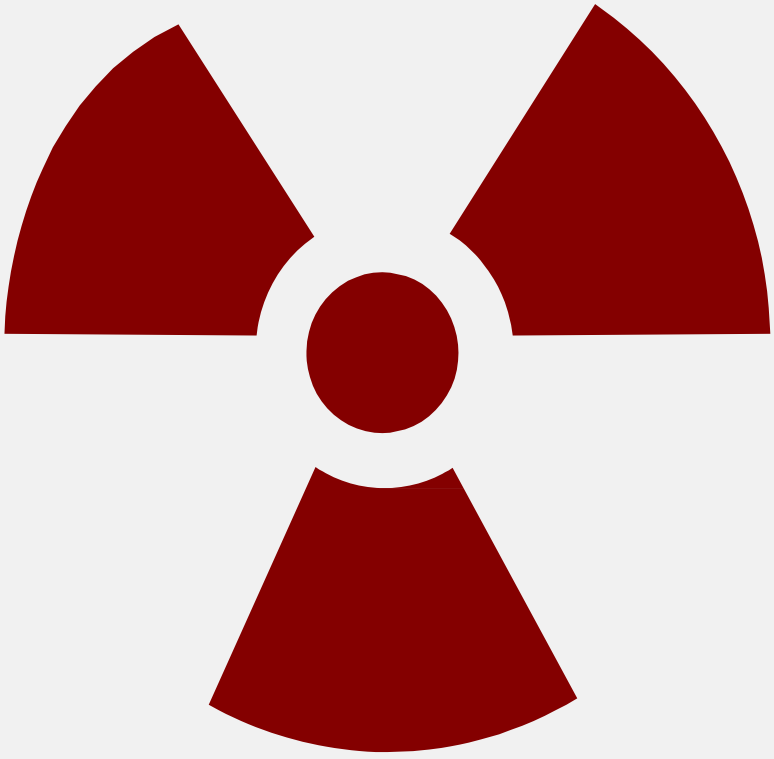
UNIVERSITY OF TEXAS ARLINGTON | ENVIRONMENTAL HEALTH & SAFETY

Radiation Safety Manual



THE UNIVERSITY OF TEXAS AT ARLINGTON

Radiation Safety Manual

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Forward

The objective of The University of Texas at Arlington (UTA) Radiation Safety Program is to assist all levels of management in fulfilling the UTA commitment to furnish a place of employment and learning that is as free as possible from recognized radiation hazards that cause, or are likely to cause, harm to UTA personnel or the surrounding community. Radiation Safety is the responsibility of all faculty, staff, and students who are involved in the use of radioactive materials, radiation-producing machines, or laser devices.

The use of radiation in a university setting, 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 public are essential.

The Environmental Health & Safety Office (EH&S) has the responsibility for establishing and pursuing an effective Radiation Safety Program for the University. The University is authorized by the State of Texas to use radioactive materials in research and education. This authorization is granted with the requirement that the University establish and pursue an effective Radiation Safety Program. It is the purpose of this manual to set out the guidelines of that program and to assist both personnel and management in complying with the objectives of the Texas Department of State Health Services (TDSHS), Radiation Control Program regulations.

All users of radioactive material must be familiar with the requirements set forth in this manual and applicable regulations of the TDSHS, Radiation Control Program and must conduct their operations accordingly.

Teik C. Lim, Ph.D.
President *ad interim*
The University of Texas at Arlington

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 (UT Arlington) and will consist of a minimum of seven (7) members. The President shall appoint to the committee, one (1) member from administration and minimum of five (5) members from the faculty of the College of Science and/or Engineering. The RSO will be appointed from the Environmental Health & Safety (EH&S) Office. A faculty member will be appointed as chair. Four (4) members shall constitute a quorum.

B. Responsibilities of the Radiation Safety Officer

The RSO 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 radioactive material at UT Arlington. The RSO will be a staff member of the EH&S Office. The RSO will be a member of the RSC and will periodically provide that committee a comprehensive updated briefing on the status of the Radiation Safety Program.

The duties and responsibility of the RSO include, but are not limited to, the following:

1. To establish and oversee operating, safety, emergency, and ALARA procedures, and to review them at least annually to ensure that the procedures are current and conform with 25TAC§289.

2. To oversee and approve all phases of the training program for personnel so that appropriate and effective radiation protection practices are taught.

3. To ensure that required radiation surveys and leak tests are performed and documented in accordance with 25TAC§289, including any corrective measures when levels of radiation exceed established limits.

4. To ensure that individual monitoring devices are used properly by occupationally exposed personnel, that records are kept of the monitoring results, and that timely notifications are made in accordance with 25TAC§289.203.

5. To investigate and cause a report to be submitted to the TDSHS, Radiation Control Program for each known or suspected case of radiation exposure to an individual or radiation level detected in excess of limits established by 25TAC§289 and each theft or loss of source(s) of radiation, to determine the cause(s), and to take steps to prevent a recurrence.

6. To investigate and cause a report to be submitted to the TDSHS, Radiation Control Program for each known or suspected case of release of radioactive material to the environment in excess of limits established by 25TAC§289.

7. To have a thorough knowledge of the University's management policies and administrative procedures.

8. To assume control and have the authority to institute corrective actions, including shutdown of operations when necessary in emergency situations or unsafe conditions.

9. To ensure that records are maintained as required by 25TAC§289.

10. To ensure the proper storing, labeling, transport, use and disposal of sources of radiation, storage, and/or transport containers.

11. To ensure that inventories are performed in accordance with the activities authorized by the University's Radioactive Material License.

12. To perform a physical inventory of the radioactive sealed sources authorized for use on the license every six months and make and maintain records of the inventory of the radioactive sealed sources authorized for use on the license every six months per the requirements of 25TAC§289.252(f).

13. To ensure that personnel are complying with 25TAC§289, the conditions of the University's Radioactive Material License, and the University's operating, safety, and emergency procedures.

14. To serve as the primary contact with the TDSHS, Radiation Control Program.

C. Responsibilities of the Radiation Safety Committee

The duties and responsibilities of the RSC include, but are not limited to the following:

1. Reviewing summaries of the following information presented by the RSO:
    - over-exposures;
    - significant incidents, including spills, contamination, or medical events; and
    - items of non-compliance following an inspection;

2. Reviewing the program for maintaining doses as low as reasonably achievable (ALARA), and providing any necessary recommendations to ensure doses are ALARA.

3. Reviewing the overall compliance status for sublicensees.

4. Sharing responsibility with the RSO to conduct periodic audits of the radiation safety program.

5. Reviewing the audit of the radiation safety program and acting upon the findings.

6. Developing criteria to evaluate training and experience of new sublicense applicants.

7. Evaluating and approving sublicense applicants who request authorization to use radioactive material at the University.

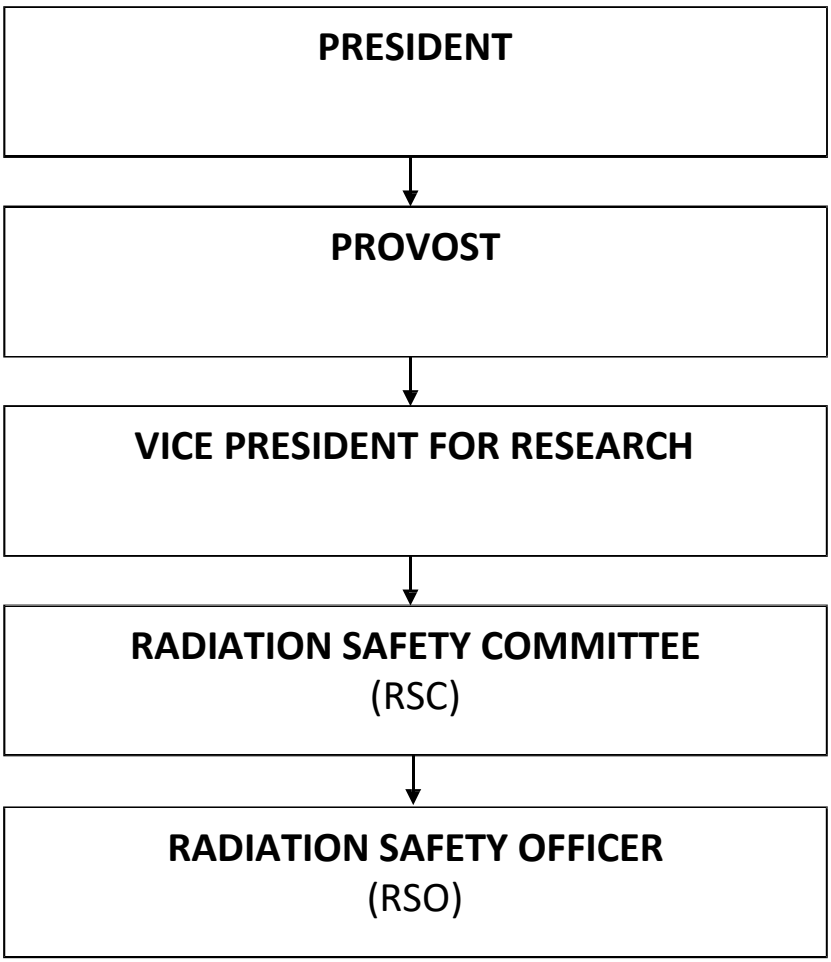
8. Evaluating new uses of radioactive material.

9. Reviewing and approving permitted program and procedural changes prior to implementation.

10. Suspending any radioactive material operations that they deem unsafe.

11. Meeting as often as necessary to conduct business at the call of the chairperson, but no less than three times per year.

D. Line of Radiation Authority and Responsibility



II. Radiation Facilities

A. Radionuclides

The use of radionuclides is authorized by the TDSHS, Radiation Control Program License Number L00248 issued to The University of Texas at Arlington. This broadscope license covers possession of any radioactive material with atomic number less than 84 in amounts up to 5 millicuries of each nuclide, 250 millicuries total. Certain radionuclides are permitted in quantities greater than the above amounts on a line item basis. The use of these radionuclides is authorized in certain buildings on campus, which are specifically listed on the license. Individual laboratory facilities at UT Arlington must be reviewed by the RSO and subsequently approved by the RSC before being commissioned for the use of radioactive materials. A copy of the University's radioactive material license is available for inspection in the University's EH&S Office.

III. Operational Radiation Safety Procedures

A. General

Each person authorized to use radionuclides is responsible for the safe use of such materials. The user must carry out the required administrative and safety procedures, select those laboratory practices which are applicable to the work being performed, train and supervise those assisting, acquaint them with proper radiation safety practices, and see that the laboratory is properly posted with signs as required by the TRCR. The user shall immediately notify the University's EH&S Office if any unexpected difficulties arise that might affect the safety of personnel.

The maximum permissible level for unrestricted areas and maximum permissible dose for individuals as stated in the TRCR are to be considered as maxima and every effort is to be made to conduct experiments and operations at levels that are **as low as reasonably achievable** (ALARA).

B. Radioactive Materials

In order to maintain compliance with the TRCR, 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 radionuclides 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. Radiation dosimeters shall be worn by all personnel who enter a radioactive area in accordance with TRCR, 25TAC§289.202(q). Radiation exposure data shall be recorded in permanent records and maintained by the RSO.

4. Radiation dosimeters should be worn at chest or waist level and stored in a designated low background area. Control badges should also be stored in a low background area.

5. TLD ring dosimeters shall be worn when handling millicurie amounts of radioactivity.

6. Radioactive waste shall be disposed of in specially labeled and properly shielded containers.

7. Transport of radioactive materials shall be done in shielded containers when necessary to protect against external radiation exposure.

8. Work areas of the laboratory should be reserved exclusively for work with radioactive materials and isolated from other work areas as much as is practical.

9. Working areas shall be monitored by the user after each use of radioactive materials, except sealed sources, to determine radiation levels and presence of contamination, if any. Results should be recorded in the user's laboratory survey book.

10. Radiation survey instruments shall be checked prior to each use to ensure they are in proper operating order.

11. Minor spills shall be cleaned up immediately. If a major spill occurs, no attempt should be made to decontaminate. The area should be isolated and the RSO notified immediately. Refer to Radiation Emergency Procedures (see Appendix).

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

13. Smoking, drinking, eating, or the application of cosmetics shall not be allowed in the same room where sources of radioactive materials are used.

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

15. Mouth pipetting of liquid radionuclides is forbidden. A rubber bulb or similar device should be used.

16. Radiation detection instruments shall be used in radioactive material use areas when applicable. The radiation-detecting instrument shall be compatible with the particular type of radiation work being done in the area.

17. Long-handled tongs, gloves, lab coats, 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 RSO for assistance.

18. Gloves and lab coats shall be worn by all employees when working with liquid radioactive materials.

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

20. Control of access into restricted areas is the responsibility of the Principal Investigator (PI) supervising the project.

21. Radiation detection instruments such as ionization chambers, proportional counters, and Geiger counters, which are used for general radiation surveys, shall be calibrated at intervals not to exceed one year. Each instrument shall be calibrated to read at an accuracy within 20% of the true radiation level. Calibrations shall be made by a contractor approved by the TDSHS, Radiation Control Program.

22. Radionuclides producing a radiation dose level in excess of 1.0 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 1.0 mR/hr or less at a distance of 1 foot from the surface of the container.

23. All unsealed sources or radioactive liquids should be stored in unbreakable, leak-proof containers.

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

25. Work with volatile radionuclides should be conducted in an approved chemical fume hood.

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

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

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

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

30. Signs or labels shall be used to identify sinks used for radionuclide activity. Only designated sinks shall be used for washing contaminated glassware.

31. Only designated storage boxes, freezers, and refrigerators shall be used for the storage of radionuclides. No food shall be placed in any freezers or refrigerators used for this purpose.

32. All radionuclide storage containers will be labeled in accordance with TDSHS, Radiation Control Program regulations with the following information:
    a.) Radionuclide
    b.) Activity and reference date
    c.) Name of PI
    d.) Caution - Radioactive Material (with radiation symbol)

33. All radionuclide storage areas will be locked when an authorized user (AU) is not in attendance.

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

35. In case of suspected or known overexposure to an employee, the RSO shall be contacted immediately. A written report will be made in each case of overexposure by the individual exposed and the PI supervising the use of the radiation on the particular project. This report will explain fully why the individual involved was subjected to an excessive amount of radiation, and will recommend measures to be taken to avoid a recurrence of the accident.

36. Records of the radiation exposure of all personnel using radiation sources at the University will be kept by the RSO. Reports of exposure history will be sent to appropriate personnel upon termination and upon request.

37. Safety glasses, optical glasses, or goggles will be worn when the activity of hard beta-emitting radionuclides (i.e., P-32) being used exceeds 10.0 microcuries.

38. Any proposed changes in a PI's sublicense will be submitted in writing to the RSC for approval.

39. The RSO will be notified before radioactive materials are transferred from one PI to another. No transfers will be made to unauthorized personnel.

40. The EH&S Office Radiation Safety Personnel shall be contacted for disposal of all liquid and solid radioactive waste.

41. Copies of the 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 so that all employees entering the area may read the bulletin. Copies of this bulletin are available from the RSO.

42. Every employee using radionuclides will be familiar with the appropriate regulations of the University's Radiation Safety Manual and of the TRCR. Copies of all regulatory documents are available upon request from the RSO.

43. Each PI will maintain a current list of personnel who are authorized to handle radioactive materials.

C. Violations of Policies and Regulations

Technical Violations

In the event of an alleged violation of the regulations as set forth in this manual, or those prescribed in the TRCR, the person noting the alleged violation will immediately contact the RSO. The RSO will contact the PI and discuss the alleged violation. Action taken by the RSO will depend upon the seriousness of the violation and the PI's record. It is anticipated that most violations will be of a minor nature and not intentional. In these cases, the RSO will clarify the policies for using radioactive material and will explain the hazards associated with the violation.

Serious Violations

If the alleged violator fails to correct serious deficiencies, or shows a flagrant disregard for proper operating procedures, the RSO will recommend in writing to the RSC that the PI's authorization to use radioactive material be withdrawn. Copies of the letter covering the facts and circumstances, with recommendations will be provided to the Provost, Vice President for Research, Vice President for Administration and Campus Operations, Dean of the College, Chairman of the Department, and Director of EH&S. If EH&S Office personnel determine that a significant radiation hazard to faculty, staff, students or the 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. Radioactive Material Accountability

A. General

Before a sublicense to use radioactive material is issued, the PI will submit an Application for Use of Radionuclides (see Appendix) to the RSO. After review and recommendations, the RSO will present the application to the RSC for their consideration. The RSC will review the application for radiation safety considerations and issue the sublicense or return the application with a request for additional information.

The sublicense application will include:

- The radioactive materials to be used.
- The physical form of the nuclides.
- The total amount of each nuclide that will be required at any one time.
- The maximum possession limit of each nuclide that will be required.
- A detailed description of how materials are to be used.
- The duration of the use of materials.
- Location where the materials are to be used.
- Names and training information of individuals who will use the materials.
- Person responsible for proper use of the material.

- A detailed description of the training and experience of the applicant.
- Radioactive material storage locations.
- Safety measures to ensure that employees or students are not exposed to excessive radiation.
- Locations of posted warning signs.
- Emergency procedures that will be taken if an accident should occur.
- Personnel monitoring requirements.
- Radiation survey and/or wipe survey procedures.
- Special equipment (fume hoods, sinks, storage facilities, etc.) requirements for the project.
- Radiation detection equipment to be used.
- Waste disposal procedures to be followed.
- Security measures to be taken.

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

B. Purchasing

It is the responsibility of every employee or person using radioactive material to comply with the policies in this manual regarding the purchase of radionuclides on this campus. In no event is any employee authorized to purchase, receive, or transfer radioactive materials except as authorized by the RSC. All purchases and transfer requests must be routed to the University EH&S Office for approval. All radioactive materials must be reported to the EH&S Office no matter how they are procured.

Prior to purchasing radioactive material, the PI must submit a Radioactive Material Requisition Form (see Appendix) to the RSO for approval. Upon approval, the RSO will notify the PI of the authorization number to be furnished to the vendor when ordering. The following procedures will be observed in purchasing or otherwise procuring radionuclides.

1. A purchase order must be obtained prior to purchasing radioactive material. Under no circumstance are procurement cards to be used to purchase radioactive materials.

2. The Radioactive Material Requisition Form will be forwarded to the RSO in the EH&S Office. The RSO will review it for compliance with the University's Radioactive Material License, the PI's sublicense, and applicable regulations. Appropriate records will be maintained by the RSO.

3. All radioactive material packages must be shipped directly to the EH&S Office.

C. Shipping

All shipments, packaging, and transportation of radioactive materials from or by the University to outside agencies shall comply with the requirements of 25TAC§289.257, the Department of Transportation, and all other applicable state and federal regulations.

The University of Texas System maintains a radioactive waste services contract to provide the University with low-level radioactive waste transportation and disposal services. All radioactive waste shipments are scheduled and administered by the RSO.

D. Receiving

The RSO will be notified of all incoming shipments of radioactive materials. Authority for use of radioactive material will automatically be transferred to The University of Texas at Arlington's Radioactive Materials License No. L00248 when the shipment is received.

Radioactive material shipments are received at the EH&S Building. The RSO or their designee 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. For liquid materials, a Radioactive Material Use Log (see Appendix) is completed and delivered with the material to the user.

E. Storing and Posting

If radioactive materials are stored in a cabinet or refrigerator, there must be sufficient shielding around the material 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 TRCR, 25TAC§289.202(z)-(dd). Adequate security must be provided as required in TRCR, 25TAC§289.202(y).

If there are any questions concerning the regulations involving purchase, shipping, receiving or storing and posting of warnings, contact the RSO for information or clarification.

F. Laboratory Commissioning

Laboratory facilities at UT Arlington must be reviewed by the RSO and subsequently approved by the RSC before being commissioned for the use of radioactive materials. The commissioning of radioactive material laboratories is done in conjunction with the sub-licensee's application or amendment review process. Nuclides, quantities, protocols, and frequency of radioactive material use, as indicated in the sub-licensee's Application for Use of Radionuclides (see Appendix) will be considered in the commissioning process.

The following items will be evaluated during the commissioning process:

1. Work areas of the laboratory should be reserved exclusively for work with radioactive materials and isolated from other work areas as much as is practical.

2. Laboratory work surfaces and floors shall be smooth and nonporous to facilitate decontamination.

3. Necessary laboratory equipment (i.e., fume hoods, sinks, etc.) must be available and in working order.

4. Adequate shielding must be available.

5. Appropriate radiation survey equipment must be available.

6. Suitable radioactive material storage space must be available.

7. Adequate radioactive waste storage must be available.

8. Security should provide for unauthorized removal of material and unauthorized entry.

9. The laboratory shall be posted with the appropriate notices, warning signs/labels, and emergency contact information.

G. Facility Contamination

It is the PI's responsibility to decontaminate any laboratory or facility under their control that becomes contaminated. In addition, upon vacating all premises where radioactive materials have been used, the PI will ensure that all residual radioactivity is properly removed and disposed of in accordance with the TRCR and this manual. The RSO will survey the premises prior to subsequent use.

H. Laboratory Decommissioning

Decommissioning refers to the complete removal of radioactive material and/or contamination from a room previously designated as a radioactive materials laboratory. Radiation safety personnel must decommission laboratories and determine that these areas are free of radioactive contamination prior to their use as general (non-radioactive) laboratory space. The procedures for laboratory decommissioning are as follows:

1. The PI shall notify the RSO in writing at least thirty days prior to vacating the laboratory. This correspondence shall include the following information:

    - Building and room number to be vacated.
    - Date the laboratory will be vacated.
    - Signature of the PI.

2. All radioactive material and/or waste will be removed by EH&S radiation safety personnel.

3. A final record of radioactive material disposition will be made and maintained on file.

4. A thorough survey of the laboratory will be conducted by EH&S radiation safety personnel to verify compliance with removable contamination levels as defined in 25TAC§289.202. Results of this survey shall be maintained on file. Areas and/or items surveyed shall include:

    - Radioactive material storage and use areas.
    - Laboratory sinks and fume hoods.
    - Equipment used in the handling of radioactive materials.

5. If contamination is detected, remedial actions and results shall be documented on the radiation survey form.

6. All radioactive material postings, signs and/or labels will be removed by EH&S radiation safety personnel.

7. The RSO shall give final approval for the room release.

8. If possible, the PI will be notified that the laboratory decommissioning is complete.

V. Radiation Instrumentation

A. General

Various types of radiation survey instruments are maintained by the RSO to provide monitoring in the event of a radiation emergency and for routine evaluations required by the TRCR.

B. Radiation Survey Meters

In addition to analytical radiation detection instrumentation, each PI shall purchase and have available an appropriate radiation 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 or the instrument is repaired.

C. Instrument Calibration Methods

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 a contractor approved by the TDSHS, Radiation Control Program. Each instrument shall be calibrated to read at an accuracy within 20% of the true radiation level.

VI. Required Tests and Records

A. General

The TDSHS, Radiation Control Program 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 TRCR, 25TAC§289.202(p) and 25TAC§289.202(nn). The requirements for radiation personnel monitoring is covered in 25TAC§289.202(q). Posting requirements are described in 25TAC§289.202(aa) and source storage in 25TAC§289.202(y). The requirements for waste disposal are covered in 25TAC§289.202(ff)-(kk) and 25TAC§289.202(tt). Every PI who is authorized to use radionuclides will become familiar with these regulations and will see that they are followed by their AUs.

B. Leak Tests

Sealed radiation source leak test analyses will be performed in accordance with the 25 TAC 289.201 (g). The analysis will be performed in-house by, or under the direct supervision, of the RSO. If, for any reason, leak tests cannot be performed in-house a third party service provider approved by the TDSHS, Radiation Control Program will be contracted by the University to provide the analysis of the leak tests.

A leak test is a check performed on a sealed source of radioactive material to ensure the effectiveness of its encapsulation. The leak test consists of wiping, with an absorbent material, the sealed source or from the surfaces of the container in which the sealed source is stored or mounted and at the nearest accessible point to the sealed source where contamination might accumulate. For a sealed source contained in a device, test samples are obtained when the source is in the "off" position. A count is performed on the wipe to check for any removable radioactive contamination.

The following criteria, in accordance with 25 TAC §289.201(g), shall be applied to perform leak tests on the required sources.

- Each sealed source received shall be leak tested prior to initial use unless it has received a certification from the transferor that the sealed source was tested within the past six months.

- Leak tests of radioactive sources shall be performed at intervals not to exceed six months for sources of beta or photon-emitters, unless otherwise exempted by 25 TAC §289.201(g)(2).

- Leak tests of radioactive sources shall be performed at intervals not to exceed three months for sources of alpha emitters, unless otherwise exempted by 25 TAC §289.201(g)(2).

- Leak tests will be performed any time there is reason to suspect that the sealed source may have been damaged or may be leaking. In this case, a sealed source will be tested for leakage or contamination before further use.

- Sources that are stored, not being used and identified as in storage will not be required to have periodic leak tests until such time as they are returned to use.

- Sealed sources that decay to activities below those exempted by 25 TAC §289.201(g)(2)(C) will not require leak testing.

- All conditions of 25 TAC §289.201(g) shall be met for sources not specifically listed in this section.

Leaking or contaminated sealed sources will be reported to the TDSHS, Radiation Control Program in accordance with 25 TAC §289.201(g)(7).

C. Internal Inspections

Radiation Safety Personnel perform Quarterly Radiation Safety Evaluations in all radioactive material laboratories to determine if the PI is maintaining compliance with their sublicense conditions, University policy and federal, state, and local regulations.

All laboratories and facilities where radioactive material is used or stored will be surveyed at least monthly by Radiation Safety Personnel in order to detect any changes in radiation levels and to prevent the spread of radioactive contamination. Records of these surveys will be maintained in the EH&S Office. Additionally, each PI will routinely perform laboratory surveys at intervals dictated by the quantity and radionuclides in use.

D. Radioactive Waste Disposal

All radioactive wastes resulting from the use of radioactive material in UT Arlington laboratories are disposed of in such a way as to prevent the occurrence of a hazard to the health of personnel, to the value of property, or to the welfare of the community.

Each PI is required to implement an effective radioactive waste management program within their laboratory. Specifically, the PI shall:

1. Utilize 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 radioactive wastes in the laboratory.

All radionuclide storage containers shall be labeled in accordance with 25TAC§289.202(cc) with the following information:

a.) Radionuclides
b.) Activity and date
c.) Name of PI
d.) "Caution - Radioactive Material" (with radiation symbol)

The EH&S Office shall be contacted for the disposal of all radioactive waste.

E. Inventories

Inventories of all radioactive materials purchased, used, stored, and disposed of will be made quarterly by each PI. The RSO will notify each PI at the time the inventory is due. A Quarterly Inventory form will be submitted to each PI of radioactive materials at the time the inventory is due. It is the responsibility of each PI to see that the form is properly completed and promptly returned.

F. Personnel Dosimeters

The EH&S Office provides personnel dosimeters, as required, to the users of radioactive material at the University. If required, users should complete the Request for Radiation Dosimeter form (see Appendix) and forward to the RSO.

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

- The EH&S Office may periodically monitor the service to determine its reliability and accuracy.
- A centralized file can be maintained for all dosimeter users on campus, thereby enabling the individual exposures to be monitored by the RSO.
- Requests for exposure records by employees, such as at the termination of employment, are furnished by the EH&S Office.

Personnel dosimeters are exchanged and processed each calendar quarter. Records of the dose received during the quarter, year-to-date, and a total accumulated dose for each individual are maintained by the RSO.

At a minimum, individual radiation dosimeters shall be worn by:

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 TRCR, 25TAC§289.202(f)(1).

2. Minors likely to receive, in one year from sources of radiation external to the body, a deep dose equivalent in excess of 0.1 rem, a lens dose equivalent in excess of 0.15 rem, or a shallow dose equivalent to the skin or to the extremities in excess of 0.5 rem.

3. Declared pregnant women likely to receive during the entire pregnancy, from sources of radiation external to the body, a deep dose equivalent in excess of 0.1 rem.

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

To assist in determining the likelihood of individuals exceeding the above-described dosages, the University has established more detailed dosimetry guidelines. These guidelines are described in the Dosimetry Policy for Radioactive Material Laboratories (see Appendix). These guidelines were established to assist radioactive material users in determining if a radiation dosimeter is required. These guidelines were derived from examining University historical dosimetry records and radionuclide usage information. Additionally, care was taken to ensure that the guidelines were in line with accepted established practices at universities comparable to UT Arlington. When required, individual monitoring devices will be worn and used in accordance with the requirements listed in 25 TAC §289.202(r).

In accordance with 25 TAC §289.202(f)(1) the annual occupational dose to individual adults will be limited to the following:

1. The total effective dose equivalent being equal to 5 rems.

2. The sum of the deep dose equivalent and the committed dose equivalent to any individual organ or tissue other than the lens of the eye being equal to 50 rems.

3. An eye dose equivalent of 15 rems.

4. A shallow dose equivalent of 50 rems to the skin of the whole body or to any extremity.

The annual occupational dose limits for minors are 10% of the annual occupational dose limits specified for adult workers in above.

G. Pregnant Radiation Worker

A special situation arises when a radiation worker becomes pregnant. Under these conditions, radiation exposure could also involve exposure to the embryo/fetus. A radiation worker who is pregnant may voluntarily "declare" their pregnancy in writing, but is not required to do so. The maximum permissible exposure for the embryo/fetus of a declared pregnant worker during the entire pregnancy is 500 mrem. Declared pregnant workers may be assigned two radiation dosimeters, one for the whole body, normally worn on the torso and one for the embryo/fetus, normally worn on the abdomen. The Pregnancy Declaration form may be obtained from the RSO. It must be completed and returned to the RSO to initiate the necessary actions. An individual may revoke their declaration of pregnancy at any time. This must also be done in writing. Should a radiation worker choose not to declare their pregnancy the usual occupational radiation exposure limits specified in 25TAC§289.202(f)(1) will apply.

H. Authorized Users and Training

Each PI overseeing the use of radioactive materials will maintain a current list of personnel authorized to handle radionuclides. Prior to designating an AU, the PI shall ensure that the individual has completed required training and is familiar with this manual and the appropriate regulations. Copies of this manual and/or applicable regulations can be obtained from the RSO.

The UT Arlington Radiation Training Policy is as follows:

1. All persons that use radioactive materials at UT Arlington, unless otherwise exempted, will be required to complete UT Arlington's Radioactive Material User Training.

2. AUs will be required to have this training before being approved to work with radioactive materials in the laboratory.

3. Exemptions to training may be granted on an individual basis as follows:

    - Individuals who can document comparable training at another institution may be granted an exemption.
    - Individuals who have had comparable training, but have no documentation, may be granted an exemption upon passing an exam encompassing the type of material covered in the course.
    - Sub-licensees may be certified as exempt from the training, by virtue of the acceptance of their training and experience by the Radiation Safety Committee for Principal Investigator status.

4. The RSO will maintain the training records and implement the Radiation Safety Training.

5. PIs will be responsible for instructing the user regarding all task-specific methodology in the laboratory.

6. Individuals who work in areas where radioactive materials are used, but do not handle or use radioactive materials, or who use only generally licensed devices, are required to complete the online Radiation Awareness Training in lieu of the Radioactive Material User Training.

The PI 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 ensure that the laboratory is properly posted with "Radiation Caution" and "Notification to Employees" signs as required by Texas Regulations for Control of Radiation.

VII. Radioactive Waste Management and Disposal

A. General

All radioactive wastes resulting from the use of radioactive material in UT Arlington laboratories are disposed of in such a way as to prevent the occurrence of a hazard to the health of personnel, to the value of property, or to the welfare of the community.

Radiation Safety Personnel shall be contacted for disposal of all radioactive waste. The RSO provides for the control and disposal of all radioactive wastes that are generated in laboratories. Strategically located areas designed for the collection and storage of contaminated laboratory waste before its ultimate disposal are maintained by the EH&S Office.

Radioactive waste will be disposed of by methods in accordance with the requirements set forth in 25TAC§289.202(ff). The methods utilized at UT Arlington are as follows:

- Transfer to an authorized recipient
- Decay-in-storage (DIS)
- Discharge into sanitary sewer
- Incineration

For information regarding radioactive waste disposal methods or alternatives not covered in this manual please contact the RSO.

B. Transfer to an Authorized Recipient

Radioactive wastes which cannot be released to the sanitary sewer system, incinerated, or decayed-in-storage are transferred to an authorized recipient in accordance with 25TAC§289.202(ff)(1)(A). The University of Texas System maintains a radioactive waste services contract to provide the University with low-level radioactive waste transportation and disposal services. All radioactive waste shipments are coordinated and scheduled by the RSO.

C. Decay-In-Storage (DIS)

The University disposes of certain radioactive waste by means of Decay-in-storage (DIS). Only short-lived waste with a physical half-life of less than or equal to 120 days may be disposed of by DIS. Prior to disposal the contents of the waste container will be allowed to decay for at least ten (10) half-lives of the longest-lived radionuclide in the container. Disposal of all DIS material will be executed by radiation safety personnel to ensure that proper procedures are followed and that appropriate records are maintained.

D. Discharge into Sanitary Sewer

Radioactive material is not discharged into the sanitary sewer system unless it is readily soluble, or is readily dispersible biological material in water. The amount disposed into the sewer system will not exceed the limits set forth in 25TAC§289.202(gg)(1). Disposal of all liquids into the sanitary sewer will be executed by radiation safety personnel to ensure that proper records are maintained and that the above limits are not exceeded.

E. Incineration

Low concentrations of waste containing H^3, C^{14}, or I^{125} may be incinerated. All incineration of these materials will be in accordance with the types and limits set forth in 25 TAC §289.202(fff)(1). Disposal of all waste by incineration will be executed by radiation safety personnel to ensure that proper records are maintained and that the above limits are not exceeded.

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, disposable gloves, disposable shoe covers, decontamination wash powder, radiation dosimeters, survey instruments, radiation signs, tags, labels, tongs, plastic bags, etc. Prompt notification to the RSO can expedite the arrival of needed equipment at the scene.

In the event of a radiation accident, steps to be taken are outlined in the “Radiation Emergency Procedures” chart (see Appendix).

B. Notification Requirements

Requirements for the notification of incidents are located in 25TAC§289.202(xx). Requirements for reporting exposures, radiation levels, and concentrations of radioactive material exceeding the limits are located in 25TAC§289.202(yy).

Immediate notification to the TDSHS, Radiation Control Program is required of any incident involving any source of radiation, which may have caused or threatens to cause:

1. An individual to receive:
   a.) a total effective dose equivalent of 25 rems or more;
   b.) an eye dose equivalent of 75 rems or more; or
   c.) a shallow dose equivalent to the skin or extremities or a total organ dose equivalent exceeding 250 rads 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 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 TDSHS, Radiation Control Program is required 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:
   a.) a total effective dose equivalent exceeding 5 rems;
   b.) an eye dose equivalent exceeding 15 rems; or
   c.) a shallow dose equivalent to the skin or extremities or a total organ dose equivalent exceeding 50 rems; 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 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.

C. Radioactive Material Spills and Contamination

Radioactivity cannot be destroyed by chemical or physical means. Decontamination, therefore, must depend upon the removal of the radioactive material. Removal of contaminants falls into two general methods, physical or chemical removal. It can be further divided into the removal from personnel and from materials or areas.

Any area is considered contaminated if removable activity is at a level greater than those specified in 25TAC§202(ggg)(6). Every effort should be made to prevent the spread of contamination during decontamination. This can be accomplished by:

1. Work from the edges toward the center of a contaminated area or from the top toward the bottom of vertical objects.

2. Prevent the tracking of contamination to other areas. This requires a thorough knowledge of where the contamination lies and the use of proper protective clothing.

3. Be aware that all equipment used in the cleanup and all run-off solutions are potentially contaminated and should be handled accordingly.

4. The Laboratory Decontamination Chart (see Appendix) lists a few methods and agents for the decontamination of the specific materials.

D. Radioactive Material 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 UT Arlington Police Department, request medical assistance, and render preliminary treatment at the scene. Ask police to notify the EH&S Office.

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

3. Transport students to the UT Arlington 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 their 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.) An instrument for evaluating contamination will not be available at the UT Arlington Student Health Center.

5. All cuts that penetrate the skin offer a point of easy access to the body for radioactive materials. Radioactive material 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 emitters cannot be easily detected in a cut, particularly in the presence of water. All cuts involving possible contamination should be reported to the RSO so that necessary steps can be taken immediately to evaluate the contamination.

E. Emergency Numbers

The TDSHS, Radiation Control Program has established a 24-HOUR RADIOLOGICAL EMERGENCY ASSISTANCE telephone number is (512) 458-7460. This number is to be used for emergency assistance and reporting only. To reach the TDSHS, Radiation Control Program for routine business matters call (512) 834-6688.

Additional assistance may be obtained if necessary, by contacting:

Department or Agency	Phone Number
UT Arlington EH&S Office	817-272-2185
UT Arlington Radiation Safety Officer	817-296-0296
UT Arlington Police Department, Emergency	817-272-3003
UT Arlington Police Department, Non-Emergency	817-272-3381
UT Arlington Student Health Center	817-272-2771
Arlington Fire Department	817-459-5500
Arlington Memorial Hospital	817-548-6100

APPENDIX

Definition of Acronyms

ALARA	As Low As Reasonably Achievable
ALI	Annual Limit on Intake
AU	Authorized User
EH&S	Environmental Health & Safety
PI	Principal Investigator
RSC	Radiation Safety Committee
RSO	Radiation Safety Officer
TAC	Texas Administrative Code
TDSHS	Texas Department of State Health Services
TRCR	Texas Regulations for Control of Radiation
UT Arlington	The University of Texas at Arlington

APPLICATION FOR USE OF RADIONUCLIDES

INSTRUCTIONS: This form shall be completed and signed by the applicant. The applicant should obtain their Department Chair's signature, then forward to the Radiation Safety Officer at Box 19257. The Radiation Safety Officer will present the application for approval to the Radiation Safety Committee. This application must be approved by UTA's Radiation Safety Committee prior to initial use of radionuclides on campus.

FORM MUST BE TYPEWRITTEN

Check One: ☐ **New Applicant** ☐ **Renewal** ☐ **Amendment**

Amendment Type (if applicable) ☐ **Location** ☐ **Nuclide** ☐ **Other**

I. USERS

APPLICANT:		EMERGENCY PHONE:	
DEPARTMENT:		EXTENSION:	
APPOINTMENT:		EMAIL:	

a) Provide a detailed description of the training and experience of the applicant related to the use of radionuclides attach additional sheets if necessary):

b) Name of Person Responsible for proper use of material (if different than applicant):

c) Names of users (in addition to applicant) of radioactive materials:

Name	Training Completion Date	Name	Training Completion Date

II. DESCRIPTION OF PROJECT

a) Location (building, room number(s)) of project:

b) How much time do you anticipate the project will require (ongoing, months, years)?

c) What equipment (laboratories, hoods, sinks, storage facilities, etc.) is required for the project?

d) Provide a DETAILED description of the project (attach additional sheets if necessary.)

III. RADIOACTIVE MATERIAL USED

Radionuclide	Physical Form (i.e., Liquid, Sealed Source, etc.)	Maximum Possession Limit (uCi)	Maximum Quantity to be Used at any One Time (uCi)

IV. SAFETY MEASURES (attach additional sheets if necessary)

a) Where will the radioactive material be stored?

b) What safety measures will be provided to ensure employee/students are not exposed to excessive radiation?

c) Where will the radioactive material warning signs and/or labels be posted?

d) Will personnel dosimeters be needed? ☐ Yes ☐ No

e) What emergency procedures will be taken if an accident should occur?

f) Provide a detailed explanation of the waste disposal procedures to be followed:

g) Provide radiation survey/wipe survey procedures and frequency:

h) What radiation detection equipment will be used?

i) What security measures will be followed?

_____ _____

Applicant's Signature Date

_____ _____

Approved, Departmental Chair's Signature Date

_____ _____

Reviewed, Radiation Safety Officer Date

_____ _____

Approved, for Radiation Safety Committee Date

The University of Texas at Arlington
Radioactive Material Requisition Form

INSTRUCTIONS:

1. Prior to submitting a PO request to your department, complete and submit this form to the Radiation Safety Officer via email or fax to the Environmental Health & Safety Office (EH&S) at ext 2144. Procurement cards may not be used to purchase radioactive materials.
2. Once your request has been approved an authorization number will be sent to you via email.
3. Authorization numbers will be assigned within 24-hours after the request has been received in the EH&S Office. Please keep in mind EH&S office hours are M-F, 8 am – 5 pm.
4. You may then submit the PO request to your department and place the order with the vendor using the shipping instructions listed below.
5. Request that all shipments arrive before noon on the day of delivery.
6. All radioactive material packages must be shipped directly to the EH&S office to be checked for contamination. Use the following shipping address:

University of Texas at Arlington
Environmental Health & Safety Office
500 Summit Ave.
Arlington, TX 76019
ATTN: Radiation Safety Officer

Principal Investigator:		**Date:**	
Phone Number:		**Email Address:** **(to send authorization number)**	
Department:		**Building:**	
		Room Number:	
Radionuclide Requested:		**Activity(µCi):**	
Physical Form:		**Chemical Compound:**	
Vendor Name:		**Expected Delivery Date:**	

RSO USE ONLY

Is a current vendor's Radioactive Material License on file?
☐ **Yes** ☐ **No**

Is this request within the limits of UTA's Radioactive Material License (L00248)?
☐ **Yes** ☐ **No**

Is this request within the limits of the Principal Investigator's approved Sub-license?
☐ **Yes** ☐ **No**

Authorization Number:	**PO Number:**
RSO Signature:	**Date:**

Radioactive Material Use Log

Principal Investigator		**Radionuclide**	
Date Received		**Reference Date**	
Chemical Form		**Original Activity**	
Specific Activity		**Lot Number**	
Vendor		**PO Number**	

Date of Use	User Name	Protocol	Volume Removed (µl)	Activity Removed (µCi)	Volume Remaining (µl)	Activity Remaining (µCi)

Badge Number: _____
Series Code: _____
Date Issued: _____

Request for Radiation Dosimeter

The following information is necessary for initiation of Radiation Dosimeter Service. Complete all blanks; use N/A where not applicable.

Last Name:	First Name:	Middle Name:

UTA ID #:	Date of Birth:	Sex:	Position:
		☐ Male ☐ Female	☐ Faculty ☐ Staff ☐ Student ☐ Visitor

Employment Start Date:	Home Phone:	Other Phone (cell, beeper, etc.):	Email:

Campus Office Extension:	Campus Lab Extension:	Department:	Supervisor:

Local Address:

Street	State	Zip

Permanent Address (if different than above):

Street	State	Zip

I will be working with the following radioactive materials and/or radiation producing machines:

Isotopes	Maximum Activity	Building	Room Number

Type of Radiation Producing Machine	Building	Room Number

Within the past year I have worked at the following institution(s) where my radiation exposure was monitored: ☐ None

Name of Institution:		Name of Institution:	
Department:		Department:	
Street Address:		Street Address:	
City, State, Zip		City, State, Zip	
Employment Dates:	From To	Employment Dates:	From To

I authorize the release of all my radiation exposure data from the institutions listed above.

Signature _____ Date_____

RETURN THIS REQUEST THRU CAMPUS MAIL TO: Radiation Safety Officer
Environmental Health & Safety Office
Box 19257

You may be entitled to know what information The University of Texas at Arlington (UT Arlington) collects concerning you. You may review and have UT Arlington correct this information according to procedures set forth in UTS 139. The law is found in sections 552.021, 552.023 and 559.004 of the Texas Government Code.

Disclosure of your Social Security Number ("SSN") is required of you in order for the University of Texas at Arlington to comply with records management requirements as mandated by Texas Health and Safety Code Ch. 401; 25 Tex. Admin. Code section 289.231, 289.232; 30 Tex. Admin. Code section 336.352, 336.405 State law. Further disclosure of your SSN is governed by the Public Information Act (Chapter 552 of the Texas Government Code) and other applicable law.

I agree to inform of co-employment as a radiation worker while at UT Arlington as a radiation worker. If you are issued dosimetry, information will be furnished to the dosimetry vendor to provide lifetime tracking of dose and kept in a secure, confidential database, akin to a medical record. Information requested allows you to be unambiguously identified across institutions.

Internet Privacy Policy:
http://www.uta.edu/oit/policy/cs/web/internet_privacy.html

The University of Texas at Arlington
Dosimetry Policy for Radioactive Material Laboratories

The following table will be used to determine if radiation dosimeters will be issued to individuals that use or work in areas where radioactive material is used or stored.

Radiation Type	Energy	Examples	Maximum Activity per Experiment or Sealed Source as Approved on Sub-license	Maximum Cumulative Activity to be Possessed per Laboratory as Approved on Sub-license(s)
Whole Body Dosimeter				
Beta	< 1.0 MeV	H-3, C-14, P-33, S-35	Not Required	Not Required
Beta	> 1.0 MeV	P-32	2: 1.0 mCi	2: 20.0 mCi
Gamma	< 0.1 MeV	I-125	2: 5.0 mCi	
Gamma	> 0.1 MeV	Na-22, Co-60, Cs-137	2: 1.0 mCi	
Ring Dosimeter (direct handling)				
Beta	> 1.0 MeV	P-32	2: 1.0 mCi	N/A
Gamma	> 0.1 MeV	Na-22, Co-60, Cs-137	2: 1.0 mCi	

Additionally, radiation dosimeters will also be issued to the following:

- Minors working in a laboratory where high-energy beta or gamma emitters are used or stored. Minors are subject to more stringent dose limits and monitoring requirements per 25TAC§289.202.
- Declared pregnant women working in a laboratory where high-energy beta or gamma emitters are used or stored. Declared pregnant women (embryo/fetus) are subject to more stringent dose limits and monitoring requirements per 25TAC§289.202.
- Individuals entering a high or very high radiation area as defined in 25TAC§289.201.
- Individuals who request radiation dosimetry service that work in a laboratory in which gamma or energetic beta emitters are used, even if they do not meet the above criteria for required monitoring.
- Other individuals as deemed necessary and approved by the Radiation Safety Committee.

Individuals that have been issued whole body dosimeters are required to wear them at all times in radioactive material laboratories. More specifically, dosimeters must be worn when working with radioactive materials or while in an area where work is performed with radioactive materials, radioactive material storage areas, and/or waste storage areas.

If dosimeters are required in a laboratory per the table above, both users and non-users of radioactive material will be issued dosimeters.

In laboratories that require dosimeters the “Radioactive Material Visitor Log” may be utilized for short-term, infrequent visitors in lieu of dosimeters. However, a dosimeter will be available to any visitor upon request.

Implemented:
October 1, 2007

LABORATORY DECONTAMINATION CHART

Material or Surface	Decontamination Agent	Technique	Advantages	Disadvantages	Type of Action
Paint	Water	Work from high to low areas, spraying should be from upwind side of object.	Most practical method for gross decontamination. Contamination reduced by 50%.	Protection needed from contaminated spray. Runoff must be controlled.	Dissolving and erosive.
	Steam	Same as Water.	Most practical method of gross decontaminating large horizontal, vertical, and overhead surfaces as well as small parts. Reduces contamination by 90%.	Same as Water.	Same as Water.
	Soapless Detergents: Tide, etc.	Hot solution applied by standard wiping technique. Concentration should be sufficient to produce suds.	Reduces contamination to tolerance in one or two applications.	Mild Action.	Emulsifying action on greasy surface.
	Complexing Agents: 1. Oxalates 2. Carbonates 3. Citrates 4. Versenes	Solution should contain 3% (by weight) of agent. Keep damp by periodic spraying with solution, and then flush off with water.	Holds contamination in solution. Contamination reduced by 75%. Easily stored, nontoxic, and non-corrosive.	Requires application from 5 to 30 minutes for effectiveness. Has reduced or little penetrating power.	Forms soluble complexes with contaminated material.

Material or Surface	Decontamination Agent	Technique	Advantages	Disadvantages	Type of Action
Paint (continued)	Caustics: Sodium, Calcium or Potassium Hydroxide	Mixture should remain on surface for 2 hours, and then be removed with high-pressure water or steam. Remaining paint should be removed with scrapers. Final rinse should be with dilute acid rinse.	Minimum contact with contaminated surface. Almost 100% reduction obtained.	Applicable to horizontal surfaces only. Not to be used on aluminum or magnesium.	Paint remover.
	Organic Solvents: Industrial	Applied by standard wiping technique on large surfaces. Small objects may be immersed.	Quick dissolving action makes solvent useful on vertical and overhead surfaces.	Requires good ventilation and fire protection.	Grease and paint solvent.
	Abrasion. Wet Sandblast, Shotblast, Crushed shells.	Standard technique of abrasive action used.	Complete removal of surface and contamination.	Method too harsh for most surfaces.	Abrasion.
Metal	Water	Same as paint.	Same as paint.	Same as paint.	See paint.
	Steam	Same as paint.	Same as paint.	Same as paint.	See paint.
	Soapless Detergents	Same as paint.	Same as paint.	Same as paint.	See paint.
	Complexing Agents	Same as paint.	Same as paint.	Same as paint.	See paint.
	Abrasion, Wet	Same as paint.	Same as paint.	Same as paint.	See paint.

Material or Surface	Decontamination Agent	Technique	Advantages	Disadvantages	Type of Action
Metal (continued)	Abrasion, Dry	Grind off top surface.	Complete removal of surface.	Possible dust hazard.	Removal of paint.
	Inorganic Acids: Hydrochloric and Sulfuric	Allow acid solution (9-19% HCl or 3-6% H2SO4) to react on weathered surfaces for 1 hour. In closed systems, 2 to 4 hours. Acid should be neutralized with mild alkali and flushed with water.	Fast, complete decontamination.	Good ventilation required due to toxicity of acid fumes. Possibility of excessive corrosion. Acid mixture cannot be safely heated.	Dissolving power with respect to metals and porous deposits.
	Acid Mixtures	Apply by standard wipe technique.	Action of weak acid reduces contamination by repeated application.	Good ventilation required due to toxicity of acid fumes. Possibility of excessive corrosion acid mixture cannot be safely heated.	See paint.
	Organic Solvents	See paint.	See paint.	See paint.	See paint.
Asphalt	Steam	Same as paint.	Same as paint.	Same as paint.	See paint.
	Flame	Melt top surface and scrape off.	Complete removal of surface.	Possible fire hazard. Difficult to apply.	Melt surface.

Material or Surface	Decontamination Agent	Technique	Advantages	Disadvantages	Type of Action
Glassware, Tile	Soapless Detergents	See paint.	See paint.	See paint.	See paint.
	Reagents: (Mineral acids, trisodium, phosphates, etc.)	Rub surface with hot 10% solution. Do not allow solution to drip. Flush with water and dry with second rag.	Reduces contamination in one or two applications. Good method for overhead surfaces.	Hand application slow and laborious. Single reagent not suitable for all contaminants. Small repeated applications more effective than large volume application.	Grease and paint solvent.
Concrete, Brick	Acid Mixtures	Same as metal.	Same as metal.	Same as metal.	See metal.
	Abrasion, Wet	Same as paint.	Same as paint.	Same as paint.	See paint.
	Abrasion, Dry	Conventional methods. Protect personnel against dust hazards.	Complete removal of contamination.	Dust hazard. May impair utility.	Removal of surface.
Wood	Abrasion, Dry	Same as brick.	Same as brick.	Same as brick.	See brick.
	Flame	Char top surface and scrape off charred layer.	Complete removal of surface layer.	Possible breathing hazard during decontamination process.	Removal of surface.

RADIATION EMERGENCY PROCEDURES

TYPE OF EMERGENCY	HAZARD	IMMEDIATE PRECAUTIONS	FOLLOW-UP
Minor Spills (Usually small microcurie amounts)	Radiation: No immediate radiation hazard to personnel. Contamination: Low	(1) Notify all persons in room (2) Confine spill immediately (3) Notify Radiation Safety Officer (RSO) (4) Start cleanup immediately	Control traffic through area until cleared by RSO.
Major Spills (Usually millicurie amounts)	Radiation: May be great hazard to personnel. Contamination: Hazard to personnel and equipment	(1) Notify all personnel to vacate room or area. (2) Make no attempt to clean up spill. (3) Switch off all fans and vacate room or area. (4) Provide temporary barricade and warning signs. (5) Notify RSO. (6) Notify UT Arlington Police.	Decontamination of personnel and equipment (including spill) to be carried out by or under supervision of RSO.
Accidents involving –Dust –Mist –Fumes –Vapors –Gases	Radiation: Internal hazard due to possible ingestion. Contamination: Wounds usually greatest hazard.	(1) Notify others to vacate room or area. (2) Close windows and block off all air circulating intakes. (3) Provide temporary barrier and warning signs. (4) Notify RSO. (5) Notify UT Arlington Police.	Do not re-enter until approved by RSO.
Injuries Involving: –Radiation Hazard –Contamination	Contamination: Wounds usually greatest hazard.	(1) Wash wound immediately in running water (2) Notify physician. (3) Notify RSO. (4) Notify UT Arlington Police.	Permit no one involved in accident to return to work until approved by RSO and physician.
Fires Involving: –Radioactivity	Radiation: Internal hazard from airborne activity. Contamination: May be spread by fire fighting techniques.	(1) Notify all persons in room and building at once. (2) Attempt to extinguish fire if radiation hazard is not immediately present. (3) Notify Fire Department. (4) Notify UT Arlington Police. (5) Notify RSO.	Emergency activities will be governed by or in cooperation with RSO.