Taylor Technology, Inc.

107 College Road East • Princeton, New Jersey 08540
609-951-0005 *Phone* • 609-951-0080 *Fax*

030-34438
03620
LL 30390

April 9, 1997

Licensing Assistant Section
Nuclear Materials Safety Branch
US Nuclear Regulatory Commission, Region I
475 Allendale Road
King of Prussia, PA 19406-1415

Dear Sir:

Enclosed is our complete application (2 copies) for a new byproduct material license. Also enclosed is a check for $1500.00 made payable to US Nuclear Regulatory Commission to cover our license application fee (fee category 3M).

Should you have any questions, please contact me or Mr. Robert White at 609-951-0005.

Very truly yours,
Taylor Technology, Inc.

Thomas D. Oglesby
Vice-President Technical Operations

124469
APR 11 1997

NRC FORM 313 (7-96)
10 CFR 30, 32, 33
34, 35, 36, 39 and 40

U. S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB: NO. 3150-0120 EXPIRES: 7/31/99

Estimated b[illegible]per response to comply with this information collection request: 7 hour[illegible]. Submittal of the application is necessary to determine that the applicant is qualified and that adequate procedures exist to protect the public health and safety. Forward comments regarding burden estimate to the Information and Records Management Branch (T-6 F33), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, and to the Paperwork Reduction Project (3150-0120), Office of Management and Budget, Washington, DC 20503. NRC may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number.

APPLICATION FOR MATERIAL LICENSE

INSTRUCTIONS: SEE THE APPROPRIATE LICENSE APPLICATION GUIDE FOR DETAILED INSTRUCTIONS FOR COMPLETING APPLICATION. SEND TWO COPIES OF THE ENTIRE COMPLETED APPLICATION TO THE NRC OFFICE SPECIFIED BELOW. 030-34438

APPLICATION FOR DISTRIBUTION OF EXEMPT PRODUCTS FILE APPLICATIONS WITH:

DIVISION OF INDUSTRIAL AND MEDICAL NUCLEAR SAFETY
OFFICE OF NUCLEAR MATERIALS SAFETY AND SAFEGUARDS
U.S. NUCLEAR REGULATORY COMMISSION
WASHINGTON, DC 20555-0001

ALL OTHER PERSONS FILE APPLICATIONS AS FOLLOWS:

IF YOU ARE LOCATED IN:

CONNECTICUT, DELAWARE, DISTRICT OF COLUMBIA, MAINE, MARYLAND, MASSACHUSETTS, NEW HAMPSHIRE, NEW JERSEY, NEW YORK, PENNSYLVANIA, RHODE ISLAND, OR VERMONT, SEND APPLICATIONS TO:

LICENSING ASSISTANT SECTION
NUCLEAR MATERIALS SAFETY BRANCH
U.S. NUCLEAR REGULATORY COMMISSION, REGION I
475 ALLENDALE ROAD
KING OF PRUSSIA, PA 19406-1415

ALABAMA, FLORIDA, GEORGIA, KENTUCKY, MISSISSIPPI, NORTH CAROLINA, PUERTO RICO, SOUTH CAROLINA, TENNESSEE, VIRGINIA, VIRGIN ISLANDS, OR WEST VIRGINIA, SEND APPLICATIONS TO:

NUCLEAR MATERIALS LICENSING SECTION
U.S. NUCLEAR REGULATORY COMMISSION, REGION II
101 MARIETTA STREET, NW, SUITE 2900
ATLANTA, GA 30323-0199

IF YOU ARE LOCATED IN: LL 30390

ILLINOIS, INDIANA, IOWA, MICHIGAN, MINNESOTA, MISSOURI, OHIO, OR WISCONSIN, SEND APPLICATIONS TO: 03620

MATERIALS LICENSING SECTION
U.S. NUCLEAR REGULATORY COMMISSION, REGION III
801 WARRENVILLE RD.
LISLE, IL 60532-4351

ALASKA, ARIZONA, ARKANSAS, CALIFORNIA, COLORADO, HAWAII, IDAHO, KANSAS, LOUISIANA, MONTANA, NEBRASKA, NEVADA, NEW MEXICO, NORTH DAKOTA, OKLAHOMA, OREGON, PACIFIC TRUST TERRITORIES, SOUTH DAKOTA, TEXAS, UTAH, WASHINGTON, OR WYOMING, SEND APPLICATIONS TO:

NUCLEAR MATERIALS LICENSING SECTION
U.S. NUCLEAR REGULATORY COMMISSION, REGION IV
611 RYAN PLAZA DRIVE, SUITE 400
ARLINGTON, TX 76011-8064

PERSONS LOCATED IN AGREEMENT STATES SEND APPLICATIONS TO THE U.S. NUCLEAR REGULATORY COMMISSION ONLY IF THEY WISH TO POSSESS AND USE LICENSED MATERIAL IN STATES SUBJECT TO U.S.NUCLEAR REGULATORY COMMISSION JURISDICTIONS.

1. THIS IS AN APPLICATION FOR *(Check appropriate item)*
   - [x] A. NEW LICENSE
   - [ ] B. AMENDMENT TO LICENSE NUMBER _____
   - [ ] C. RENEWAL OF LICENSE NUMBER _____

2. NAME AND MAILING ADDRESS OF APPLICANT *(Include Zip code)*
   Taylor Technology, Inc.
   107 College Road East
   Princeton, NJ 08540

3. ADDRESS(ES) WHERE LICENSED MATERIAL WILL BE USED OR POSSESSED
   107 College Road East, Princeton, NJ 08540

4. NAME OF PERSON TO BE CONTACTED ABOUT THIS APPLICATION
   Thomas D. Oglesby
   TELEPHONE NUMBER
   609-951-0005

SUBMIT ITEMS 5 THROUGH 11 ON 8-1/2 X 11" PAPER. THE TYPE AND SCOPE OF INFORMATION TO BE PROVIDED IS DESCRIBED IN THE LICENSE APPLICATION GUIDE.

5. RADIOACTIVE MATERIAL.
   a. Element and mass number; b. chemical and/or physical form; and c. maximum amount which will be possessed at any one time.

6. PURPOSE(S) FOR WHICH LICENSED MATERIAL WILL BE USED.

7. INDIVIDUAL(S) RESPONSIBLE FOR RADIATION SAFETY PROGRAM AND THEIR TRAINING EXPERIENCE.

8. TRAINING FOR INDIVIDUALS WORKING IN OR FREQUENTING RESTRICTED AREAS.

9. FACILITIES AND EQUIPMENT.

10. RADIATION SAFETY PROGRAM.

11. WASTE MANAGEMENT.

12. LICENSEE FEES *(See 10 CFR 170 and Section 170.31)*
    FEE CATEGORY | AMOUNT ENCLOSED $

13. CERTIFICATION. *(Must be completed by applicant)* THE APPLICANT UNDERSTANDS THAT ALL STATEMENTS AND REPRESENTATIONS MADE IN THIS APPLICATION ARE BINDING UPON THE APPLICANT.

THE APPLICANT AND ANY OFFICIAL EXECUTING THIS CERTIFICATION ON BEHALF OF THE APPLICANT, NAMED IN ITEM 2, CERTIFY THAT THIS APPLICATION IS PREPARED IN CONFORMITY WITH TITLE 10, CODE OF FEDERAL REGULATIONS, PARTS 30, 32, 33, 34, 35, 36, 39 AND 40, AND THAT ALL INFORMATION CONTAINED HEREIN IS TRUE AND CORRECT TO THE BEST OF THEIR KNOWLEDGE AND BELIEF.

WARNING: 18 U.S.C. SECTION 1001 ACT OFJUNE 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.

CERTIFYING OFFICER – TYPED/PRINTED NAME AND TITLE	SIGNATURE	DATE
THOMAS D. Oglesby, V.P. Operations	[signature]	4/9/97

FOR NRC USE ONLY

TYPE OF FEE	FEE LOG	FEE CATEGORY	AMOUNT RECEIVED $	CHECK NUMBER	COMMENTS
APPROVED BY				DATE	

NRC FORM 313 (7-96) PRINTED ON RECYCLED PAPER

OFFICIAL RECORD COPY ML 10 APR 11 1997 124469

US Nuclear Regulatory Commission
Radioactive Material New License Application

Taylor Technology, Inc.
107 College Road East
Princeton, NJ 08540

609-951-0005

Contact:
Robert J. White, Senior Scientist
Radiation Safety Officer

31 March 1997

license application prepared with the assistance of
Wesley R. Van Pelt Associates, Inc.
Paramus, NJ

Table of Contents

Question 5 - Radioactive Material Possession Limits

We request to possess and use the following radionuclides in the named maximum possession amounts.

a. Element & Mass Number	b. Chemical/Physical Form	c. Maximum Amount Possessed at Any One Time
Hydrogen-3 (tritium)	any	50 mCi
Carbon-14	any	10 mCi
Sulfur-35	any	5 mCi

Question 6 - Purpose for Which Licensed Material Will be Used

Taylor Technology, Inc. is a high technology company providing research and development services to the pharmaceutical research community. In particular, Taylor Technology, Inc. provides analysis of clinical and other samples for organic constituents using advanced liquid chromatographic, mass spectrometric and similar techniques.

It is expected that all incoming radioactive samples (e.g., blood plasma and urine from human or animal clinical trials) will contain sub-microcurie quantities of radioactivity.

The radionuclides named in Question 5 above will be used for the general purpose of laboratory research and development, including calibration standards for on-site radiation detection equipment.

There will be no human use of radioactive materials conducted under this license.

There will be no use of radioactivity in laboratory animals under this license.

Products containing radionuclides will not be commercially manufactured and distributed under this license.

There will be no field application of radionuclides in the outdoor environment under this license.

Decommissioning Funding Consideration

NRC regulation 30.35 requires decommissioning planning and funding assurance if license possession limits for radionuclides with half lives in excess of 120 days exceed certain activity levels. The following table shows all requested radionuclides with half lives more than 120 days. The sum of the ratios rule applies for more than one radionuclide. The evaluation makes use of the value R, defined in 10 CFR 30.35(a), which is the possession limit divided by the value in Appendix B to 10 CFR 30. Since the sum of the R values divided by 10^3 is less than one, the licensee will be exempt from the decommissioning funding requirements of 10 CFR 30.35(a)-(f).

Decommissioning Funding Calculation (Half Lives > 120 days)				
Radionuclide	**Requested Possession limit, millicurie**	**Value in Appendix B to 10 CFR 30, millicurie**	**R**	**R Divided by 10^3**
Hydrogen-3	50	1.00	50	0.05
Carbon-14	10	0.10	100	0.10
Sum of Ratios:				**0.15**

Consideration of Need for Emergency Plan for Responding to a Release

NRC regulation 10 CFR 30.32 (i) requires evaluation of the need for an emergency plan for responding to a release when licensees have possession limits above the levels listed in Schedule C of 10 CFR 30.72. Applying the sum of the ratios rule for more than one radionuclide, the requested possession limits are well below the level requiring consideration of an emergency plan for responding to a release. Therefore the licensee will be exempt from the requirements of 10 CFR 30.32 (i).

Question 7 - Individuals Responsible for Radiation Program and Their Training and Experience.

The Radiation Safety Officer will be Robert J. White. Mr. White, whose title is Senior Scientist, is a full time employee located at the 107 College Road East, Princeton, NJ site. A Statement of Training listing Mr. White's training and experience with radionuclides is attached.

Question 8 - Training for Individuals Working in or Frequenting Restricted Areas.

The following individuals, called Principal Radiation Users, will use or supervise the use of licensed radioactive materials:

Mr. Robert J. White, Senior Scientist
Dr. Thomas D. Oglesby, Vice President, Technical Operations
Dr. A.K. Chaudhary, Senior Research Scientist

The attached Statements of Training are brief resumes summarizing the training and professional and technical experience of these individuals directly related to their ability to safely use radioactive materials.

Question 9 - Facilities and Equipment

Facilities

Taylor Technology, Inc., Inc. is located in a portion of a modern building at 107 College Road East, Princeton, NJ. The Taylor Technology, Inc. facility contains modern laboratories and offices for about 40 personnel. Offices are separate from laboratory areas.

The attached floor plan shows the Taylor Technology, Inc. facility. Areas where radioactive material may be used or stored are shown shaded on the floor plan. Radioactive materials coming into and out of the shaded area, such as incoming samples and outgoing radioactive waste, will be in sealed containers.

Samples will be processed in the area designated "Wet Chem Lab." Processed samples will be brought to the "Instrument Lab" for analysis by liquid chromatography and mass spectrometry. A contiguous room labeled "Sample Storage" will be used for storing radioactive and other samples in freezers and refrigerators.

Radioactive waste for storage and decay will be stored in a single designated room, currently designated as "Waste Stor." on attached the floor plan.

The facility is sprinkler protected in the event of fire, and has an alarm system to warn of both fire and unauthorized entry.

Biological safety cabinets are available for the safe use of radionuclides where the experiment also involves sterile or biohazardous conditions. Microbalances are available if the need arises to weigh radioactive materials. The microbalances are located in a small isolated room which will mitigate against radioactive contamination, if any.

The entire facility is secure against unauthorized entry in that all non-emergency entry and exit will be through the main entrance door. The main entrance door will be locked whenever the Receptionist area is unattended, and only employees and authorized visitors will be admitted.

Equipment

Since tritium, carbon-14 and sulfur-35 are soft beta emitters, no special radiation shielding is required.

Storage and use areas will be marked with the standard radiation caution labels. As much as practical, the storage and use of radioactive materials will be segregated from other areas so that contamination control and routine surveys can be better managed.

Question 10 - Radiation Safety Program

Radiation Detection Instrumentation

The facility will obtain a liquid scintillation counter. Current plans call for the purchase of a Packard Tri-Carb 2100TR. This or an essentially equivalent liquid scintillation counter will be used to assay radiation survey swipes for tritium, carbon-14, and sulfur-35.

The licensee will purchase a radiation survey instrument consisting of a Ludlum Measurements, Inc. hand-held battery-operated Model 3 ratemeter with a Model 44-9 end-window pancake-style Geiger detector probe, or equivalent. This Geiger probe has a window thickness of 1.7 mg/cm^2 of mica, with an active open area of 15.5 cm^2. It has a background of about 40 cpm and a sensitivity range of 100 to 500,000 cpm. The 2-pi detection efficiency of this probe for carbon-14 is listed as 10 percent. This, or an essentially equivalent radiation survey meter will be used to detect the presence and relative intensity of carbon-14 and sulfur-35.

Radiation Detection Instrumentation Calibration

The liquid scintillation analyzer is auto-calibrating and self-normalizing in that the spectrum analyzer and quench indicating parameters recalibrate via a carbon-14 reference standard for absolute activity calculations. In addition, the Packard Tri-Carb 2100TR uses Direct DPM for single label beta radionuclides which provides dpm for the full range of beta nuclides, even heavily quenched tritium. Whichever liquid scintillation counter is purchased will have the ability to report results in dpm units. The instrument will be calibrated according to the manufacturer's instructions.

The Geiger radiation survey meters will be calibrated annually and after any repairs other than battery or cable replacement. Calibrations will be done by the manufacturer or by a reputable commercial calibration lab. The calibration lab currently selected is Ludlum Measurements, Inc., PO Box 810, Sweetwater, TX 79556.

Personnel Monitoring

Whole body dosimeter badges and ring dosimeters are not necessary since all radionuclides are soft beta emitters and will not produce an external radiation hazard.

The need for tritium bioassay is established in the American National Standard "Internal Dosimetry Programs for Tritium Exposure - Minimum Requirements," HPS N13.14-1994.

Table 1 of this ANSI standard indicates up to 100 mCi of HTO and tritiated organics including DNA precursors may be used in an open room on a bench top without the need for considering a bioassay program. Since all tritium use will be well below this activity, no tritium bioassay program is required.

The potential need for bioassaying for carbon-14 and sulfur-35 is addressed by comparison with the Annual Limit on Intake (ALI). Since it is expected that any single tube or container will contain less than a few microcuries of carbon-14 or sulfur-35, inhalation or ingestion of anything close to the ALI is essentially impossible. Therefore, bioassay for carbon-14 and sulfur-35 is not necessary.

	ALI (inhalation)	**ALI (ingestion)**
Carbon-14	2 mCi (compounds)	2 mCi (compounds)
Sulfur-35	20 mCi (D) 2 mCi (W)	8 mCi (D) 6 mCi (W)

Radiation Surveys

Routine contamination surveys will be performed in all active radiation use locations on a monthly basis. Storage locations will be surveyed quarterly if they contained radioactive material during the quarter. Individuals responsible for each lab or storage area will conduct the survey and maintain records of the survey. Contamination surveys will be done by swiping surfaces such as bench tops, equipment, floors, storage cabinets, etc., with filter papers and assaying the filter papers for radioactivity. Removable contamination in excess of 200 dpm per 100 cm^2 will be decontaminated promptly by the responsible individual. Removable contamination levels in excess of 1000 dpm per 100 cm^2 will be reported to the Radiation Safety Officer and promptly decontaminated. The monthly contamination survey will also incorporate a scan of surfaces using the end window Geiger ratemeter. Other than radioisotope work in process, spots or areas with contact readings greater than 500 cpm will be marked with radiation warning tape and noted on the survey sheet. Such spots or areas of contamination will be decontaminated by the responsible individual to levels as low as reasonably achievable.

Records Management Program

The Radiation Safety Officer, or his specific designee, will be responsible for maintaining all required records relating to radiation safety and regulatory compliance. Record systems will be established for the following radiation protection related functions:

a. Incoming radioactive materials received.

b. Radioactive materials (non-waste) shipped out, if any.
c. Radioactive waste disposed in the sewer, if any.
d. Radioactive waste containing liquid scintillation solution (<0.05 µCi/ml H-3 or C-14 only) disposed without regard to radioactivity, if any.
e. Radioactive waste decayed, surveyed and disposed as non-radioactive waste, if any.
f. Radioactive waste shipped to commercial waste brokers, if any.
g. Inventory of radioactive materials on hand.
h. Incident and accident investigations, and special surveys, if any.
i. Routine contamination surveys.
j. Records of use areas and spills relating to final decommissioning (as per 10 CFR 30.35(g))

Sealed Source Leak Test Program

Use of sealed sources of byproduct material requiring leak testing is not anticipated.

Instructions to Personnel

Persons who work with radioactive materials will receive written instructions as follows.

1. Lab coats are available and must be worn when using radioactive materials.

2. Contamination surveys must be performed at least monthly in all active radioisotope use areas.

3. Every storage container of radioactive material (including waste, glassware, contaminated equipment, etc.) must be labeled with the standard "Caution Radioactive Material" label with the isotope, and, if known, an estimate of the activity. Racks of small tubes or vials may be labeled on the rack.

4. Every room or area where radioactive material is used or stored must be posted with the standard "Caution Radioactive Material" sign.

5. Radioactive waste will be collected in the laboratory. Different isotopes should not be mixed in the same waste collection container. Sulfur-35 (half life 88 days) can be held in the laboratory or in the waste storage room for decay for at least 10 half lives. Only the RSO or his specific designate may authorize the disposal of decayed waste. All waste containers will be labeled with the standard "Caution Radioactive Materials" label and with the isotope, estimated activity in microcuries, and the date. Solid and liquid waste must be kept in separate containers. Liquid wastes also containing RCRA hazardous materials such as methanol or acetonitrile must be labeled with the names

of these chemical components. Radioactive waste may be disposed into the sewer only if it is soluble material or readily dispersible biological material, and only with the authorization of the RSO.

6. Radiation users are required to know the quantities of radioactive materials in their possession (including waste) and provide this to the RSO or his specific designate upon demand. Records allowing this information to be generated must be kept by the radiation user. The Radiation Safety Officer will maintain centralized records of the current radioisotope inventory with sufficient accuracy to assure that the total possession of licensed material does not exceed the license limit.

7. The following **radiation safety rules** will be observed by all radiation users when using licensed radioactive materials.

    a. Lab coat and disposable gloves shall be used whenever pipetting or otherwise dispensing radioactive solutions.

    b. Never pipette radioactive solutions by mouth.

    c. Absolutely no eating, drinking, smoking or storing of food or beverages shall be permitted in radionuclide areas.

    d. Disposable plastic-backed absorbent sheets or impervious cleanable surfaces (e.g., plastic trays or Teflon coatings) shall be placed on lab benches to contain radioactive solutions if spilled.

    e. Never put radioactive waste in the ordinary garbage.

    f. Notify your supervisor or the Radiation Safety Officer of any spills except those of a very minor nature.

    g. Never store food or beverages in refrigerators or freezers which also contain radioactive materials.

Emergency Procedures

All emergencies involving fire, explosion, flooding, etc. shall be brought under control promptly by trained personnel. Fire fighting, emergency response, medical emergency, first aid, etc. take precedence over radiological considerations until the immediate emergency is stabilized. Once the emergency is under control, the Radiation Safety Officer will direct all follow-up operations including radiation monitoring and decontamination. Emergencies

involving radioactive material will be handled according to the following emergency procedures.

For a radioactive spill:

a. Notify all persons in the immediate vicinity of the spill, and tell them where the spill is and to keep away. If you must leave the area, post another person at the spill site or put a temporary sign at the spill.
b. First aid and other life saving actions take precedence over radiation contamination concerns.
c. Notify the Principal Radiation User, your supervisor or the Radiation Safety Officer.
d. Put on impervious gloves and a lab coat.
e. Confine the spill with absorbent material, being careful not to spread the material.
f. Use a radiation survey instrument to locate the extent of the spill (for Carbon-14 or Sulfur-35 only).
g. Decontaminate the area by cleaning with disposable absorbent towels.
h. Collect all contaminated materials in a plastic bag labeled with the standard radiation symbol and the words "Caution Radioactive Material." Dispose as radioactive waste.
i. Survey the area and all involved individuals with an appropriate radiation survey instrument. Continue cleaning until the meter shows no contamination above twice background.
j. Using filter paper swipes, survey the area for removable contamination. Continue cleaning until all areas are below 200 dpm per 100 square centimeters of removable contamination.

For personal skin contamination:

a. Notify your supervisor, the Principal Radiation User, and/or the Radiation Safety Officer.

b. If large areas of the body or clothing are contaminated, proceed to a locker room or water shower and begin decontamination immediately.

c. Wash all areas of contamination beginning with mild warm soapy water. Do not abrade or crack the skin with excessive cleaning.

Package Receiving Procedures

All incoming packages of radioactive materials will be logged into the appropriate "Radioactive Package Log" immediately upon receipt at the facility. The log entry will

indicate the isotope, the amount in µCi or Bq, the vendor or sender, the name of the person who will use it, and the date. Packages of radioactive material will be received at the main entrance door or loading dock and moved as soon as possible to the laboratory or storage location.

External Surface Contamination Survey. Packages labeled with a Radioactive White I, Radioactive Yellow II or Radioactive Yellow III US DOT label, or packages with evidence of degradation of package integrity (such as crushed, wet or damaged) will be surveyed for **external surface contamination** within three hours of receipt according to the requirements of 10 CFR 20.1906(b, c, d). Such packages will be monitored for external surface contamination using the following procedure.

a. Assay the outside of the shipping package for surface contamination as soon as possible, but no later than three hours after its arrival at the building. (If received during non-business hours, it must be assayed within three hours from the start of the next business day.)
b. Put on disposable impervious gloves and a lab coat.
c. Place the package in a secure place in the lab.
d. With a filter paper, swipe all sides of the outer package, covering about 300 square centimeters.
e. Assay the swipe for net radioactivity (in dpm or microcuries, but not cpm) using the liquid scintillation counter. If more than one swipe per package is taken, the one with the highest radioactivity will determine the contamination level.
f. Divide the dpm by the area swiped in square centimeters (e.g., 300 cm2) to calculate dpm per square centimeter.
g. If the net radioactivity on the outside of the package is greater than 22 dpm per square centimeter, immediately take the following action:

    (1) Notify the Radiation Safety Officer.
    (2) Notify the final delivering carrier.
    (3) By telephone and telegraph, mailgram or facsimile, notify the U.S. Nuclear Regulatory Commission Region I Office, 475 Allendale Road, King of Prussia, PA.
    Current NRC Phone No.: 610-337-5000
    Current NRC Fax No: 610-337-5324, -5368

h. If the net radioactivity on the outside of the package is greater than 2.2 dpm per square centimeter, take the following action:

    (1) Notify the Radiation Safety Officer or the authorized Principal Radiation User of the contamination.
    (2) Place a label on the package giving the contamination level.
    (3) Keep the package on a disposable absorbent pad or impervious plastic sheet.
    (4) Wearing gloves and a lab coat, open the package in a laboratory hood, monitoring contamination levels with a suitable radiation survey meter.

(5) Dispose of contaminated packaging material as radioactive waste.
(6) If the inner container is broken or leaking, transfer any remaining radioactive material to a new container, seal shut, and apply the appropriate label and label information.

Radiation Dose Rate Level Survey. Incoming packages will not be monitored for **radiation dose rate level** as part of the receiving procedure because possession limits for all radionuclides are below the Type A quantities as defined in 10 CFR 71.4. Thus, all incoming packages will be below Type A quantities and do not require radiation dose rate level monitoring as per 10 CFR 1906(b)(2).

Package Opening Procedures

The following procedure will be used for opening all radioactive packages received at Taylor Technology, Inc.:

a. Keep the package on a disposable absorbent pad, impervious plastic sheet, or non-porous cleanable surface.
b. Wearing gloves and a lab coat, open the package, monitoring contamination levels on packaging materials and container surfaces with a suitable radiation survey meter.
c. Dispose of any contaminated packaging material as radioactive waste.
d. If the inner container is broken or leaking, transfer any remaining radioactive material to a new container, seal shut, and apply the appropriate label and label information.
e. Store the radioactive material in a secure and posted location.

Radiation Safety Training

No person, in the course of their employment at Taylor Technology, Inc., is expected to receive an occupational dose in excess of 100 mrem in a year. Therefore, instructions to workers according to 10 CFR 19.12 are not required.

A Radiation Safety Orientation presentation will be provided to individuals who work with or near radioactive materials. Taylor Technology, Inc. will keep records of all radiation safety training.

The Radiation Safety Orientation will consist of a ½ to 1 hour didactic presentation which will cover the following topics:

a. Licensing, regulation and inspection by US NRC
b. Presence of radioactive material in workplace
c. Labeling and posting requirements

d. Rules for handling radioactive material in the lab
e. Contamination control
f. Radioactive waste collection and management practices
g. Emergency procedures
h. Employee rights to contact NRC without prejudice

Taylor Technology, Inc. will give the necessary instruction to personnel initially and annually thereafter on a refresher basis. The instruction will be given by the Radiation Safety Officer, an authorized user named on the license, or by an outside consultant who is Certified in Health Physics by the American Board of Health Physics.

Question 11 - Radioactive Waste Management

Radioactive waste will consist of liquid solutions and solid waste.

Waste will be managed by one of the following four methods: decay for at least 10 half-lives and disposal as non-radioactive waste; transfer to a licensed radioactive waste broker for further management, treatment and/or disposal as radioactive waste; disposal of certain liquid scintillation liquids without regard to radioactivity; and disposal into the sewer system serving the laboratory facility.

Storage for Decay

Radioactive waste with half-lives less than 100 days (i.e., S-35) may be held for at least 10 half-lives, and disposed as non-radioactive waste. All waste destined for decay will be labeled with the standard radiation caution label, the isotope, the approximate activity, and the date. It will be held in the waste storage room for decay. Following the prescribed decay period, the material will be surveyed with a survey meter for any detectable radioactivity. The waste will be disposal as non-radioactive waste only if the survey shows that the waste cannot be distinguished from background. Prior to disposal as non-radioactive waste, all labels and references to radioactivity will be removed or obliterated. A record will be made of the final survey and disposal.

Transfer to Commercial Radioactive Waste Broker or Processor

Radioactive waste will be packaged in containers supplied or specified by the radioactive waste disposal broker or processor. A radioactive waste broker or processor licensed by the NRC or an Agreement State will be used. The brokers under consideration for contract waste removal are Teledyne Brown Engineering Environmental Services, Westwood, NJ; and Radiac Research Corp., Brooklyn, NY. A log of cumulative activity by isotope will be placed at each waste collection container so that the total activities of each isotope can be determined. Radioactive waste will be prepared for transfer according to instructions supplied by the broker or processor.

Disposal of Liquid Scintillation Wastes Without Regard to Radioactivity

Liquid scintillation wastes which contain only carbon-14 and/or tritium will be disposed without regard to radioactivity if the activity concentration is less than 0.05 µCi/ml. It is expected that all waste streams containing liquid scintillation solution will be below 0.05 µCi/ml. Records of each disposal done under this provision (see NRC regulation 10 CFR 20.2005) will be made and maintained.

Disposal to the Sewer

Liquid radioactive waste may be disposed of in a sink or drain leading to the sewer if it is readily soluble material or readily dispersible biological material. This procedure will be within the regulations of 10 CFR 20 as demonstrated by sample calculations as follows.

The sewer flow rate from the Taylor Technology, Inc. facility is estimated at 100,000 cubic feet of water per quarter (9.4×10^8 ml/month) based on actual discharge volume. Using this sewer flow rate and the monthly sewer disposal limits specified in 10 CFR 20.2003(a), the limits for allowable quantities which may be disposed of into the sewer per month are calculated as follows:

Radionuclide	Monthly Sewer Concentration Limit Table 3, (Appendix B, 20.1001-2401) µCi/ml	Monthly Sewer Release Limit, mCi
Hydrogen-3	0.01	9400
Carbon-14	0.0003	282
Sulfur-35	0.001	940

The above table shows release limits if a single radionuclide only is released into the sewer. A sum of ratios method will be applied if more than one radionuclide is released.

The license applicant is aware of the additional limits on annual total sewer activity of 5,000 mCi of tritium, 1,000 mCi of carbon-14 and 1,000 mCi total for all remaining radionuclides (10 CFR 20.2003(a)(4)).

The above sample calculation illustrates that the sewer can be used as a disposal method where releases would be within the limits of 10 CFR 20.2003. Actual sewerage flow will be determined from water meter or sewer flow meter readings. Actual average concentrations will be calculated monthly when disposal occurs during that month. Liquid waste disposal into the sewer drain will be under the direct control of the RSO who will pre-authorize such disposal. The RSO will keep records of all radioactive materials disposed into the sewer.

Attachments

Statements of Radiological Training and Experience of:
- Robert J. White
- Thomas D. Oglesby, Ph.D.
- A. K. Chaudhary, Ph.D.

Course Brochure: A Series of Short Courses on Radiation Safety, Rutgers University.
Floor Plans Showing Radioisotope Area

STATEMENT OF TRAINING FORM

(For Principal Radiation User)

Name: Robert J. White **Title:** Senior Scientist and Radiation Safety Officer

Formal Courses on Radiation Safety and Radioisotope Technology:

Please list all educational and training courses which included principles and practices of radiation protection, radioactivity measurements, radiation monitoring techniques, and/or biological effects of radiation. (Include college courses, radiation safety training lectures, and short courses.)

Institution, city	Date and duration	Name of course and short description
Rutgers University New Brunswick, NJ	12 November 1996. One full day.	1. Basic Radioisotope Theory. *
Rutgers University New Brunswick, NJ	13 November 1996. One full day.	2. Health Effects of Ionizing Radiation. *
Rutgers University New Brunswick, NJ	14 November 1996. One full day.	3. Radioisotope Laboratory Safety. *
Rutgers University New Brunswick, NJ	18 November 1996. One full day.	5. Radiation Protection Program Management. *
Rutgers University New Brunswick, NJ	19 November 1996. One full day.	6. Liquid Scintillation Counting. *
Rutgers University New Brunswick, NJ	22 November 1996. One full day.	9. Radioactive Waste Management. *

* Sponsored by the Radiation Science Option, Cook College Environmental Sciences Department and the Eastern Regional Radon Training Center of Rutgers University. Dr. Alan Appleby, Ph.D., Course Director. See attached course brochure for full description of each course.

Experience with radiation:

Please list all the different types of work you have done with radioisotopes or radiation

Institution, city	Date and duration	Radio-isotope(s)	Amount per experiment	Type(s) of experiment or use
SUNY, Albany, NY	1/81 - 6/83	Ni-63 sealed source	15 mCi	Detection and quantitation of chemical composition.
Killam Assoc., Millham, NJ	11/84 - 7/86	Ni-63 sealed source	15 mCi	Detection and quantitation of chemical composition.
EMS Labs, Lakewood, NJ	7/86 - 9/88	Ni-63 sealed source	15 mCi	Detection and quantitation of chemical composition.

STATEMENT OF TRAINING FORM

(For Principal Radiation User)

Name: Thomas D. Oglesby, Ph.D. **Title:** Vice President, Technical Operations

Formal Courses on Radiation Safety and Radioisotope Technology:

Please list all educational and training courses which included principles and practices of radiation protection, radioactivity measurements, radiation monitoring techniques, and/or biological effects of radiation. (Include college courses, radiation safety training lectures, and short courses.)

Institution, city	Date and duration	Name of course and short description
U. of S. Carolina, Columbia, SC	1978, one semester	Radiochemistry - Principals and Practices, Safety, Comprehensive.
The Upjohn Co., Kalamazoo, MI	1982, one day	Radioisotope Safety - Safety, monitoring and disposal.
CIGA-GEIGY, Summit, NJ	1984, two days 1986, two days	Radiochemistry and Safety - Comprehensive Course - Safety knowledge and disposal. (86 renewal)

Experience with radiation:

Please list all the different types of work you have done with radioisotopes or radiation

Institution, city	Date and duration	Radio-isotope(s)	Amount per experiment	Type(s) of experiment or use
U. of S. Carolina, Columbia, SC	9/77 - 9/82	H-3, C-14, P-32, Ca-45	0.01 - 1 μCi	*in vitro* biochemistry
The Upjohn Co., Kalamazoo, MI	10/82 - 11/84	H-3, C-14, P-32	0.01 - 1 μCi	*in vitro* biochemistry synthesis
CIGA-GEIGY, Summit, NJ	12/84 - 9/89	H-3, C-14, P-32	0.01 - 1 μCi	*in vitro* biochemistry

STATEMENT OF TRAINING FORM

(For Principal Radiation User)

Name: A. K. Chaudhary, Ph.D. **Title:** Senior Research Scientist

Formal Courses on Radiation Safety and Radioisotope Technology:

Please list all educational and training courses which included principles and practices of radiation protection, radioactivity measurements, radiation monitoring techniques, and/or biological effects of radiation. (Include college courses, radiation safety training lectures, and short courses.)

Institution, city	Date and duration	Name of course and short description
Panjab Univ., Chandigarah, India	1977, two semesters	Radiochemistry - Principals and Practices and Safety. Part of Modern Analytical Techniques.
Univ. Of Saskatchewan, Saskatoon	1986/87, one day	Radioisotope Safety - safety, monitoring and disposal.
Vanderbilt Univ., Nashville, TN	1992/93, one day	Radiochemistry and Safety - Comprehensive Course - Safety knowledge and disposal.

Experience with radiation:

Please list all the different types of work you have done with radioisotopes or radiation

Institution, city	Date and duration	Radio-isotope(s)	Amount per experiment	Type(s) of experiment or use
Panjab Univ., Chandigarh, India	1980-84	C-14	0.01-1 uCi for drug metabolism 5 mCi for radiosynthesis	
Univ. of Saskatchewan, Saskatoon	1986-90	H-3, C-14, P-32	microcurie quantities	radioimmunoassay, receptor binding assays
Indiana Univ., School of Medicine, Gary IN	1990	H-3, microcurie quantities P-32, 1 mCi each, continuous use I-125, 10 mCi, one experiment		molecular biology, receptor binding assays
Vanderbilt Univ., Nashville, TN	1991-96	H-3, 1 mCi C-14, microcurie quantities		radiosynthesis, drug metabolism

Course Brochure: A Series of Short Courses on Radiation Safety, Rutgers University.

A Series of Short Courses on Radiation Safety

November 12-15 & 18-22, 1996

Introduction

The Radiation Science Graduate Program Option in the Department of Environmental Sciences at Cook College, Rutgers, The State University of New Jersey and the Eastern Regional Radon Training Center are pleased to present a series of short courses for radiation science, safety and applied health physics professionals. These short courses cover topics ranging from the fundamentals of radioactivity and radiation to advanced radiation safety and radioactive waste management. You may choose to attend all of the courses or only those that satisfy your interests or professional development needs. In general, courses are designed to address fundamental technical subjects during the first five courses and more advanced topics scheduled for the last four courses. If you are a novice radiation safety officer you may wish to take most of the offerings. If you are an experienced professional in radiation protection, you may opt for some or all of the advanced topics in order to update, refresh or expand your knowledge of radiation safety. If you are a research scientist or lab technician you may wish to take only those courses that relate to your research activities..

The instructors for these courses are drawn from the university community, industrial research, medical institutions, laboratories and federal and state agencies.

Who Should Attend

- Health Physicists
- Radiation Safety Officers
- Health Physics Technicians
- Nuclear Medicine Technologists
- Managers Responsible for Contamination Control Programs
- Radiopharmacists
- Industrial Hygienists
- Safety Personnel
- Nuclear Engineers
- X-Ray Technicians
- Radiological Engineers
- Occupational Health Professionals
- Radiological Personnel Who Use Radioactive Materials

Selected Faculty

Alan Appleby, Ph.D.
Rutgers University

Martin Costello
Rutgers University

Edward Christman, Ph.D., C.H.P.
Columbia University

Elan Gandsman, Ph.D.
Yale University

Bob Tokarz
St. Peters Medical Center

Glenn Sturchio
Merck & Company

John Kinneman, C.H.P.
U.S. Nuclear Regulatory Commission

Alfred W. Grella, C.H.P.
Grella Consulting, Inc.

Wesley Van Pelt, Ph.D., C.H.P., C.I.H.
Wesley Van Pelt Associates

Faculty Coordinator

Alan Appleby, Ph.D. is the Director of and a professor in the Radiation Science Option of the Environmental Sciences Graduate Program at Cook College, Rutgers University. He has special expertise in the chemical behavior and effects of radioactive materials.

Radiation Safety Short Course Series

1. Basic Radioisotope Theory

Tuesday, November 12, 1996
9:00 A.M. - 4:00 P.M. Fee: $195

"Dr. Appleby provided a good refresher. He was easy to understand."

This course is intended for individuals using radioactive materials or who are responsible for their safe use. Topics include the nature of radioactive decay, the characteristics of the emitted particles, the sources of radioactive elements, and the concepts of activity, decay constant, and half-life.

2. Health Effects of Ionizing Radiation

Wednesday, November 13, 1996
9:00 A.M. - 4:00 P.M. Fee: $195

"Dr. Gandsman's lectures were very complete, very good, interesting and well done."

"A vast amount of very interesting information presented in a short time."

This course will address the somatic and genetic effects induced by ionizing radiation, their nature, and the magnitude of the risks. It will also discuss the effects of low-level ionizing radiation as presented in the BEIR V report.

3. Radioisotope Laboratory Safety

Thursday, November 14, 1996
9:00 A.M. - 4:00 P.M. Fee: $195

"I found all of the information useful."

This program discusses the fundamentals governing the safe use of radioactive material in research laboratories and clinical surroundings. Topics include contamination control procedures and techniques, external radiation protection methods, recordkeeping, proper laboratory design, and emergency procedures. Basic Radioisotope Theory (Course #1) or its equivalent is a prerequisite.

4. Radiation Instrumentation

Friday, November 15, 1996
9:00 A.M.- 4:00 P.M. Fee: $195

"Dr.Gandsman has the excellent ability to make complex information fairly understandable."

This program presents a discussion of the fundamental mechanisms and characteristics of the most commonly used ionizing radiation detectors and instruments (e.g. gas ionization, scintillation and semiconductor detectors). An introduction to the assessment and expression of uncertainties which exist when radioactive fields are measured is included. Calibration standards, requirements and procedures will also be considered.

"Well done!"

5. Radiation Protection Program Management

(including Standards and Regulations for Radiation Protection)
Monday, November 18, 1996
9:00 A.M.- 4:00 P.M. Fee: $195

"Well organized and very useful for planning and implementing a start-up safety program."

This course will discuss the goals, structure, recordkeeping requirements, training requirements and management techniques for the proper operation of radiation safety program. The focus is oriented towards research or industrial organizations. This course includes a review of the current standard-setting and regulatory organizations, their interrelationships and responsibilities, and their impact on radiation safety programs.

"Great recommendations for staying within compliance."

*** INDIVIDUALS REGISTERING FOR COURSES 1-5 MAY DO SO FOR A REDUCED FEE OF $850.**

"Good information, useful, good pace."

"Lectures were very informative, lively and enthusiastic."

"Entire class was useful; the lab work and calculations were the most helpful."

6. Liquid Scintillation Counting

Tuesday, November 19, 1996
9:00 A.M. - 4:00 P.M. Fee: $195

This course will provide a discussion of the fundamentals of liquid scintillation counting. It will include laboratory exercises to provide hands-on experience in liquid scintillation.

7. D.O.T. Nuclear Transport Regulations

Wednesday, November 20, 1996
9:00 A.M.- 4:00 P.M. Fee: $195

This course will provide a comprehensive overview, review, and understanding of the current regulations in the USA for safety in the transportation of radioactive materials. Organizational responsibilities, package requirements, and carrier requirements are discussed. All lecture material is up-to-date with respect to the recent (9/28/95) regulatory revisions by DOT/NRC to achieve compatibility of US regulations with the 1985 (1990 Rev) IAEA Safety Series No. 6. Major features of those revisions are highlighted as well as their impact on shippers and carriers. A written examination is provided for consideration by a hazmat employer when making his certification of his student's (hazmat employee) training which has been provided pursuant to D.O.T. training regulations.

8. Radiation Safety for Machine Sources of Radiation

Thursday, November 21, 1996
9:00 A.M.- 4:00 P.M. Fee: $195

"All speakers were very good."

"Excellent presentation."

This course will review the fundamentals of machine source operation and the radiation protection measures for analytic and industrial x-ray devices and medical x-ray devices. This course includes a review of the current standards and regulation. A representative of the New Jersey Bureau of Radiation Protection will describe the current statutes and regulatory actions.

9. Radioactive Waste Management

Friday, November 22, 1996
9:00 A.M.- 4:00 P.M. Fee: $195

"A good mix of need to know stuff and practical experience."

"Learned a great deal for the first time in a course on this subject."

"Handouts were great!"

This course will explain current techniques of radioactive waste management from packaging to storing and decay. Mixed waste management options will be discussed. The problem of long term storage will be examined and techniques of waste minimization. This course includes a comprehensive tour of the Rutgers Waste Facility.

*** Individuals registering for courses 6-9 may do so for a reduced fee of $680. Individuals registering for courses 1-9 may do so at a reduced fee of $1485.**

Companies and individuals who have benefitted from the Radiation Short Course Series include:

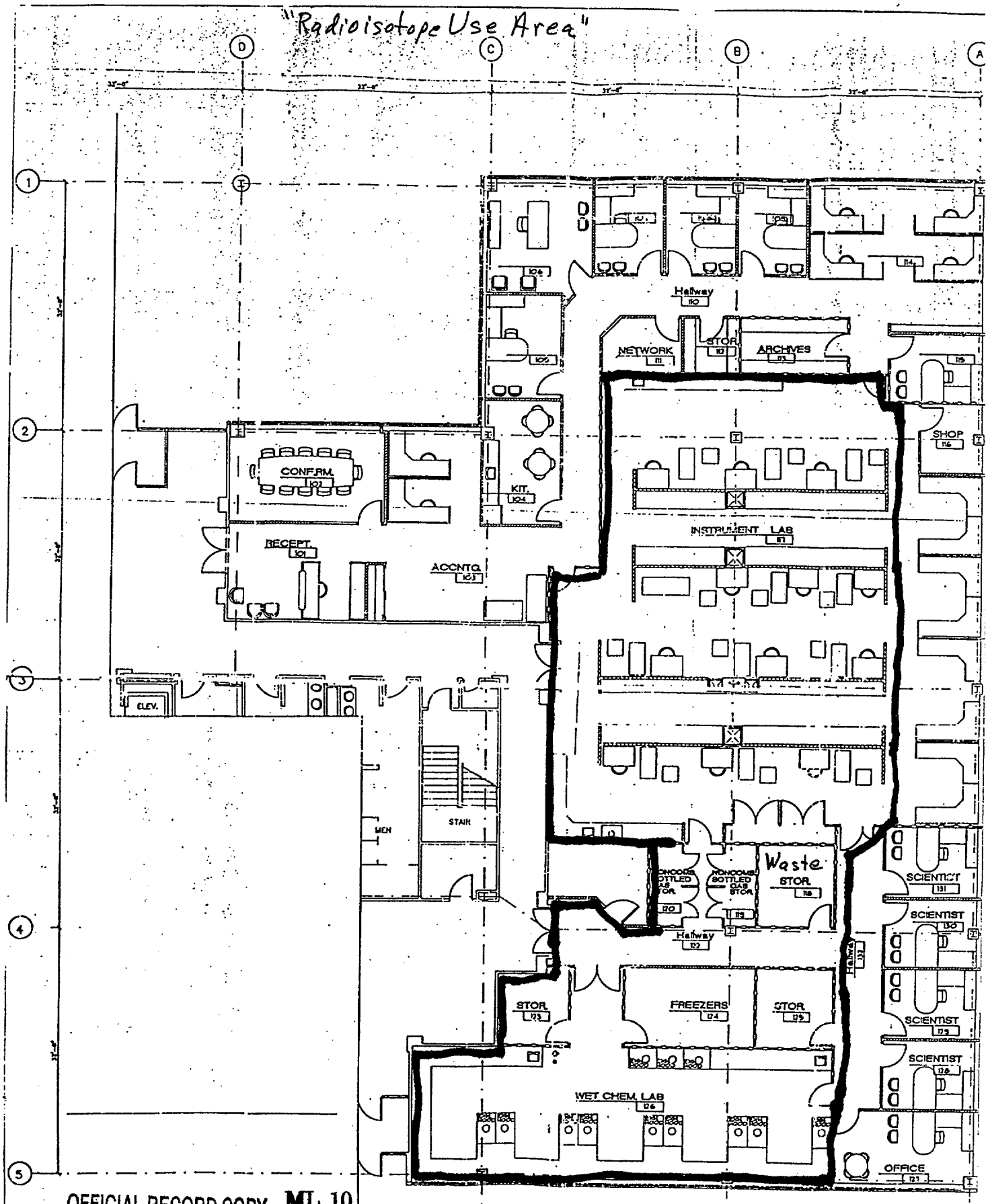
Cytogen Corporation • Synaptic Pharmaceuticals • Exxon • Ciba-Geigy • Wyeth Ayerst American Cyanamid • Smithkline Beecham • Hoffman LaRoche, Inc. • Sandor Pharmaceuticals UMDNJ • U.S. Navy • NJDEP • Sharp Electronics • Unilever • and others.

Floor Plans Showing Radioisotope Area

Floor Plans Showing Radioisotope Area

Taylor Technology Inc.
Princeton, N. J.

"Radioisotope Use Area"



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