THE UNIVERSITY OF TEXAS AT ARLINGTON

RADIATION SAFETY MANUAL
NOTICE

The purpose of this manual is to supplement federal state and local regulations for the control of radiation, and in no case is it intended to replace these regulations.

In the event that existing or future federal, state or local regulations are found to differ from the requirements contained in this manual, those legally accepted regulations shall be followed.

This manual has been approved by the Texas Department of Health (TDH).
FOREWORD

RADIATION SAFETY is the responsibility of all faculty, staff, and students who are directly or indirectly involved in the use of radioisotopes or radiation producing devices.

The University of Texas at Arlington is licensed by the State of Texas to use radioactive materials in research, development, and instruction. While this means a minimum of controls by the state, it entails the responsibility that we establish and pursue an effective Radiation Safety Program. It is the purpose of this manual to set out the guidelines of that program.

The use of radiation in a university, where a large number of people may be unaware of their exposure to radiation hazards, makes strict adherence to procedures established by federal and state authorities of paramount importance. Special efforts to ensure the safety of faculty, staff, students and the general public are essential. The Environmental Health & Safety Office has the responsibility for establishing and pursuing an effective Radiation Safety Program for this University.

It is the responsibility of all faculty, staff, and students involved in radiation work to familiarize themselves with the program outlined in this manual, and to comply with its requirements. Radiation safety depends on a continuous awareness of potential hazards.

Robert E. Witt
President
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IX. APPENDIX
I. RADIATION SAFETY PROGRAM MANAGEMENT

A. APPOINTMENTS

1. The Radiation Safety Officer (RSO) responsibilities on this campus will be performed by the RSO or appointed delegate.

2. The Radiation Safety Committee (RSC) is appointed by the President of The University of Texas at Arlington and will consist of a minimum of seven (7) members. The President shall appoint a minimum of five (5) members to the committee from the faculty of the Science and Engineering Departments. The Radiation Safety Officer will be appointed from the Environmental Health & Safety Office. A faculty member will be appointed as chairman. Four (4) members shall constitute a quorum.

B. RESPONSIBILITIES OF RADIATION SAFETY OFFICER (RSO)

The Radiation Safety Officer has the broad responsibility for monitoring, updating and determining the degree of compliance with established regulations, policies and practices regarding the license, purchase, shipment, use, monitoring, disposal, and transfer of radioisotopes or sources of high energy radiation at The University of Texas at Arlington. The RSO will report this findings to the Director of Environmental Health & Safety for appropriate action. The RSO will be a member of the Radiation Safety Committee and will periodically provide that committee a comprehensive update briefing on the status of the Radiation Safety Program.

Specific responsibilities of the Radiation Safety Officer are:

1. Terminate any operations which the RSO feels are causing excessive or illegal radiation hazards. Termination of any function will be reported to the Director of Environmental Health and Safety for follow-up action and reports.

2. Perform periodic inspections of areas where sources of radiation are stored or used. Prepare written reports detailing deficiencies and recommendations for scheduled formal inspections and unscheduled inspections when serious deficiencies are identified.

3. See that the records of radiation surveys and inventories of radioisotopes are maintained by each person who is authorized to use radioactive material or sources of radiation on this campus.

4. Administer the rules and procedures developed to control the procurement and use of radioisotopes and sources of radiation on campus.

5. Prepare instructions as necessary to provide adequate protection of the University personnel in compliance with federal and state regulations, and the University’s Radioactive Material License.

I. B. (Continued)
6. Ensure that a service of periodic calibration of survey instruments is maintained.

7. Maintain a comprehensive file on receipt, use, storage, and disposal of radioisotopes, and on all matters pertinent to the Radiation Safety Program.

8. Leak test sealed sources and maintain records on leak tests.

9. Review and evaluate safety precautions and procedures for each prospective user of radioactive materials and radiation-producing equipment prior to purchasing radioisotopes or operating a source of ionizing radiation. Safety precautions and procedures must be approved by the Radiation Safety Committee before an authorization to use radioisotopes or radiation-producing devices can be issued.

10. Maintain a close liaison with University, state and federal authorities in matters of radiation safety license requirements. Act as primary contact with the State Department of Health in the administration of the license, including copies of applications and sub-licenses.

11. Assist the departments of the University in obtaining service for the disposal of radioactive waste. Monitor disposal activities to ensure compliance with regulations.

12. Advise and assist all University personnel who use, or plan to use, radioactive material or radiation-producing equipment in matters of radiation safety (radiation monitoring, area posting, and record keeping) and in procuring, using, storing, and disposing of those radiation sources.

13. Investigate and provide both informal briefings and formal written reports to the Director of Environmental Health & Safety and University management, as appropriate, of accidents and serious incidents involving radiation activities. This will include personnel overexposures, facility contamination, violations of regulations and any deficiency warranting management concern.

14. Provide briefings as needed to UTA Police Department and the Arlington Fire Department on the Radiation Safety Program and those problems and concerns that would exist in the event of fires, explosions, tornadoes, thefts or vandalism.

15. Develop formats and maintain records as required by federal, state and University regulations, manuals and policies. This shall include the development of long term exposure files for persons (including students) working with radioactive/radiation-producing materials or devices.

16. Provide a Radiation Safety Program status briefing to the Radiation Safety Committee at least once each calendar quarter.

I B. (Continued)
17. Keep the University Director of Environmental Health & Safety fully apprized of all aspects of the University Radiation Safety Program.

C. RESPONSIBILITIES OF RADIATION SAFETY COMMITTEE

1. The committee will review policies and practices regarding the license, purchase, shipment, use, monitoring, disposal, and transfer of radioisotopes or sources of high energy radiation.

2. They will provide technical support and information to the Radiation Safety Officer.

3. They will make recommendations to the Director of Environmental Health & Safety to ensure that regulations, standards and policies are followed.

4. They will review applications for the use of radioactive materials and radiation-producing equipment to ensure that applicants are qualified to use the source(s) in the manner and for the purpose requested. They will determine that the applicant has the equipment and facilities to operate in compliance with federal and state regulations and this manual.

5. They will act as an Intra-University advisory and information exchange group for the academic departments on radiation-producing activity, equipment in use and test instruments available.

6. Keep a normal record of committee activity.

7. The committee shall meet at least once each calendar quarter and as otherwise required at the call of the chairperson.
D. LINE OF RADIATION AUTHORITY AND RESPONSIBILITY

- President
  - Provost (Designee for Radiation Responsibility)
  - Radiation Safety Committee (R.S.C.)
    - Radiation Safety Officer (R.S.O.)
      - Radiation Technician
II. RADIATION FACILITIES AND EQUIPMENT

A. RADIOISOTOPES

The use of all radioisotopes and sources of radiation (exclusive of special nuclear materials) is authorized by the Texas Department of Health Radioactive Materials License Number L00248 issued to The University of Texas at Arlington. This broad license covers possession of any radioactive material with atomic number less than 84 in amounts up to 5 millicuries of each isotope, 250 millicuries total. Certain other isotopes are covered in quantities greater than the above amounts on an individual basis. A copy of this license is available for inspection in the University Environmental Health & Safety Office.

B. X-RAY MACHINES AND ELECTRON MICROSCOPES

All X-ray machines, electron microscopes, and other radiation-producing equipment are required to be registered with the Texas Department of Health, Bureau of Radiation Control by the Texas Regulations for Control of Radiation, 25 TAC §289.226(c) and 25 TAC §289.226(h).

University personnel must contact the Radiation Safety Officer before procuring radiation-producing equipment.

C. LASERS

Class III and IV lasers are required to be registered with the Texas Department of Health, Bureau of Radiation Control, by the Texas Regulations for the Control of Laser Radiation Hazards, 25 TAC §289.301

University personnel must contact the Radiation Safety Officer before procuring Class III or IV lasers.
III. OPERATIONAL RADIATION SAFETY PROCEDURES

A. GENERAL

Each person authorized to use radioisotopes or sources of radiation is responsible for the safe use of such materials and/or devices. The user must carry out the required administrative and safety procedures, select those laboratory practices which are applicable to the work, train and supervise those assisting, acquaint them with proper radiation safety practices, and see that the laboratory is properly posted with "Radiation Caution" and "Notification to Employees" signs as required by Texas Regulations for Control of Radiation. The user shall immediately notify the University Environmental Health & Safety Office if any unexpected difficulties arise which might affect the safety of personnel.

The maximum permissible level for unrestricted areas and maximum permissible dose for individuals as stated in the Texas Regulations for Control of Radiation are to be considered as maxima and every effort is to be made to conduct experiments and operations at level which are as low as reasonably achievable (ALARA).

B. RADIOISOTOPES

In order to maintain compliance with the Texas Regulations for Control of Radiation, the University's Radioactive Materials License, and to ensure protection for all personnel, the following procedures shall be incorporated into each department's Radiation Safety Program:

1. The user shall maintain a record file on the receipt, use, transfer, storage, and disposal of radioisotopes, and on the radiation surveys conducted in the areas of potential problems.

2. Signs shall be posted wherever radioactive materials are present. Signs shall identify each area as a restricted area where a dose rate above 2.0 mR/hr exists.

3. Personnel dosimeters (film badge or TLD) shall be worn by all personnel who enter a radioactive area in accordance with Texas Regulations for Control of Radiation, 25 TAC 289.202(q)(1), uses or operates any source of radiation except those operating minimal threat radiation machines listed in Texas Regulations for Control of Radiation, 25 TAC 289.201(q)(2). Radiation exposure data shall be recorded in permanent records.

4. Working areas shall be monitored by the user after each use of radioisotopes, except sealed sources, to determine radiation levels and presence of contamination, if any. Record results in the user's laboratory survey book.

5. Authorized users of radioactive materials shall check their radiation survey instruments between each use to make sure they are in proper operating order.
III. B. (Continued)

6. Minor spills as defined in Section VIII. of this manual shall be cleaned up immediately. If a major spill occurs, do not attempt to decontaminate. Isolate the area and notify the Radiation Safety Officer immediately.

7. Protective clothing and hands shall be monitored upon completion of laboratory work involving the handling of radioisotopes.

8. Smoking, drinking, eating, or the application of cosmetics shall not be allowed in the same room where open sources of radioactive materials are used, and the room shall be posted accordingly.

9. Proper clothing shall be worn while in a laboratory containing radioactive materials (i.e., no shorts, no sandals, etc....).

10. Mouth pipetting of liquid radioisotopes is forbidden. Use a rubber bulb or similar device.

11. Radiation detection instruments shall be used at radioisotope use areas when applicable. The radiation detecting instrument shall be compatible with the particular type of radiation work being done in the area.

12. Long-handled tongs, gloves, smocks, and other equipment shall be used whenever such safety measures are needed. When in doubt as to whether special equipment is necessary, the user shall contact the Radiation Safety Officer for assistance.

13. Gloves and smocks shall be worn by all employees when working with liquid radioactive materials.

14. Radioactive materials shall not be handled with bare hands, nor shall sealed sources be opened.

15. Control of access into restricted areas is the responsibility of the individual supervising the project.

16. Radiation detection instruments such as ionization chambers, proportional counters, and Geiger counters which are used for general radiation surveys shall be calibrated annually. Each instrument shall be calibrated to read within ± 20% of the correct exposure reading. Calibrations shall be made by an Agency-approved contractor.

17. Radioisotopes producing a radiation dose level in excess of 1 mR/hr at a distance of 1 foot from the source shall be stored in shielded containers of sufficient thickness to reduce the dose rate to 1 mR/hr or less at a distance of 1 foot from the surface of the container.
18. All unsealed sources or radioactive liquids should be stored in non-breakable, leak-proof containers.

19. Work involving liquid radioisotopes shall be performed on trays lined with absorbent paper or on surfaces protected with plastic-backed absorbent paper.

20. Radioactive materials shall not be used on human beings or in field applications where such activity is released without prior approval of the Radiation Safety Committee.

21. Chemical hoods in which radioactive materials are used shall have a minimum velocity of 100 linear feet per minute.

22. All glassware and equipment containing radioactive material shall be properly labeled.

23. Trial runs should be made whenever practicable to determine proper procedures and to evaluate necessary radiation protection.

24. Signs or labels shall be used to identify sinks used for radioisotope activity. Only the designated sinks will be used for washing contaminated glassware.

25. Only designated storage boxes, freezers, and refrigerators will be used for the storage of radioisotopes. Do not put food in any freezers or refrigerators used for this purpose.

26. All radioisotope storage containers will be labeled in accordance with Texas Health Department Regulations with the following information:

   a) Radioisotopes
   b) Activity and date
   c) Authorized user
   d) Caution - Radioactive Material (with radiation symbol)

27. All radioisotope storage areas will be locked when an authorized user is not in attendance.

28. All radioisotopes shall be stored in a locked room or cabinet. Approved warning signs will be posted on the room or cabinet doors.

29. In case of suspected or known overexposure to an employee, the Radiation Safety Officer will be contacted immediately. A written report will be made in each case of overexposure by the employee and the person supervising the use of the radiation on the particular project. This report will explain fully why the employee involved was subjected to an excessive amount of radiation, and will recommend measures to be taken to avoid a recurrence of the accident.
III. B. (Continued)

30. Records of the radiation exposure of all personnel using radiation sources at the University will be kept by the Radiation Safety Officer. Reports of exposure history will be sent to appropriate personnel annually, upon termination, and upon request.

31. Safety glasses, optical glasses, or goggles will be worn when the activity of hard beta-emitting radioisotopes (i.e., P-32) being used exceeds 10 microcuries.

32. Any proposed changes in a user's current authorization will be submitted in writing to the Radiation Safety Committee for approval.

33. The Radiation Safety Officer will be notified before radioisotopes are transferred from one authorized user to another. No transfers will be made to unauthorized personnel.

34. The Environmental Health & Safety Office shall be contacted for disposal of liquid and solid radioactive waste.

35. Copies of a bulletin titled "Notice to Employees" will be posted in a sufficient number of places in every area where employees are engaged in activities using radiation or radioisotopes so that all employees entering the area may read the bulletin. Copies of this bulletin are available from the Radiation Safety Officer.

36. Every employee using radiation-producing equipment or radioisotopes will be familiar with the appropriate regulations of the University Radiation Safety manual and of the Texas Regulations for Control of Radiation. Copies of all regulatory documents are available upon request from the Radiation Safety Officer.

37. Each Principal Investigator will maintain a current list of personnel who are authorized to handle radioactive materials or radiation-producing devices.

38. Additions or alterations to these rules may be made by the Vice President for Academic Affairs with the approval of the Texas Department of Health, when, in the estimation of the Radiation Safety Officer or Committee, such additions and alterations are necessary for the protection of the University, its employees or the general public.

C. X-RAY MACHINES AND ELECTRON MICROSCOPES

Only qualified personnel will be allowed to operate X-ray units and electron microscopes. No personnel monitoring shall be required in facility categories specified as minimal threat in the Texas Regulations for Control of Radiation, 25 TAC §289.201(q)(2). This list includes Electron Microscopes, X-ray Fluorescence (Machine), X-ray gauges, Radiography-Certified Cabinet X-ray, Particle Size Analyzer (X-ray), Baggage or Package X-ray, and Electron Beam Welding.

III. C. (Continued)
A personnel monitoring device will be worn by the operator of an X-ray unit and a suitable survey meter will be used to monitor the general area of the X-ray unit to ensure that excessive radiation levels are not present to endanger the operator or other personnel. As a safety feature in the use of uncollimated x-ray beams, micro switches will be located on the doors to the exposure cell which will deactivate the X-ray generator should the door be opened while the generator is in operation. For well-collimated, narrow beam geometries, physical restriction of access to the X-ray beam is required.

Where specific manufacturer's instructions are not available, the following procedures should be used for operating X-ray generators or electron microscopes:

1. Each individual entering a radiation area including high radiation areas or uses or operates any source of radiation shall use the personnel dosimeters (film badge or TLD) as provided by the Environmental Health & Safety Office.

2. Turn on radiation survey instrument.

3. Install the desired filter on the tube head.

4. Make sure that no one is in the exposure cell or in any radiation field outside the cell.

5. Insert the high voltage interlock and turn on the circuit breakers to energize the system.

6. Turn on the main power switch.

7. Close the shutter switch.

8. If the tube has not been used in the last 12 hours, it should be warmed up as follows:
   a. Set high voltage.
   b. Set current switch.
   c. Decrease rheostat or rotary switch to start and unlock HV safety circuit.
   d. Slowly increase voltage until the rheostat or rotary switch is in the operating position.

9. After the tube has been warmed up, set the high voltage and current to the desired operating values.

10. Set the timer to give the required exposure.

11. Open the shutter, start the timer and allow the beam to irradiate the samples or photograph.

12. After the irradiation is completed, turn off the X-ray generator or electron microscope and open the circuit breakers.

III. C. (Continued)
13. Remove the high voltage interlock key.

14. Records should be kept of each operation of the X-ray machine or electron microscope. The records should indicate the date of operation, time, voltage, filter, shield or shutter arrangement, and should be initialed by the operator using the instrument.

15. The Radiation Safety Officer will be notified whenever the shielding or the location of X-ray generators is changed.

D. X-RAY DIFFRACTION UNITS

This section provides special requirements for analytical X-ray equipment. These requirements are in addition to and not in lieu of requirements in other parts of this manual.

A safety device which prevents the entry of any portion of an individual's body into a primary X-ray beam path or which causes the beam path to be shut off upon entry into its path will be provided on all open-beam configurations. A user may apply to the RSC for an exemption from the requirement of a safety device. Such application will include:

1. A description of the various safety devices that have been evaluated.

2. The reason that each of these devices cannot be used.

3. A description of the alternative methods that will be used to minimize the possibility of an accidental exposure, including procedures to assure that operators and others in the area will be informed of the absence of safety devices.

Open-beam configurations will be provided with a readily discernible warning device which will reveal the X-ray tube status (on-off) and shutter status (open-closed). Warning devices shall be labeled so that their purpose is easily identified and shall have fail safe characteristics. Unused ports will be secured in the closed position in a manner which will prevent casual opening.

All analytical X-ray equipment will be labeled with a readily discernible sign or signs bearing the radiation symbol and the words:

"CAUTION - HIGH INTENSITY X-RAY BEAM" or words having a similar intent, on the X-ray source housing, and,

"CAUTION RADIATION - THIS EQUIPMENT PRODUCES RADIATION WHEN ENERGIZED," or words having a similar intent, near any switch that energizes the X-ray tube.

Each port of any radiation device with open-beam configuration will be equipped with a shutter that cannot be opened unless a collimator or a coupling has been connected to the port.

III. D. (Continued)
An easily visible warning light labeled with the words "X-RAY ON" will be located near any switch that energizes the X-ray tube and will be illuminated only when the tube is energized. Warning lights will have fail-safe characteristics on new equipment installations.

Sufficient radiation surveys will be conducted on all analytical X-ray systems to show compliance with this manual and the TDH Regulations. Also, a radiation survey will be made after any change in operating configuration.

Each area or room containing analytical X-ray equipment will be posted with a sign bearing the radiation symbol and the words "CAUTION X-RAY EQUIPMENT" or words having a similar intent.

Only persons authorized by the principal user of an analytical X-ray device will be permitted to operate the equipment. A current list of authorized personnel will be maintained in each laboratory. No person will bypass a safety device without obtaining the approval of the RSO. When a safety device has been negated, an appropriate warning sign will be placed on the radiation source housing.

Finger dosimetry devices will be worn by workers using systems having an open-beam configuration and not equipped with a safety device.

E. LASERS

Procedures for the operation of lasers at The University of Texas at Arlington are described in general in Texas Regulations for Control of Laser Radiation Hazards, 25 TAC §289.301. A copy of specific instructions for laser control will be posted in each area where lasers are being used.

F. VIOLATIONS OF REGULATIONS

1. Technical Violations
   In the event of an alleged violation of the regulations as set forth in this manual, or those prescribed in the Texas Regulations for Control of Radiation, the person noting the alleged violation will immediately contact the Radiation Safety Officer. The RSO will contact the authorized user and discuss the alleged violation. Action taken by the Radiation Safety Officer will depend upon the seriousness of the violation and the authorized user's record. It is anticipated that most violations will be of a minor nature and not intentional. In these cases, the Radiation Safety Officer will clarify the policies for using radioactive materials or radiation-producing equipment and will explain the hazards associated with the violation.

III. F. (Continued)
2. **Serious Violations**

If the alleged violator fails to correct serious deficiencies, or shows a flagrant disregard for proper operating procedures, the Director of Environmental Health & Safety will recommend in writing to the Radiation Safety Committee that the user's authorization to use radiation-producing items be withdrawn. Copies of the letter covering the facts and circumstances, with recommendations will be provided to the President, Vice President for Academic Affairs, Vice President for Business Affairs, Dean of the College and Chairman of the Department. If the Environmental Health & Safety Office personnel determine that a significant radiation hazard to faculty, staff, students or the general public exists, they are authorized to secure the hazard area by means of signs, barriers, police guards or by changing door locks. If circumstances require an area to be isolated or secured, the key administrators mentioned in this paragraph will be notified by the most expeditious means.
IV. RADIATION-RADIOISOTOPE ACCOUNTABILITY

A. GENERAL

Before an authorization to use radiation-producing equipment or radioisotopes is issued, the user will make application using the format in the Appendix and submit it to the Radiation Safety Officer. The Radiation Safety Committee will review the intended user's plan for radiation safety considerations and authorize use or return the application for additional information.

The evaluation will include:

1. What equipment or materials are to be used.
2. The physical form of the isotope.
3. The total amounts of the isotopes that will be required at any one time.
4. How equipment or materials are to be used.
5. The duration of the use of equipment or materials.
6. Where the equipment or materials are to be used.
7. Who will use the equipment or materials.
8. Who will be responsible for proper use.
9. Where the material is to be stored.
10. What safety measures are needed to ensure that employees or students are not exposed to excessive radiation.
11. Where warning signs will be posted.
12. What emergency procedures will be taken if an accident should occur.
13. The type of personnel monitoring devices, if necessary.
14. Radiation survey and/or wipe survey procedures.

When all items meet approved safety standards, authorization to use the requested materials or equipment may be issued by the Radiation Safety Committee.

It is the responsibility of every employee or person using radiation-producing equipment or radioactive material to comply with the following regulations regarding the purchase of radioisotopes, irradiation service, or radiation-producing equipment on this campus. In no event is any employee authorized to purchase, receive or transfer radiation-producing materials, equipment or irradiation services except as authorized by the Radiation Safety Committee.
IV. A. (Continued)

All purchases and transfer requests will be routed to the University Environmental Health & Safety Office for approval and signature. All radioactive materials, radiation-producing equipment, and lasers must be reported to the Environmental Health & Safety Office no matter how they are procured.

B. PURCHASING

After obtaining an authorization, the following procedures will be observed in purchasing or otherwise procuring radioisotopes or sources of ionizing and non-ionizing radiation:

1. A departmental requisition shall be prepared indicating the radioisotopes or equipment to be purchased or procured. The activity of each radioisotope is required and the name of the authorized user purchasing the radioisotope must be included. For ionizing or non-ionizing radiation-producing equipment, include the type, the power output and the authorized user.

2. The departmental requisition including spot or emergency will be forwarded to the Environmental Health & Safety Office. The RSO will review it for compliance with the license and regulations. Appropriate records will be maintained by the RSO.

3. After RSO review and concurrence the requisition shall be forwarded to the Purchasing Office for processing or returned to the originator as appropriate.

C. SHIPPING

All shipments of radioactive materials from or by the University to outside agencies shall comply with the requirements of the appropriate regulating agencies. A file of applicable regulations is maintained in the University Environmental Health & Safety Office.

A Radioactive Waste Material Disposal Request will be completed for each shipment, and all shipments will be approved by the Radiation Safety Officer.

D. RECEIVING

The Radiation Safety Officer will be notified of all incoming shipments of radioactive materials. Authority for use of radioisotopes will automatically be transferred to The University of Texas Radioactive Materials License No. L00248 when the shipment is received.

Radioactive material shipments are received at the Environmental Health & Safety Building. The Radiation Safety Officer logs in the material, measures the surface dose rate, if applicable, and checks the package for external damage. The package is opened and a detailed survey is made including dose rate measurements and contamination checks when applicable. An Isotope Disposition Document is completed and delivered with the material to the user.
E. STORING AND POSTING

If radioisotopes are stored in a cabinet or refrigerator, there must be sufficient shielding around the radioisotopes such that the radiation level at the surface of the cabinet or refrigerator is less than 2.0 mR/hr. Posting of signs must be in compliance with Texas Regulations for Control of Radiation (TRCR), 25 TAC §289.202(z) - (dd). Adequate security must be provided as required in Texas Regulations for Control of Radiation, 25 TAC §289.202(y).

If there are any questions concerning the regulations involving purchase, shipping, receiving or storing and posting of warnings, users are instructed to contact the Radiation Safety Officer for information or clarification.
V. RADIATION INSTRUMENTATION

A. GENERAL

One laboratory is maintained and used by the Environmental Health & Safety Office of UTA in Room 101A in the Environmental Health and Safety Office Building.

Various types of survey instruments are used by the Radiation Safety Officer to provide additional monitoring in the event of a radiation emergency and for routine evaluations required by the Texas Regulations for Control of Radiation. A list of these instruments follows:

1. Ludlum Model 15 Ratemeter for the detection of x-, gamma-, and beta- radiation.
2. Personnel dosimeters for neutron, Beta-gamma, and X-ray exposure.
3. Ludlum Model 2200 Scaler/Ratemeter with 2 pi gas flow detector
5. Ludlum Model 2241-2 Scaler/Ratemeter for the detection of x-, gamma-, and beta- radiation

B. RADIATION SURVEY METERS

In addition to analytical radiation detection instrumentation, each Principal Investigator shall have available a proper survey meter. Radiation monitoring and survey instruments will be calibrated at intervals not exceeding one year, or more often in the event that the response of the instrument becomes suspect.

C. INSTRUMENT CALIBRATION METHODS

All radiation survey instruments at the University will be calibrated to read within ± 20% at the point of the reading for long readout meters not less than every 12 months. Calibrations will be made using an appropriate radiation source depending on the type of radiation the instrument is designed to detect. Calibrations will be performed by an Agency approved contractor.

The radiation detection instrument will be exposed to a known (calculated) radiation field. The meter reading of the instrument should be adjusted to within ± 20% of the calculated value. At least two radiation exposure values will be checked for each meter scale; preferably, these values should be approximately 25% and 75% of the full scale reading.
VI. REQUIRED TESTS AND RECORDS

A. GENERAL

The Texas Department of Health, Bureau of Radiation Control requires that certain tests be made and records maintained of the results of these tests. The requirements for radiation surveys and records of these surveys are covered under Texas Regulations for Control of Radiation, 25 TAC §289.202(p) and 25 TAC §289.202(nn)(2)(A). The requirements for personnel monitoring with film badges and/or Thermoluminescent Dosimeters (TLD) are covered in 25 TAC §289.202(q)(1). Posting requirements are described in 25 TAC §289.202(aa) and source storage in 25 TAC §289.202(yy). The requirements for waste disposal are covered in 25 TAC §289.202(ff)-(kk) and 25 TAC §289.202(tt). Texas Department of Health Radioactive Material License No. L00248 (The University of Texas at Arlington) defines the requirements for leak testing of sealed sources. Every professional employee who is authorized to use radioisotopes or radiation-producing machines will become familiar with these regulations and will see that they are followed by the personnel who work for the user.

B. LEAK TESTS

The Radiation Safety Officer is responsible for leak testing sealed radiation sources at the University. When leak tests are due, arrangements will be made with the Source Custodian for the RSO or the designated alternate to perform the test.

The following procedure will be followed in leak testing of sealed sources:

1. If the radiation source can be removed from the irradiation unit, wipe the surface of the source with a Whatman filter saturated with alcohol.

2. If the source cannot be removed from the unit, wipe around the irradiation port or source placement tube or other accessible part of the unit where contamination might collect.

3. Wear personnel dosimeter during testing operation.

4. Use long-handled tongs or suitable methods to limit exposure to hands and body when wiping over surface of source or source holder.

The Radiation Safety Officer will evaluate the wipe test by counting the test filter in a 2 Pi gas flow proportional counter which has been suitably calibrated to yield results in microcuries. The results will be kept in permanent records by the RSO.

C. INTERNAL INSPECTIONS

The Radiation Safety Officer or the designated alternate will make periodic inspections of the isotope usage, storage, and disposal records that are maintained in the user's laboratory to determine if the user is in compliance with University procedures and state/federal regulations. All laboratories and facilities where radioactive materials are used or stored will be surveyed periodically in order to detect any changes in radiation levels and to prevent the spread of radioactive contamination.

VI. C. (Continued)
The frequency of these surveys will be determined by the Radiation Safety Officer based on the quantity and isotopes in use. Records of these surveys will be maintained in the University Environmental Health & Safety Office.

D. RADIOACTIVE WASTE DISPOSAL

Records of all disposals will be kept and should include the following information:

1. Radioactive isotope
2. Activity in millicuries
3. Method of disposal
4. Date of disposal

At the end of each calendar quarter of a year, the disposal of each particular radioisotope will be itemized and reported on the Quarterly Inventory.

The gross quantity of radioisotopes released into the sanitary sewer of the University will not exceed the limits set forth in the Texas Regulations for Control of Radiation, 25 TAC §289.202(nn); therefore, a cumulative total is maintained by the Radiation Safety Officer to ensure that the limits are not exceeded.

E. INVENTORIES

Inventories of all radioisotopes purchased, used, stored, and disposed of will be made quarterly by each authorized user of radioisotopes. The Radiation Safety Officer will notify each authorized user at the time the inventory is due. A quarterly inventory document (Appendix) will be submitted to each authorized user of radioisotopes at the time the inventory is due. It is the responsibility of each authorized user to see that the form is properly completed and promptly returned. For good isotope accountability records, all columns on the Quarterly Inventory form must be completed.

F. PERSONNEL DOSIMETERS AND ANALYSES

A centralized personnel dosimeter service is available to authorized users of radioisotopes at the University. See Appendix for sample application.

The advantages of using a centralized personnel dosimetry service are as follows:

1. The University Environmental Health & Safety Office will periodically monitor the service to determine its reliability and accuracy.

2. A centralized file can be maintained for all film badge users on campus, thereby enabling the individual exposures to be monitored by the Radiation Safety Officer.

VI. F. (Continued)

3. Requests for exposure records by employees, such as at the termination of employment, are
furnished by the University Environmental Health & Safety Office.

Film badges and/or TLD's are to be worn by all University personnel who may be working in areas where the following conditions exist:

1. Adults likely to receive, in one year from sources external to the body, a dose in excess of 10 percent of the limits in Texas Regulations for Control of Radiation, 25 TAC §289.202(f)(1).

2. Minors and declared pregnant women likely to receive, in one year from sources external to the body, a dose in excess of 10 percent of any of the applicable limits in Texas Regulations for Control of Radiation, 25 TAC §289.202(l) or 25 TAC §289.202(m).

3. Individuals entering a high or very high radiation area.

G. AUTHORIZED PERSONNEL

Each supervisor of an area using radioisotopes or radiation-producing devices will maintain a current list of personnel authorized to handle radioisotopes or operate the radiation-producing devices. Prior to designating "Authorized Personnel," the supervisor should assure that each individual is properly trained and is familiar with this manual and the appropriate regulations. Copies of this manual or applicable regulations may be obtained from the Radiation Safety Officer.
VII. DISPOSAL OF RADIOACTIVE WASTE

A. GENERAL

Radioactive nuclides cannot be destroyed except by natural decay. As a result, the disposal of radioactive waste is strictly governed by federal and state regulations to prevent harm to human and ecological populations. To facilitate disposal in compliance with these regulations, the following requirements and procedures for disposal of various types of waste will be observed.

Radioactive waste is disposed of at UTA by four (4) methods. Each disposal method meets the requirements of the state and federal laws applicable to each case. These methods are as follows:

1) Disposal into sanitary sewer system
2) Shipment to designated commercial burial area
3) Release into the atmosphere
4) Incineration

B. SANITARY SEWER

Radioactive material will not be discharged into the sanitary sewer system of the University unless it is readily soluble or dispersible in water. The amount disposed of monthly into the sewer system cannot exceed the concentrations listed in Texas Regulations for Control of Radiation, 25 TAC §289.202(ggg)(2)(F), Table III. Short-lived radioisotopes will be held for decay before disposal into the sanitary sewer system. After dumping, flush sinks with large quantities of water for dilution.

C. BURIAL (OFF SITE)

Solid radioactive wastes and liquids which cannot be released to the sanitary sewer system or incinerated will be shipped to a designated commercial burial site. Each shipment shall be made in compliance with Texas Regulations for Control of Radiation, 25 TAC §289.202(jj).

The responsibility for the storage and ultimate disposal of laboratory wastes contaminated with radioactive materials is accepted by the Radiation Safety Committee to provide a service to the authorized users of radioactive materials and to provide single-point control of contamination. The agent for the Committee in execution of this responsibility is the Radiation Safety Officer. The Radiation Safety Officer will provide for the control and disposal of all radioactive wastes that are generated in using laboratories. For assistance in matters relating to waste disposal contact the Environmental Health & Safety Office at Extension 2185.

VII. C. (Continued)
The Principal Investigator is required to implement an effective Radioactive Waste Management Program within the laboratory. Specifically, the Principal Investigator shall:

1. Provide adequate and properly labeled receptacles for radioactive wastes.
2. Ensure that radioactive wastes are placed in their assigned receptacles, and are not disposed of as ordinary wastes.
3. Maintain written inventory records of the activity (in microcuries, or multiples thereof) of all contaminated wastes removed from the laboratory.

The following restrictions are stated in the Radiation Safety Manual concerning packaging of radioactive waste:

1. All such solid waste should be packaged in plastic bags in as compact a manner as possible. Preferably, 12" X 8" X 24" size polyethylene bags should be used. Larger sizes will tend to rip open because of the weight of the contents.
2. Liquid waste should be packaged in non-breakable containers or, if packaged in a breakable container, the secondary container should have a sufficient amount of absorbent to absorb all of the liquid in the event of primary container breakage.
3. Each package shall be sealed and labeled identifying each radioactive isotope with its estimated activity. Use radioactive caution labels.

D. RELEASE INTO THE ATMOSPHERE

The following restrictions will be observed when releasing radioactive gas or vapor into the atmosphere.

1. Disposal of radioactive gases will be made in a properly functioning laboratory fume hood.
2. The concentration of the gaseous waste will be diluted to values that are in compliance with the Texas Regulations for Control of Radiation, 25 TAC §289.202(ggg)(2)(F), Table II, prior to release to an unrestricted environment.

E. INCINERATION

1. The incinerator on the roof of the Life Science Building has been approved for incineration in accordance with Texas Regulations for Control of Radiation, 25 TAC §289.202(fff)(1)(B) of animal carcasses contaminated with Tritium or Carbon-14.
2. Radioactive animal carcasses will be placed in plastic bags and stored in freezers pending incineration.

VII. E. (Continued)
F. FACILITY DECONTAMINATION

It will be the responsibility of the authorized user to decontaminate any laboratory or facility which becomes contaminated. Also, upon vacating all premises where radioactive materials have been used, the authorized user will ensure that all residual radioactivity is properly removed and disposed of in accordance with the Texas Regulations for Control of Radiation and this manual. The RSO will survey the premises prior to subsequent use.

Please contact the Radiation Safety Officer if your waste disposal problem is not covered by any of the above mentioned alternatives.
VIII. EMERGENCY PROCEDURES

A. GENERAL

In the event of an emergency involving radiation, special precautions must be taken to protect personnel. Items to be considered for use include: coveralls, disposal gloves, disposal shoe covers, respirators, decontamination wash powder, dosimeters, survey instruments, radiation signs, tags, labels, tongs, plastic bags, air samplers, etc. Prompt notification of the Radiation Safety Officer can expedite the arrival of needed equipment at the scene. Some equipment may have to be obtained from off-campus agencies.

Immediate notification to the Texas Department of Health is required by telephone and telegraph, mail-gram, or facsimile, of any incident involving any source of radiation which may have caused or threatens to cause:

1. An individual to receive:
   (i) a total effective dose equivalent of 25 rems (0.25 sievert) or more;
   (ii) an eye dose equivalent of 75 rems (0.75 sievert) or more; or
   (iii) a shallow dose equivalent to the skin or extremities or a total organ dose equivalent exceeding 250 rads (2.5 grays) or more; or

2. The release of radioactive material, inside or outside of a restricted area, so that, had an individual been present for 24 hours, the individual could have received an intake in excess of five (5) times the occupational ALI. This provision does not apply to locations where personnel are not normally stationed during routine operations, such as hot-cells or process enclosures.

Twenty-four hour notification to the Texas Department of Health is required by telephone and telegraph, mail-gram, or facsimile, of any incident involving any source of radiation which may have caused or threatens to cause:

1. An individual to receive, in a period of 24 hours:
   (i) a total effective dose equivalent exceeding 5 rems (0.05 sievert);
   (ii) an eye dose equivalent exceeding 15 rems (0.15 sievert); or
   (iii) a shallow dose equivalent to the skin or extremities or a total organ dose equivalent exceeding 50 rems (0.5 sievert); or

2. The release of radioactive material, inside or outside of a restricted area, so that, had an individual been present for 24 hours, the individual could have received an intake in excess of one (1) occupational ALI. This provision does not apply to locations where personnel are not normally stationed during routine operations, such as hot-cells or process enclosures.

In the event of a radiation incident, the procedures outlined in the following section shall be followed immediately. A current notification list (p. 26) shall be posted in each area where radioisotopes are used.
B. RADIOISOTOPE ACCIDENT/INCIDENT

If a person is both injured and contaminated, a quick decision will have to be made as to the best possible course to follow. Possible choices are:

1. Notify the UTA Police Department, request medical assistance, and render preliminary treatment at the scene. Ask police to notify the Environmental Health & Safety Office.

2. When ambulance arrives, the medical team can provide any additional treatment required before transporting the patient to the hospital.

3. Transport students to the student Health Center if injuries are not too serious.

4. In determining the severity of the injury contamination, the following factors must be considered:
   a) External contamination is not immediately harmful to the patient unless his skin is badly punctured or wet.
   b) All but a very few of the most serious accident cases can be treated successfully by medical personnel at the scene.
   c) The contamination of the individual may be harmful to other people if it is spread to the ambulance and the emergency room.
   d) Instrument for evaluating contamination will not be available at the Student Health Center emergency room.

5. All cuts which penetrate the skin offer a point of easy access to the body for radioactive materials. Radioisotopes should not be allowed to contact a cut anywhere on the body. If a person is cut by a contaminated article, the wound should receive immediate treatment. It should first be cleansed very thoroughly with soap and water. Free bleeding should then be checked for contamination if a high energy beta or gamma emitter is known to be involved. Soft beta and gamma cannot be easily detected in a cut, particularly in the presence of water. All cuts involving possible contamination should be reported to the Radiation Safety Officer so that necessary steps can be taken immediately to evaluate the contamination.

C. X-RAY MACHINE OR ELECTRON MICROSCOPE ACCIDENT/INCIDENT

In the event that any person is suspected of being exposed to X-radiation in excess of the limits specified in Section VIII-A of this manual, the following steps should be taken:

1. Turn off the X-ray generator or electron microscope immediately.
2. Do not change voltage or current controls or alter the position of the tube head so that the conditions of irradiation may be duplicated to determine the extent of the radiation exposure.

3. Notify the Radiation Safety Officer of the incident.

4. Record the conditions which existed when the exposure occurred so that the Radiation Safety Officer can determine the extent of the exposure.

D. EMERGENCY NOTIFICATION

The Texas Department of Health's Radiation Control Branch has established a 24-HOUR RADIOLOGICAL EMERGENCY ASSISTANCE: telephone number: (512) 458-7460. This number will be used for emergency assistance reporting only.

For routine business matters call (512) 834-6688.

Additional assistance may be obtained if necessary by contacting:

University Environmental Health & Safety Office ............ 272-2185
University Police, Emergency Number ....................... 272-3003
Chief, University Police ....................................... 272-3381
Student Health Center ......................................... 272-2771
Arlington Fire Department ................................. 459-5500
Arlington Memorial Hospital .......................... 548-6100
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