

# 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.

## FEDERAL AGENCIES FILE APPLICATIONS WITH:

U.S. NUCLEAR REGULATORY COMMISSION  
DIVISION OF FUEL CYCLE AND MATERIAL SAFETY, NMSS  
WASHINGTON, DC 20555

ALL OTHER PERSONS FILE APPLICATIONS AS FOLLOWS, IF YOU ARE LOCATED IN:

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

U.S. NUCLEAR REGULATORY COMMISSION, REGION I  
NUCLEAR MATERIAL SECTION B  
631 PARK AVENUE  
KING OF PRUSSIA, PA 19406

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

U.S. NUCLEAR REGULATORY COMMISSION, REGION II  
MATERIAL RADIATION PROTECTION SECTION  
101 MARIETTA STREET, SUITE 2900  
ATLANTA, GA 30323

## IF YOU ARE LOCATED IN:

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

U.S. NUCLEAR REGULATORY COMMISSION, REGION III  
MATERIALS LICENSING SECTION  
799 ROOSEVELT ROAD  
GLEN ELLYN, IL 60137

ARKANSAS, COLORADO, IDAHO, KANSAS, LOUISIANA, MONTANA, NEBRASKA, NEW MEXICO, NORTH DAKOTA, OKLAHOMA, SOUTH DAKOTA, TEXAS, UTAH, OR WYOMING, SEND APPLICATIONS TO:

U.S. NUCLEAR REGULATORY COMMISSION, REGION IV  
MATERIAL RADIATION PROTECTION SECTION  
611 RYAN PLAZA DRIVE, SUITE 1000  
ARLINGTON, TX 76011

ALASKA, ARIZONA, CALIFORNIA, HAWAII, NEVADA, OREGON, WASHINGTON, AND U.S. TERRITORIES AND POSSESSIONS IN THE PACIFIC, SEND APPLICATIONS TO:

U.S. NUCLEAR REGULATORY COMMISSION, REGION V  
MATERIAL RADIATION PROTECTION SECTION  
1450 MARIA LANE, SUITE 210  
WALNUT CREEK, CA 94596

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 JURISDICTION.

## 1. THIS IS AN APPLICATION FOR (Check appropriate item)

- ☒ A. NEW LICENSE  
☐ B. AMENDMENT TO LICENSE NUMBER \_\_\_\_\_  
☐ C. RENEWAL OF LICENSE NUMBER \_\_\_\_\_

## 2. NAME AND MAILING ADDRESS OF APPLICANT (Include Zip Code)

Air Products and Chemicals, Inc.  
P.O. Box 538  
Allentown, PA 18105

## 3. ADDRESS(ES) WHERE LICENSED MATERIAL WILL BE USED OR POSSESSED.

Air Products and Chemicals, Inc.  
Iron-Run-Facility-  
50 North-Snowdrift-Road-  
Fogelsville, PA

R&D Laboratory #3  
Route 222  
Trexlerstown, PA 18087

## 4. NAME OF PERSON TO BE CONTACTED ABOUT THIS APPLICATION

Eugene I. Handwerk

## TELEPHONE NUMBER

215-481-3606

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 AND 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 3.P. AMOUNT ENCLOSED \$ 230

## 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, 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 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.

## SIGNATURE—CERTIFYING OFFICER

## TYPED/PRINTED NAME

## TITLE

## DATE

*Brian M. Rushton*

Brian M. Rushton

Vice President - R&D

## 14. VOLUNTARY ECONOMIC DATA

### a. ANNUAL RECEIPTS

|             |                                     |           |
|-------------|-------------------------------------|-----------|
| <\$250K     | <input checked="" type="checkbox"/> | \$1M-3.5M |
| \$250K-500K | <input type="checkbox"/>            | \$3.5M-7M |
| \$500K-750K | <input type="checkbox"/>            | \$7M-10M  |
| \$750K-1M   | <input type="checkbox"/>            | >\$10M    |

### b. NUMBER OF EMPLOYEES (Total for entire facility excluding outside contractors)

125

### c. NUMBER OF BEDS

NA

d. WOULD YOU BE WILLING TO FURNISH COST INFORMATION (Dollar and/or staff hours) ON THE ECONOMIC IMPACT OF CURRENT NRC REGULATIONS OR ANY FUTURE PROPOSED NRC REGULATIONS THAT MAY AFFECT YOU? (NRC regulations permit it to protect confidential commercial or financial—proprietary—information furnished to the agency in confidence)

☒ YES

☐ NO

## FOR NRC USE ONLY

## TYPE OF FEE

8505310401 850503  
REG1 LIC30  
37-05105-07 PDR

## APPROVED BY

## AMOUNT RECEIVED

## CHECK NUMBER

## DATE

## PRIVACY ACT STATEMENT

Pursuant to 5 U.S.C. 552a(e)(3), enacted into law by section 3 of the Privacy Act of 1974 (Public Law 93-579), the following statement is furnished to individuals who supply information to the Nuclear Regulatory Commission on NRC Form 313. This information is maintained in a system of records designated as NRC-3 and described at 40 Federal Register 45334 (October 1, 1975).

1. **AUTHORITY:** Sections 81 and 161(b) of the Atomic Energy Act of 1954, as amended (42 U.S.C. 2111 and 2201(b)).
2. **PRINCIPAL PURPOSE(S):** The information is evaluated by the NRC staff pursuant to the criteria set forth in 10 CFR Parts 30, 32, 33, 34, 35 and 40 to determine whether the application meets the requirements of the Atomic Energy Act of 1954, as amended, and the Commission's regulations, for the issuance of a radioactive material license or amendment thereof.
3. **ROUTINE USES:** The information may be (a) provided to State health departments for their information and use; and (b) provided to Federal, State, and local health officials and other persons in the event of incident or exposure, for their information, investigation, and protection of the public health and safety. The information may also be disclosed to appropriate Federal, State, and local agencies in the event that the information indicates a violation or potential violation of law and in the course of an administrative or judicial proceeding. In addition, this information may be transferred to an appropriate Federal, State, or local agency to the extent relevant and necessary for an NRC decision or to an appropriate Federal agency to the extent relevant and necessary for that agency's decision about you.
4. **WHETHER DISCLOSURE IS MANDATORY OR VOLUNTARY AND EFFECT ON INDIVIDUAL OF NOT PROVIDING INFORMATION:** Disclosure of the requested information is voluntary. If the requested information is not furnished, however, the application for radioactive material license, or amendment thereof, will not be processed. A request that information be held from public inspection must be in accordance with the provisions of 10 CFR 2.790. Withholding from public inspection shall not affect the right, if any, of persons properly and directly concerned need to inspect the document.
5. **SYSTEM MANAGER(S) AND ADDRESS:** U.S. Nuclear Regulatory Commission  
Director, Division of Fuel Cycle and Material Safety  
Office of Nuclear Material Safety and Safeguards  
Washington, D.C. 20555

APPLICATION FOR MATERIAL LICENSE

Radioactive Material

- a. Hydrogen 3
- b. Titanium tritide deposited as a thin layer onto copper giving the appearance of a foil disc one quarter inch in diameter.
- c. A maximum of 30 disks will be maintained in storage for uses described in this license. Also, foils which lose their efficiency, and are therefore replaced, will be retained in a suitable storage receptacle. The number of replaced foils will increase with time and will be stored until 30 to 40 are collected; at which time they will be disposed with a licensed disposal agent. Foil replacement occurs roughly on a three-year cycle. Each disc represents 50 millicuries of tritium. Therefore, a maximum of 3.5 curies of tritium will be possessed at any one time. The foils are not preconditioned before installation into the analyzer cells.

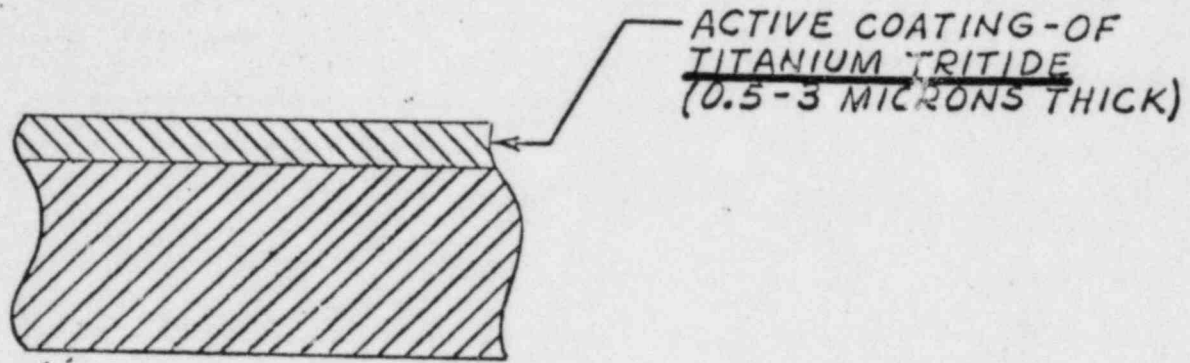
Purposes For Which Licensed Material Will Be Used

Air Products and Chemicals, Inc. (hereafter referred to as Air Products) manufactures high purity argon gas. For several years, Air Products has purchased Argon Purity Analyzers from Com Sip, Inc. Delphi Instrument Division, 3030 Red Hat, Whittier, CA 90601 under an instrument design licensing agreement between Com Sip and Air Products. See attached Patent and Know-How License Agreement and Instructions for Model D Ion Mobility Detector.

The argon purity analyzer uses a tritium source identified in the U.S. Radium Corporation drawing number 508-3 within a sealed cell to ionize argon and nitrogen molecules passing through the cell. Differences in the two ions mobility can be measured electronically and interpreted in terms of the nitrogen concentration in the argon gas. Since the Air Products' demand for analyzers will continue, and those analyzers currently in use will eventually require replacement of the sealed source material, Air Products plans to build and maintain argon purity analyzers. (See Exhibit I - Operating and Maintenance Manual.)

The argon purity analyzers built and maintained by Air Products will be solely for company use and are not intended to be distributed commercially.

|            |      |    |      |      |       |
|------------|------|----|------|------|-------|
| D.W.G. NO. | REV. | BY | AP'D | DATE | REVIS |
|            |      |    |      |      |       |
|            |      |    |      |      |       |
|            |      |    |      |      |       |
|            |      |    |      |      |       |



BACKING FOIL,  
ONE OF:  
302 STAINLESS STEEL .002"-.010" THICK  
OF HC COPPER .005"-.030" THICK  
HASTELOY "C" .002"-.010 THICK

THIS DRAWING IS FURNISHED FOR ENGINEERING INFORMATION AND REFERENCE ONLY AND IS NOT TO BE USED FOR MANUFACTURING PURPOSES UNLESS AUTHORIZED. THE FURNISHING OF THIS DRAWING DOES NOT CONVEY ANY REPRODUCTION OR MANUFACTURING RIGHTS.

|                            |  |                   |                                  |  |
|----------------------------|--|-------------------|----------------------------------|--|
| NUCLEAR PRODUCTS           |  | DEPT.             | UNITED STATES RADIUM CORPORATION |  |
| MATERIAL<br>SPEC. AS NOTED | TOLERANCES<br>FRACTIONS ± 1/64" ANGLES ± | DW'N BY <i>ja</i> | TITLE<br><br>TRITIUM<br>FOIL     |  |
|                            | F. CITALS UNLESS OTHERWISE NOTED *       | CHK'D BY          |                                  |  |
| THICKNESS                  | F. CITAL DISTORTIONS TO 3° *             | APP'D BY          |                                  |  |
|                            | F. CITAL DISTORTIONS 3° TO 12° *         | DATE 12-13-75     |                                  |  |
|                            | F. CITAL DISTORTIONS 12° AND UP *        | SCALE             |                                  |  |
|                            | THREADS CLASS — FIT                      | REF. DWG.         | DWG. NO. 508-3                   |  |
| DO NOT SCALE DWG.          |  |                   | REV. 508-1 REV. B                |  |



Radiation Safety Officer

Mr. Eugene I. Handwerk is the Radiation Protection Officer for Air Products and Chemicals, Inc. He will be responsible for insuring the safety of the personnel handling the tritium foil which is the subject of this notice.

Air Products has contracted a consultant, Dr. Walter S. Vincent, a professor at the University of Delaware, to assist and advise in radiation safety matters.

## RPO Resume

### EUGENE I. HANDWERK COORDINATOR, TOXICOLOGY AND REGULATORY COMPLIANCE AIR PRODUCTS AND CHEMICALS, INC.

Mr. Handwerk holds the position of Coordinator of Toxicology and Regulatory Compliance. This is a corporate staff function within the Corporate Safety and Environmental Activities Department. Mr. Handwerk reports to Mr. A. J. Diglio, Director of Corporate Environmental Activities, who in turn reports to Mr. J. M. Norwood, Corporate Director of Safety and Environmental Activities. Mr. Handwerk has responsibility for the Corporation's product stewardship programs and compliance with the Nuclear Regulatory Commission, Food and Drug Administration, and the Environmental Protection Agency regulations.

Mr. Handwerk has been employed in this position with Air Products and Chemicals, Inc. since January 1982. Prior to that, he was assigned this responsibility for the Chemicals Group Division of Air Products and Chemicals, Inc. beginning in January 1977.

#### Education

B.S., Muhlenberg College, Allentown, PA, 1963-1967  
Major: Natural Sciences - prime emphasis in chemistry

M.S. degree credits: 27; in biochemistry, molecular biology, genetics,  
and biophysics  
Lehigh University, Bethlehem, PA, 1975-1980

Radiation Safety Training - 7 hours lecture covering principals,  
measurement, and biological effects of  
radiation

Instruction by Dr. Walter Vincent, University of Delaware, 1984

Basic Training and Hospital Corp. School, U.S. Navy, 1967-1968  
Included first aid, triage and protection from radiation exposure as might  
be anticipated to occur in a nuclear war

#### Isotope Use

Life Science Laboratory, Air Products and Chemicals, Inc.,  
Trexlerstown, PA, 1975-1976

| <u>Isotope</u>  | <u>Max. Amount</u> | <u>Type of Use</u>         |
|-----------------|--------------------|----------------------------|
| C <sup>14</sup> | 250 uC             | Label biological material. |
| H <sup>3</sup>  | 250 uC             | Label biological material. |

\*Resume of Consultant to RPO

Walter S. Vincent, Ph.D.

Dr. Vincent has signed an agreement with APCI to serve as an on-call consultant to APCI for radiation safety matters.

Academic Positions:

AEC Pre Doctoral Fellow,  
U. of Pennsylvania, 1949-1950

Instructor, Assistant Professor, Dept. of Anatomy,  
Upstate Medical Center, NY, 1952-1961

Associate Professor, Dept. of Anatomy and Cell Biology,  
University of Pittsburgh Medical Center, 1961-1971

Professor and Chairman, Dept. of Biological Sciences,  
University of Delaware, 1971-1976

Professor of Cell and Molecular Biology,  
University of Delaware 1976-present

Summer Investigator, Marine Biological Laboratory (MBL), 1949-present

Member, Radiation Committee, 1958-1963, 1977-1984

Chairman, Radiation Committee, 1977-1983

Radiation Protection Officer, 1977-1984

(Trustee, 1967-1975, Member Executive Committee, 1972-1975)

Chairman, Biohazards Subcommittee, 1978-present

B.S., M.S. - Oregon State University, 1946-1948

Ph.D. - University of Pennsylvania, 1952

Field: Cell and Molecular Biology

- a. Training in Radiation Physics, Isotope Handling, etc.

Biophysics, Oregon State University, 1948, 3 months, lectures  
and Lab: radiation, isotopes, radiation measurement, health physics.

Isotope Handling and Safety, MBL, summer 1954, isotope handling,  
measurement, safety and use. 10 hours, lecture and demonstration.

Health Physics for Investigators, University of Pittsburgh, 1963.  
9 - 1 hour lectures on radiation and isotopes as related to health  
safety.

- b. Courses taught: Use and Handling of Radioisotopes in Biological  
Experimentation. University of Pittsburgh Medical Center, 1963-1968.  
20 lectures, 60 laboratory hours on use, handling, safety, laboratory  
techniques, calculations, measurements relating to design of  
experiments using radioisotopes.

Isotope Use: See following page.

Experience with Radiation -- Walter S. Vincent, Ph.D.

| <u>Isotope</u>    | <u>Maximum Amount</u> | <u>Where</u>   | <u>Duration</u>  | <u>Type of Use</u>                       |
|-------------------|-----------------------|--|--|--|
| H <sup>3</sup>    | 100 uC                | Upstate Medical Center<br>Pittsburgh Medical Center<br>University of Delaware<br>MBL | 1960-1961<br>1961-1971<br>1971-present<br>1958-present | Labeling<br>Biological<br>Materials      |
| C <sup>14</sup>   | 20 uC                 | Upstate Medical Center<br>Pittsburgh Medical Center<br>University of Delaware<br>MBL | 1956-1961<br>1961-1971<br>1971-present<br>1956-present | do.                                      |
| p <sup>32</sup>   | 10 mC                 | Upstate Medical Center<br>Pittsburgh Medical Center<br>MBL<br>University of Delaware | 1954-1961<br>1961-1971<br>1953-present<br>1971-present | do.                                      |
| S <sup>35</sup>   | 1.0 mC                | Upstate Medical Center<br>Pittsburgh Medical Center<br>MBL                           | 1960-1961<br>1961-1971<br>1960-1975                    | do.                                      |
| Na <sup>24</sup>  | 1.0 mC                | MBL  | 1960-1965  | do.                                      |
| Ca <sup>45</sup>  | 10 uC                 | MBL  | 1960-1970  | do.                                      |
| Co <sup>60</sup>  | 1 uC                  | MBL  | 1955-1957  | do.                                      |
| I <sup>125</sup>  | 5 mC                  | MBL  | 1973-1978  | do.                                      |
| I <sup>131</sup>  | 10 uC                 | MBL  | 1970-1971  |  |
| Cs <sup>137</sup> |                       | MBL  | 1964   | Irradiation<br>of biological<br>material |

Radiation Safety Supervision: Member of Radiation Safety Committee at the Marine Biological Laboratory for 11 years, Chairman for 6 years. Radiation Protection Officer for six years, 1977 to 1984.

The Marine Biological Laboratory is licensed to use all byproducts of mass numbers 3 through 83. The amounts of commonly used isotopes licensed for use include: 32P: 100 mCi.; 42K: 50.0 mCi.; 24 Na: 50.0 mCi.; 35S: 200 mCi.; 125I: 100 mCi.; 3H: 1000 mCi.; 14C: 500 mCi.; 45 Ca: 100 mCi.

As the Marine Biological Laboratory has a heavy influx of summer workers (approximately 400 investigators and students from all over the world), as well as a sizable group of year round investigators (about 100 investigators and students), the problems of radiation safety are particularly acute. The MBL has had as its mission not only the provision of a safe environment within which to



work with radioactive byproducts, but also to see that individuals who come there are trained in their safe use. During the 6 years that Dr. Vincent was Radiation Protection Officer there were approximately 85 senior users and 100 student users of radioisotopes during the summers. In the winter months the number of users dropped to about 20 senior investigators and 30 students.

As Radiation Protection Officer, and concurrently Chairman of the Radiation Safety Committee, Dr. Vincent was responsible for supervision and training of all those who used radioactive materials at the Marine Biological Laboratory.

### Employee Training

The following Air Products and Chemicals, Inc. employees will have basic training in radiation safety including instruction on:

- a. Principles and Practices of Radiation Protection
- b. Radioactivity Measurement
- c. Math Basic to Radioactivity Measurement
- d. Biological Effects of Radiation

Mr. Charles Ackerman is the supervisor of the instrument pool section of Corporate Research Services Department.

Mr. William Bechtel is a Senior Instrument Engineer in Corporate Research Services and provides oversight to all department activities from the point of view of an engineer.

Randolph M. Weber is an electronics technician in the instrument pool of the Air Products and Chemicals, Inc. Corporate Research Services Department. Mr. Weber has had formal training in electronics and TV repair. Mr. Weber will assemble the argon purity analyzer cells in the laboratory supervised by Mr. Charles Ackerman. A condition of Mr. Weber's performance of this work will be training in radiation safety and on-the-job familiarization with techniques in handling radioactive materials directly applicable to the construction of analyzer cells.

Assemblage of cells will be on an intermittent basis. It is anticipated that Mr. Weber would assemble a maximum of 20-40 cells within a 5-day period. Six months might lapse before additional cells would be assembled.

All principals will have hands-on training and guidance by a qualified radiation safety specialist using mock radioactive materials prior to working with the titanium tridide foils.

### Facilities and Equipment

Titanium tritide foil storage and assembly into analyzer cells will be in the Corporate Research Services Department's Instrumentation Experimental Apparatus Service lab of the Air Products and Chemicals, Inc. Research and Development facility No. 3 (R&D 3).

Assembly work will be conducted within a ventilated hood designated solely for this work during the time frame needed to assemble a sufficient number of cells to maintain an inventory for 6-12 months, i.e., 20-40 cells. Dedicated tools will be stored in a closed container when not in use. The ventilated hood has been tested and determined to provide a minimum of 100 feet per minute face velocity. This hood is included in the Air Products research facility's annually scheduled program for testing. Either an Alnor Type 8100 anemometer or an Alnor Type 8500 thermo-anemometer is used to measure the face velocities of hoods in research facilities.

Tritium foils will be stored within the glass jars (vials) in which they are received from the supplier. The jars will be maintained in a locked storage cabinet labeled CAUTION! RADIOACTIVE MATERIALS. Titanium tritide foils will only be removed from jars within the ventilation hood.

The layout of the laboratory spaces is depicted on the following pages showing where the radioactive materials will be used.

## Radiation Safety Program

### Introduction

This document is a summary of the rules and procedures pertaining to the use of radioactive materials in the Research and Development Facility of Air Products and Chemicals, Inc. (hereafter R&D 3, APCI). Compliance with these rules is necessary primarily to protect the health and safety of yourself and your colleagues.

Air Products and Chemicals, Inc. is legally responsible for enforcement of these rules and for assuring that all personnel using radioactive materials fully comprehend the reasons for the rules. A breach of the safety procedures put forth herein is a serious matter which may lead to irreversible harm to health and a loss of all APCI privileges in using radioactive materials.

The use of all radioactive materials at APCI is authorized by the Nuclear Regulatory Commission (hereafter NRC) through a Byproducts Material License for Industrial Use given to APCI. The Director of the laboratory is nominally responsible for these matters. The Director delegates operational authority for radiation safety to the Radiation Protection Officer (RPO). The RPO is, in effect, the Nuclear Regulatory Commission's representative at APCI. He is charged with safeguarding and instructing those within his jurisdiction and will ensure compliance with the applicable parts of Title 10, Chapter 1, Code of Federal Regulations - Energy.

All users of radioactive materials in R&D 3, APCI are designated either "Authorized Users" or "Supervised Users". All radioactive materials are the responsibility of designated "Authorized Users". Authorized Users' responsibilities include training and control of supervised users, execution of safety measures, cleanup and personnel monitoring measures, proper recordkeeping, and appropriate communication with the RPO. Supervised users are immediately and directly responsible for proper safety and experimental procedures to their supervisory authorized user.

### Radiation Control Procedures

#### A. Authorization Procedures

All persons who will use radioisotopes at R&D 3, APCI must have a personal "entrance interview" with the RPO or Authorized User. The interviewee must attest, in writing, to his/her understanding and accepting the contents of this document prior to beginning any work with radioisotopes. If the interviewer determines that the interviewee's training and experience are sufficient for him/her to safely carry out the proposed experiments, the interviewee may be designated a Supervised User by the RPO. Acceptable training should include but is not limited to:

1. Principles and practices of radiation protection.
2. Radioactivity measurements, standardization and monitoring techniques and instruments.



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

4. Biological effects of radiation.

Note: The use of millicurie quantities of the radioisotope listed in the industrial license for R&D 3, APCI by a person with a minimum of training and experience under precisely specified and controlled conditions subject to the surveillance of a competent and adequately trained radiation protection officer may be justified. Such minimum training and experience consist of a few hours of training and experience in the use of one or more radioisotopes similar to the use proposed in the license application under the supervision of a licensed user.

Pregnant females and persons younger than 18 years will be discouraged from working with radioisotopes due to their greater likelihood of harm from controlled or uncontrolled (accidental) exposure.

#### B. Procurement, Receipt and Transfer of Radioisotopes

Only Authorized Users may purchase radioisotopes to be delivered to R&D 3, APCI. All purchases must be approved and procured via the RPO. Only the authorized user may receive radioactive materials and must wipe test the packages coming into R&D 3.

Radioisotopes may be transferred from R&D 3, APCI with authorization of the RPO's of APCI and the licensed recipient institutions. They must be shipped and packaged by Authorized Users, in accordance with NRC regulations.

All radioisotopes at R&D 3, APCI are assigned to Authorized Users.

Proper keeping of records is essential to the safe use and oversight of radioisotopes. Records of personnel exposure, radiation surveys, instrument calibration, and isotope fate, constitute the primary evidence for compliance by R&D 3, APCI and Users with legally required regulations. Keeping of records is a prime responsibility of Authorized Users.

Each Authorized User must maintain an inventory record of radioisotopes assigned to him/her. The inventory record will include a list of the isotopes, their activities, quantities, form, places of storage, intended and actual fates, and other parameters as may be recommended by the Radiation Protection Officer. Users also may be required to keep logs and records of personnel monitoring done by them, if appropriate to their experiments.

#### Caution Signs and Labels

Each container of radioactive material must be labelled by the User to indicate the isotope, its activity, the quantity, the date on which it was assayed, and User's name.

Any room in which radioactive materials are being used must have on its door a sign, "CAUTION--RADIOACTIVE MATERIALS", indicating the radioisotope(s) within. The hood in which the radioactive materials are being handled must be similarly labeled.

#### Radiation Monitoring and Surveys

Monitoring and radiation surveys of all laboratories and areas containing radioactive materials will be done from time to time by Authorized Users. Specifically, a survey shall be made prior to the initial introduction of the foils into the lab area, whenever changes in the procedure may cause an increase in exposure, after an accident and periodically on a routine basis as addressed below. Laboratory space will not be assigned unless it has been determined to be free from radioactive contamination on the basis of appropriate surveys. Authorized Users will not leave R&D 3, APCI at the conclusion of their work before they have made a final survey of their laboratory.

Authorized Users are required by RPO to conduct daily surveys at the conclusion of the periods of radioisotope use as follows:

- A. For monitoring "loose" contamination, an operation called a "wipe test" is performed. It consists of wiping a surface of about 100 cm<sup>2</sup> with a piece of filter paper and then counting it in a Beckman LS 3801 liquid scintillation counter sensitive down to 5 dpm above background. Wipe tests can detect low energy beta radiation. Wipe test survey reports will be given to the Radiation Protection Officer within three days of conducting the survey. The hood area and all completed cells will be subjected to a wipe test. Counts above 40 cpm net (or 70-100 dpm) will indicate the need for additional investigation into the source of the contamination and a reevaluation of the work practices to ensure minimization of exposure to the user.

#### Storage of Radioactive Materials

All radioactive materials must be stored in a secured location with appropriate shielding, ventilation, and labeling. Storage of titanium tritide foils will be in the glass vials in which the foils are shipped and received. The vials will be opened only within the ventilated hood in which cell assembly will be performed.

#### Waste Disposal

Iron Run, APCI provides contracted radioactive waste disposal service with a licensed contractor. No radioactive material or suspected radioactive material may be discarded in the regular trash.

The following packaging procedures must be followed for waste:

- A. All waste must be labeled with the identity of the radioisotope, and chemical form, the activity, the date of disposal, and the name and location of the Authorized User.

- B. DRY waste should be placed in plastic bags and securely closed.
- C. LIQUID waste should be poured into plastic jugs containing enough suitable absorbent to prevent sloshing and securely closed.

#### Personnel Monitoring

Monitoring systems\* such as wipe tests and urinalyses will be performed as appropriate. Based on the nature and amounts of radioisotope to be used (less than one curie per assembly period) in R&D 3, APCI, it is not perceived that bioassays are necessary or required according to the U.S. N.R.C. Draft Regulatory Guide "Applications of Bioassay for Tritium". Nevertheless, urinalysis bioassays for tritium will be performed after each assembly period for the first 5 assembly periods. If there is no evidence of tritium absorption, routine urinalysis will be reduced to annually. Annual physicals are given to all lab personnel as a matter of standard operating practices at Air Products.

#### Emergency Procedures

Locations and telephone numbers of emergency response personnel are posted at the lab entrance door. The RPO should be notified immediately of any spills, releases to the air, contamination of person or property, or other emergencies involving radioactive material. The User identifying the emergency should proceed as follows, pending subsequent instruction or action by RPO.

- A. Spills. Isolate the area and pick up the foils, wearing gloves. Do not spread the contamination by walking through it. Mark off the contaminated area with tape labels and signs until decontamination is complete.
- B. Personal contamination. If personal contamination is known or suspected, avoid contacting the contaminated area with other parts of the body. Wash the contaminated area with soap and water for no longer than 2 or 3 minutes and monitor the areas with a wipe test. Dry with paper towels. Repeat this procedure no more than 4 times. Excessive washing will enhance absorption through the skin and washing areas adjacent to the contaminated one will tend to spread the contamination. Four hours after contact, obtain a urine sample for bioassay for tritium.
- C. Property contamination. Remove contaminated clothing and personal items immediately and place them, and other contaminated articles, in a radioactive waste container or a plastic bag tagged CAUTION! RADIOACTIVE MATERIAL. Store in a shielded, ventilated area if appropriate, pending transfer to a licensed radioactive waste disposal contractor.

\* Monitoring for airborne releases of tritium in this process is not appropriate. Tritium is tied up as a thin layer of titanium tritide deposited on a foil backing. Tritium is not substantially released from the foil into the air until the foil temperature approaches 225°C. During the assembly of the cells the foils will be at room temperature (25°C). In the analyzer, the maximum temperature rise achievable by the 30 watt heater is 27 centigrade degrees above ambient which is well below 225°C. No tritium is released to the air.

## Appendix

R&D 3, APCI is committed to keep all exposures to radiation as low as reasonably achievable. This means that any unnecessary exposures are a violation of the terms of our NRC license. The following maximum permissible exposure for workers will serve as the standard for Air Products:

- Employee assembling cells will be informed on basic radiation safety.
- Employee will perform all assembly work inside a ventilated hood.
- Employee will wear surgical rubber gloves and a lab coat.
- No food, drink, or smoking is permitted in the cell assembly area.
- Routine wipe test results indicating removable contamination greater than 40 cpm will require a work stoppage, decontamination of the work area, and reassessment of work practices.
- Employee must maintain good housekeeping practices in the laboratory.
- Employee must label radioactive materials and equipment and segregate waste for disposal.