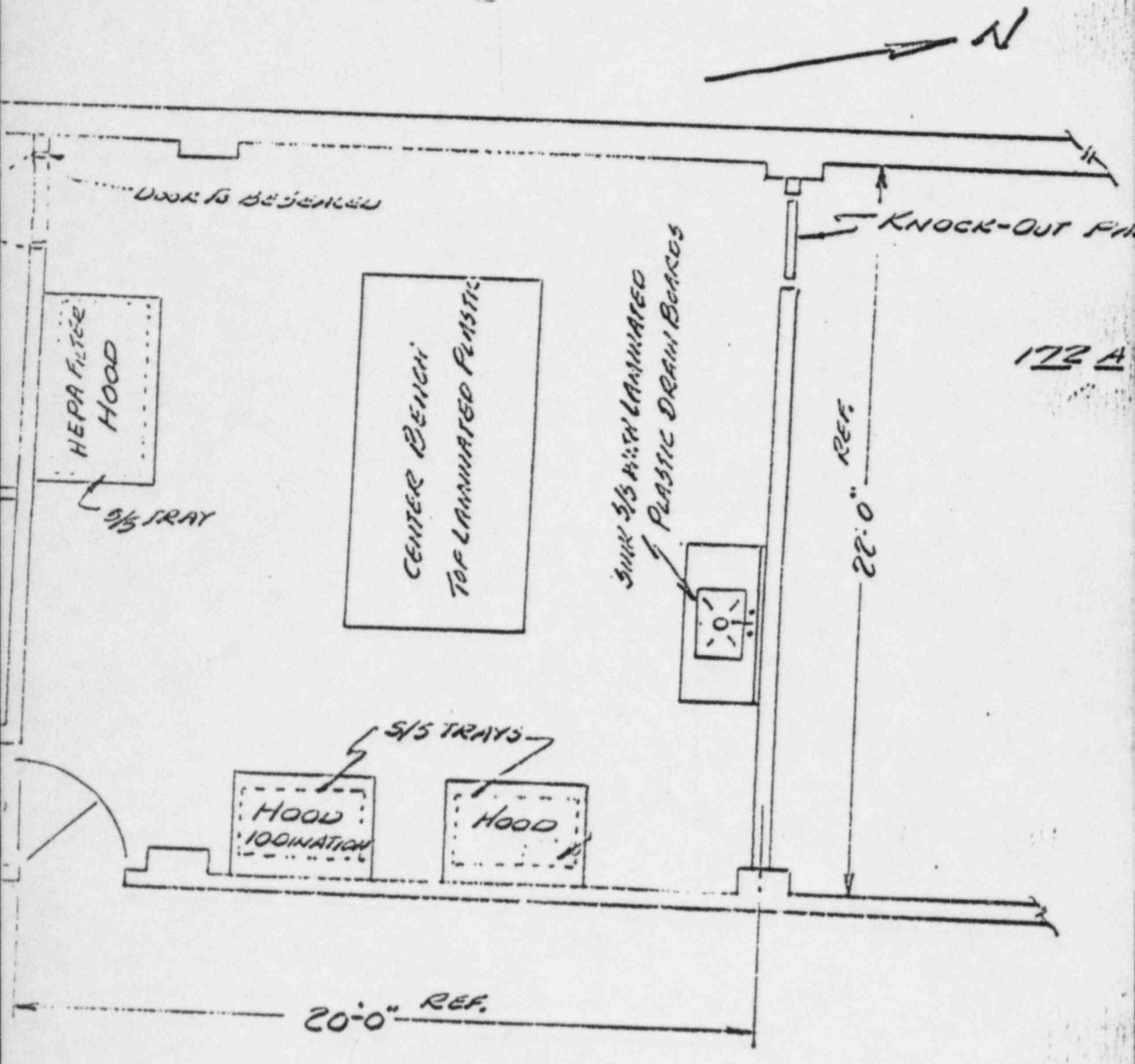
LAB-229

TYPICAL-TWO CHEMICAL FUME HOODS

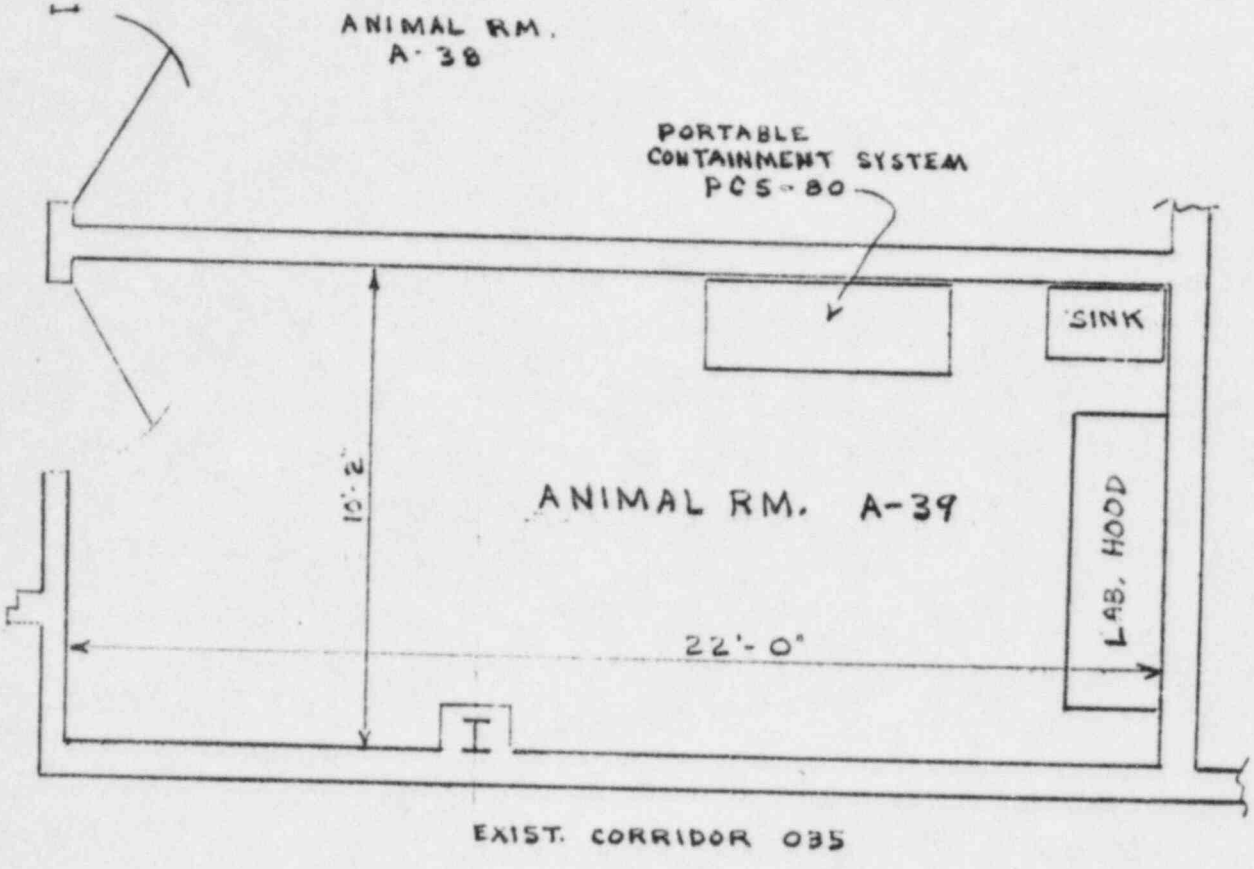


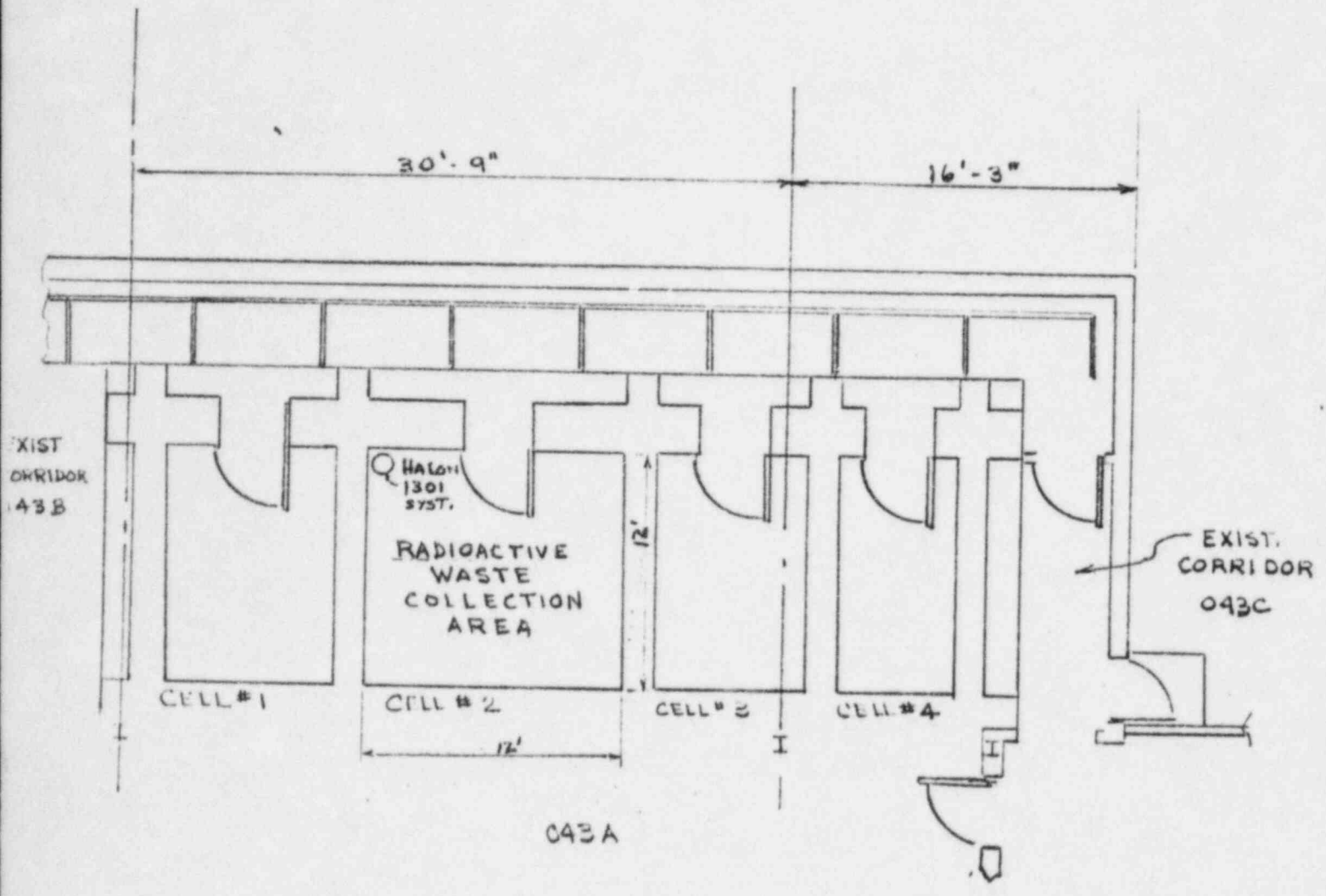
LAB 225

TYPICAL - ONE BIO. HOOD


N
DOOR TO BE DEADED
KNOCK-OUT PA
172 A
HEPA FILTER HOOD
5/5 TRAY
CENTER BENCH TOP LAMINATED PLASTIC
SINK 5/5 WITH LAMINATED PLASTIC DRAIN BOARDS
22'-0" REF.
5/5 TRAYS
HOOD
100 INATION
HOOD
20'-0" REF.

LAB 172B


ANIMAL RM.
A-38
PORTABLE
CONTAINMENT SYSTEM
PCS-80
SINK
ANIMAL RM. A-39
10'-2"
22'-0"
LAB. HOOD
EXIST. CORRIDOR 035


30'-9"
16'-3"
EXIST
CORRIDOR
043B
HALON
1301
SYST.
RADIOACTIVE
WASTE
COLLECTION
AREA
12'
EXIST.
CORRIDOR
043C
CELL #1
CELL #2
CELL #3
CELL #4
12'
I
I
043A