RADIATION SAFETY MANUAL

for

The University of Texas at Austin

March 28, 2005
August 14, 2006
April 18, 2007
June 25, 2009

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 machines.

In July 1963, the State of Texas granted The University of Texas at Austin a broad radioactive materials license for research, development and instruction. While this means a minimum of controls by the state, it requires that The University establish and pursue an effective Radiation Safety Program. The Radiation Safety Committee is responsible for The University's radiation control program outlined in this manual.

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 for the protection of The University and the safety of its faculty, staff and students.

It is the responsibility of all faculty, staff and students involved in radiation work to familiarize themselves thoroughly with The University's radiation control program and to comply with its requirements and all applicable federal and state regulations. I hope you will always keep in mind that radiation safety depends on a continuous awareness of potential hazards and on the acceptance of no short cuts toward the achievement of negligible radiation exposures.

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 State Health Services and replaces the "MANUAL OF RADIATION SAFETY" issued in April 2001, at The University of Texas at Austin. The revised Manual is dated March 28, 2005, and has an effective date of July 28, 2005.

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RADIATION SAFETY MANUAL

for

The University of Texas at Austin

I. ADMINISTRATION

A. RADIATION SAFETY COMMITTEE COMPOSITION

The Radiation Safety Committee of The University of Texas at Austin shall be composed of a Chair and at least six members. The Committee and Chair shall be appointed by the President of The University or the President's delegate. The Committee shall include at a minimum a representative from Executive Management with signature authority to commit University resources, a representative from the College of Engineering, a representative from the Department of Physics, a representative from the Nuclear Engineering Teaching Laboratory, and such other members as deemed appropriate. The Radiation Safety Officer shall be an ex-officio member of the Committee.

A.1 Quorum

Four members shall constitute a quorum, except a quorum may not be declared without the presence of the Chair or Vice-Chair, the representative from Executive Management or his/her delegate, and the Radiation Safety Officer.

A.2 Meeting Frequency

The Committee shall meet at a minimum of three times per calendar year on a called basis. The Committee may meet at other times on request of the Chairman, the representative from Executive Management, or the RSO.

B. COMMITTEE CHARTER

B.1 Charge

The Committee shall establish policies so:

a) That licensed radioactive materials are used safely. This includes review as necessary of training programs, equipment, facilities, supplies, and procedures;

b) That licensed radioactive materials are used in compliance with Title 25 Texas Administrative Code §289 (25 TAC §289) and the License issued to The University of Texas at Austin;

c) That the use of radioactive materials is consistent with the philosophy of ALARA;

d) As to establish a program to control individual occupational radiation exposures; and

e) As to identify program problems and implement solutions for any problems recognized.

B.2 Responsibilities

The Committee shall:

a) Retain expertise to be familiar with all pertinent regulations, the License, and amendments to the License;

b) Review the training and experience of proposed Authorized Users and the Radiation Safety Officer to determine qualifications in accordance with regulatory and License requirements;

c) Review on the basis of safety all requests for Authorization to Use radioactive materials within The University;

d) Prescribe any special conditions for authorizing uses of radioactive materials;

e) Review the RSO's report on exposures of all personnel, and, when necessary, require modifications to the operations of the Radiation Protection Program to decrease the levels of exposure;

f) Review the RSO's annual summary report of the Radiation Protection Program.

g) Recommend and cause to be implemented remedial action to correct deficiencies identified in the Radiation Protection Program;

h) Maintain written minutes of all Committee meetings, including members present, members absent, agenda items, discussions, actions, recommendations, decisions, and numerical results of all votes; and

i) Establish policies so that The University's Radiation Safety Manual and License are amended as required by 25 TAC §289.

C. MEMBERS

Proposed members of the Radiation Safety Committee shall be submitted to the Texas Department of State Health Services per License Condition 12.C. A list of the members appears as Appendix I-A to this Manual.

D. RADIATION SAFETY OFFICER

The Radiation Safety Officer is charged with implementing the University's Radiation Safety Program and directing the Radiation Safety staff. The incumbent is an Assistant Director within the Office of Environmental Health & Safety (EHS) and reports directly to the Director. The Director, EHS, reports indirectly to the Vice President for Employee and Campus Services through the Associate Vice President for Campus Safety and Security.

The Radiation Safety Officer has authority, delegated by the President through the Vice President for Research to the Radiation Safety Committee, to take such actions as needed to safeguard the public welfare with regard to radiation and radioactive materials.

II. FACILITIES AND EQUIPMENT

A. GENERAL

The University of Texas at Austin is required to possess licensure and registration for sources of radiation per the Title 25 Texas Administrative Code §289 (25 TAC 289) and its successor legislative acts and rules. All radioactive materials and radioisotopes must be controlled by licensure. The University has developed a Radiation Safety Program to ensure this control. This Manual addresses radioactive materials and radioisotopes.

B. RADIOACTIVE MATERIALS AND RADIOISOTOPES

The use of radioisotopes and sources of radiation (excluding special nuclear materials) is authorized by a Radioactive Materials License, # L00485, issued to The University of Texas at Austin by the Texas Department of State Health Services. This specific license with broad authorizations covers possession of any radioactive material with atomic number 3-83 inclusive in a maximum total amount specified by the terms of the License. Certain specific isotopes are covered in quantities greater than these amounts on an individual basis. Possession and use of radioactive materials with Atomic Numbers 84-105 inclusive are licensed in maximum amounts of any single isotope. A copy of the License is available for inspection in the offices of Radiation Safety and at the Environmental Health & Safety website. The License is granted to authorize use at the following sites:

SITE	LOCATION
000	Austin - Main Campus, The University of Texas at Austin
002	Port Aransas - Marine Science Institute
003	Austin - J.J. Pickle Research Campus

In addition, certain specific isotopes in limited quantities may be used at specifically designated locations throughout the State of Texas or in its waters without release to the environment.

C. CESIUM-137 IRRADIATOR

A 3600 Curie (original activity) Cesium-137 GAMMACELL 40 source is located in the Animal Resources Center. Each of the two 1800 Curie Cesium-137 sources is doubly encapsulated in stainless steel and is held in a source drawer. The drawers move in cylindrical tubes located within the steel encased biological shield. The system is designed to physically extend the source drawers, therefore removing the sources from the shield, when the specimen drawer is open. When the sources are extended, the source drawers engage slots in the specimen tray, which prevents the specimen tray from opening. The GAMMACELL 40 was designed to meet the needs of the medical and life science research and is self shielded for installation in a conventional laboratory.

III. OPERATIONAL PROCEDURES

A. GENERAL

An Authorized User of radioactive materials is a person who has been extended a sub-License, or Authorization, by The University of Texas at Austin to use radioactive materials/radioisotopes. Each employee who uses radioisotopes or sources of radiation is responsible for the safe use of such materials. The Authorized User shall:

1) Establish a local Radiation Safety Program,
2) Carry out the required administrative and safety procedures,
3) Select those laboratory practices which are applicable to the work,
4) Ensure proper training of employees and assistants,
5) Supervise all operations carried out under the Authorization,
6) Maintain a written record which documents the receipt, use, transfer, storage, and disposal of radioisotopes, and the radiation surveys conducted as part of the local Program,
7) Ensure the laboratory is properly posted with "Caution-Radioactive Materials" and "Notification to Employees" signs as required by 25 TAC §289, and
8) Immediately notify the Radiation Safety Officer if any unexpected difficulties arise which might affect the safety of personnel, procedural violations, health hazards, or danger to the community.

The Authorized User shall be provided a current copy of The University's Radioactive Materials License. All personnel shall be trained and acquainted with proper radiation safety practices and supervised to see that these practices are observed.

The maximum permissible level for unrestricted areas and maximum permissible dose for individuals as stated in the 25 TAC §289 are to be considered as **absolute maxima** and every effort is to be made to conduct experiments and operations at levels which will result in as low as reasonably achievable (**ALARA**) radiation exposures.

B. RADIOACTIVE MATERIALS/RADIOISOTOPES

Radioactive materials/radioisotopes may be present in two physical configurations: Sealed Sources and Open Form. Sealed Sources shall be sealed in accordance with applicable regulations of the U.S. Nuclear Regulatory Commission or Agreement States. Open Form radioactive materials/radioisotopes may be in liquid or solid form. Radioactive gases may be used only with express consent of The University's Radiation Safety Officer or the Radiation Safety Committee on a case-by-case basis. In order to maintain compliance with the 25 TAC §289, The University's Radioactive Materials License, and to ensure protection for all personnel, the following procedures shall be incorporated into each local Radiation Safety Program by the Authorized User:

1. Signs shall be posted where radioactive materials are present per 25 TAC §289,

2. Radioisotopes shall be secure at all times. Specifically, all radioactive materials shall be stored in a locked cabinet, refrigerator, freezer, or room, and when not in a locked device or room shall be accompanied by trained personnel at all times.

B. RADIOACTIVE MATERIALS/RADIOISOTOPES (Cont'd.)

3. Indirect and/or direct reading dosimeters shall be worn by personnel pursuant to Section VI, F of this Manual, and dosimetry reading records shall be maintained per 25 TAC §289 by Radiation Safety.

4. Direct reading dosimeters shall also be worn and the reading recorded hourly when working in high radiation areas (areas where radiation levels are greater than 100 mrem/hr (1 mSv/hr)). The Radiation Safety Officer shall be notified before entry into a high radiation area.

5. Working areas shall be surveyed as necessary after the use of Open Form radioactive material to determine the radiation field level and for presence of contamination. Radiation field levels should be determined using an instrument capable of detecting the radiation in question (i.e., a thin window (1.5 - 2.0 mg/cm^2) G-M detector to survey for soft beta emitters, etc.). Wipe tests shall be analyzed using an instrument capable of detecting the radiation in question. The counting efficiency of this instrument should be known in order to convert the counts per minute (cpm) to disintegrations per minute (dpm). If wipe samples indicate contamination levels of 1000 dpm beta/gamma or 100 dpm alpha activity per 100 cm^2 of surface area, the area shall be cleaned until the contamination is reduced significantly below these levels. Radiation Safety shall be notified when decontamination is required.

6. Radiation survey instruments should be checked before beginning use to ensure proper operating conditions.

7. Minor spills as defined in Section VIII shall be cleaned up immediately. If a major spill occurs do not attempt decontamination. Isolate the area and notify the Radiation Safety Officer or his/her designee immediately.

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

9. Smoking, drinking or eating shall not be allowed in the same room where Open Form radioactive materials are used, or where the room is posted prohibiting such activity.

10. Employees shall wash their hands thoroughly before leaving an area where unsealed radioisotopes are being used.

11. Mouth pipetting of liquid radioisotopes is strictly forbidden.

12. Radiation detection instruments shall be used at all radioisotope use areas when applicable. The instrument shall be capable of detecting the type of radiation in question. All instruments shall be in calibration during use.

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

B. RADIOACTIVE MATERIALS/RADIOISOTOPES (Cont'd)

14. Gloves and smocks shall be worn by employees when working with Open Form radioactive materials. In addition, a respirator should be worn by employees working with gaseous or powdered radioactive material. The Radiation Safety Officer shall be contacted prior to using gaseous form radioactive materials.

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

16. Control of access into restricted areas is the responsibility of the individual supervising the laboratory. A restricted area is one which is posted per 25 TAC §289.

17. Radiation detection instruments such as ionizing chambers, proportional counters and Geiger counters which are used for general radiation surveys shall be in calibration per Section V of this Manual.

18. Radioisotopes producing a radiation dose rate in excess of 2 mrem/hr (0.02 mSv/hr) at a distance of one foot from the source shall be stored within shielding sufficient to reduce the dose rate to less than 2 mrem/hr (0.02 mSv/hr) at a distance of one foot. Radiation dose rates shall not exist in an unrestricted area that could result in a personnel exposure which exceeds 100 mrem (1 mSv) per year or 2 mrem/hr (0.02 mSv/hr). Radiation areas shall be posted pursuant to Section IV.E. of this Manual and 25 TAC §289.

19. Open Form radioactive materials should be stored in nonbreakable, leak-proof containers.

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

21. Radioactive materials shall not be used in or on human beings. Any animals administered radioactive materials, or the products of such animals, shall not be used for human consumption.

22. Radioactive materials shall not be used in field applications where activity is released without prior approval of the Radiation Safety Committee and the Radiation Safety Officer.

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

24. Glassware and equipment containing radioactive material shall be properly labeled.

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

B. RADIOACTIVE MATERIALS/RADIOISOTOPES (Cont'd.)

26. Only designated sinks shall be used for washing contaminated glassware or for disposing radioisotopes. Quantities of radioisotopes disposed in the designated sinks to the sanitary sewer may not exceed the limits specified in 25 TAC §289.202(ggg), for the entire University.

27. Only designated storage boxes, freezers and refrigerators shall be used for the storage of radioisotopes. **DO NOT** put food in any freezer or refrigerator used for this purpose.

28. Radioisotope storage containers shall be labeled in accordance with the 25 TAC §289, with the following information:
    a. Radioisotope
    b. Activity and date
    c. Authorized user
    d. Caution-Radioactive Materials (with radiation symbol)

29. If a suspected or known overexposure occurs to any employee, notify the Radiation Safety Officer immediately. A written report shall be made in each case of overexposure, by the employee and the person supervising the use of the radiation for the particular project. This report shall explain fully why the employee involved was subjected to an excessive amount of radiation, and should recommend measures to be taken to avoid a recurrence of the incident.

30. Records of radiation exposures of University employees, who are required to wear personnel monitoring devices, shall be maintained by Radiation Safety per 25 TAC §289. Reports of exposures shall be sent to individuals pursuant to 25 TAC §289.

31. Safety glasses, optical glasses or goggles should be worn when the skin dose from beta-emitting radioisotopes may exceed 100 mrem (1 mSv) per week (0.6 mrem/hr (0.006 mSv/hr)).

32. Proposed changes in the original authorization shall be submitted in writing to the Radiation Safety Officer for approval, and shall be submitted and approved prior to changing the authorized use of radioactive material.

33. Approval of the Radiation Safety Officer shall be obtained prior to the transfer of any radioactive material to any other User, institution, or licensee.

34. Copies of the "*NOTICE TO EMPLOYEES AND STUDENTS*" signs shall be posted in a sufficient number of places in every establishment where employees are engaged in activities using radioisotopes so that they can be seen by employees entering the area.

35. Each employee using radioisotopes shall be familiar with the appropriate regulations of this Manual and of 25 TAC §289. Copies of these regulations are available upon request from the Radiation Safety Officer and via the Internet at http://www.tdh.texas.gov/radiation/rules.htm.

B. RADIOACTIVE MATERIALS/RADIOISOTOPES (Cont'd.)

36. Individuals involved in operations which utilize, at any one time, more than 100 millicuries of tritium in a non-contained form, other than metallic foil, shall have bioassays performed within one week following a single operation and at weekly intervals for continuing operations.

37. Additions and alterations to these procedures may be made by the Radiation Safety Committee when in the estimation of the Committee such additions and alterations are necessary for the protection of The University and its charges, students, or employees. Approval of substantive changes to these procedures shall be requested of the Texas Department of State Health Services, Radiation Control.

38. For activities involving radioactive materials and animals, Authorized Users shall comply with the procedure titled, "Procedures for Laboratory Animal and Veterinary Medicine Uses," found in Appendix VI.

C. LABORATORY SURVEYS AND INSPECTIONS

C.1 Surveys by Laboratory Personnel

Each Laboratory in which radioisotopes are used shall perform regular surveys. These in-lab surveys are separate and distinct from the surveys (inspections) performed by Radiation Safety. Surveys shall be performed in accordance with Section III.B.5 of this Manual.

C.1.1 Frequency of Surveys

Frequency of the surveys shall be determined by level of isotope usage. If the laboratory receives a shipment of isotopes in open form, a survey shall be performed at a minimum the earlier of:

A. On termination of activities the day the shipment of isotopes is opened and used,
B. At the end of the week during which the isotopes were received, or
C. As specified in the conditions of the Authorization.

If the laboratory uses isotopes in sealed form (Sealed Source), a survey shall be performed:

A. At the close of each day's activities if the source is greater than 1 millicurie,
B. At the close of each week's activities if the source is less than one millicuries, or
C. As specified in the conditions of the Authorization.

C.1.2 Records of Surveys

Records of all surveys shall be recorded in a Laboratory Logbook or equivalent. The Logbook shall be available for review by Radiation Safety at any time. Information recorded as part of the Survey shall be at a minimum:

1. The date and time of the survey.
2. The person performing the survey.
3. The reason for the survey.
4. Information on the instrument used to perform the survey.
    a. The Make, Model, and Serial # of the instrument.
    b. The latest Calibration date of the instrument.

5. The background reading in the laboratory, taken well away from any known radioactive materials.
6. The building and room number of the survey.

C.2 Inspections by Radiation Safety Staff

The Radiation Safety Officer shall cause a risk-based laboratory inspection program to be performed by qualified personnel who report to the Radiation Safety Officer. The inspections shall be sufficient to detect radiation fields or contamination to ensure that hazards do not exist to personnel apart from expected exposure to radiation workers. If the inspections detect an unsafe condition, the Radiation Safety Officer shall cause the unsafe condition to be ameliorated by cleanup, shielding, removal of personnel or equipment, or any other means available to the Radiation Safety Officer.

C.2.1 Frequency of Routine Inspections

The purpose of the risk-based radioactive materials laboratory inspection classification program is to develop a quantitative method, based on the risk associated with the laboratory, to determine the inspection frequency. The risk-based approach allows Radiation Safety to determine an appropriate inspection frequency for laboratories using radioactive materials. The main criterion used in the risk-based program is the quantities of radioactive materials used in the laboratory. Laboratories are reassessed periodically to assure proper inspection classification. For the purpose of classification, multiple laboratories under the control of a single Authorized User shall be grouped as a single laboratory.

Laboratory inspection intervals will be quarterly or annually based on the inspection classification (high-frequency or low-frequency) determined by the criteria outlined below. The overall goal of the risk-based inspection program is to make laboratories and their occupants safer for teaching and research and at the same time ensuring regulatory compliance.

Quantities of Radioactive Materials Used

Laboratories that use more than a predetermined amount of any particular radioactive material in a certain time period (typically 10 mCi in a calendar quarter) will be classified as high-frequency. All other laboratories will be classified as low-frequency. Radioactive materials use is determined by amount of radioactive material received and/or amount of radioactive waste generated in the specified time period.

Additional Factors

A laboratory classified as low-frequency based on the criteria above may be reclassified as high-frequency due to other factors such as failure to mitigate compliance issues identified during inspections, repeat offenses, etc. A laboratory classified as high-frequency based on the criteria above may be reclassified as low-frequency with a consistent history of good compliance with radioactive materials regulations.

Inspections shall be performed at a minimum according to the laboratory's frequency classification. The listing of laboratory frequency classifications shall be maintained by the Radiation Safety Office. High-frequency laboratories shall be inspected quarterly. Low-frequency laboratories shall be inspected annually.

C.2.2 Records of Routine Inspections

The results of all routine inspections shall be documented and maintained for review. Information recorded as part of the inspection shall include, as a minimum, the following:

1. The date and time of the inspection.
2. The person performing the inspection.
3. The reason for the inspection.
4. Information on the instrument used to perform the radiation and/or contamination survey(s).
    a. The Make, Model, and Serial # of the instrument.
    b. The latest Calibration date of the instrument.
5. The background reading in the laboratory, taken well away from any known radioactive materials.
6. The building and room number of the inspection.

If swipes are taken as part of the survey, a record of the swipes shall be attached to the record of the survey.

The current inspection form, "Radioisotope Laboratory Audit Form," is shown in Appendix IV. This form may be revised at the discretion of the Radiation Safety Officer.

C.3 Non-routine Inspections

A non-routine inspection may be performed after any of the following events occur:

A. Cleanup of a spill.
B. Laboratory decommissioning.
C. On request.
D. Detection of an unsafe condition.

The "Radioisotope Laboratory Audit Form" or the equivalent may be used to document the results of non-routine inspections.

D. VIOLATIONS OF REGULATIONS

In the event of an alleged violation of the requirements set forth in this Manual, or those prescribed in the 25 TAC §289, the person noting the alleged violation shall immediately contact the Radiation Safety Officer or a member of the Radiation Safety Committee. The Committee may request the authorized user to meet and discuss the alleged violation with the Committee. Subsequent action taken by the Committee will depend on the seriousness of the violation and the authorized user's past record. If the alleged violation is found to be minor, the Radiation Safety Officer shall clarify the policies for using radioactive materials and shall explain the hazards associated with the violation. If the alleged violation is serious, or the alleged violator shows a flagrant disregard for proper operating procedures, the Radiation Safety Committee may revoke the authorized user's privilege of using radioactive materials.

IV. RADIOISOTOPE ACCOUNTABILITY

A. APPLICATION FOR AUTHORIZATION TO USE RADIOACTIVE MATERIALS

Prior to any purchase or use of radioactive materials or change in an existing authorization, the user shall make Application to Use Radioactive Materials and submit to the Radiation Safety Officer. A copy of the application form is shown in Appendix V and may be revised at the discretion of the Radiation Safety Officer. The Radiation Safety Officer shall review and make an evaluation of the intended user's plans for radiation safety.

The evaluation will include:

1. What equipment or materials are to be used.
2. The physical form of the isotopes.
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, including a diagram of the laboratory.
7. Who will use the equipment or materials (furnish a list of users).
8. Who will be responsible for proper use of the equipment or materials.
9. Training of individual(s).
10. Where the material is to be stored.
11. What safety measures are needed to ensure that employees or students are not exposed to excessive radiation.
12. Where warning signs will be posted.
13. What emergency procedures will be taken if an accident should occur.
14. The type of personnel monitoring devices, if necessary.
15. The radiation survey and/or wipe survey procedures.
16. If animal use is proposed, procedures for handling animals, animal waste and carcasses.

17. Contact with references to verify previous Authorization and use at another institution.

When the Radiation Safety Officer completes the review, the application for a new user or to amend an existing Authorization shall be submitted to the Radiation Safety Committee for review and approval. If any issue is raised by a Committee member, the issue shall be resolved prior to issuance of the Authorization.

New users and amended Authorizations shall be approved by a quorum of the Committee with the exception discussed below. A quorum shall consist of four voting Committee members and must include the Chair or Vice-Chair and a representative from executive management with signature authority to commit University resources.

Committee members shall submit their approvals to the Radiation Safety Officer either in writing or by electronic means, such as e-mail. Upon completion of the required radiation safety training by the applicant and the Committee's approval, the Authorization is finalized with the signature of the applicant, the Radiation Safety Officer, and the Committee Chair or Vice-Chair. Each Authorization is assigned a unique number. The expiration date of the Authorization is maintained electronically by the University's mainframe system and coincides with the expiration date of the License. The Radiation Safety Officer or his/her designee shall maintain the Committee member approvals and the Authorization. A copy of the latter is provided to the Authorized User.

Following the issuance of the Authorization, the Radiation Safety Officer or his/her designee shall meet with the new Authorized User (and staff if necessary) to conduct any final training and hold a question and answer session. The laboratory facilities are again reviewed by the Radiation Safety staff; signs are posted; waste containers are provided; and final security training is provided.

An Authorized User may submit to the Radiation Safety Officer a written request to amend his/her authorization to reduce possession limits, remove places of use, and/or discontinue previously authorized activities. Such requests do not require approval of the Committee quorum but shall be reviewed and processed by the Radiation Safety Officer. The amended Authorization shall be finalized with the signature of the applicant, the Radiation Safety Officer, and the Committee Chair or Vice-Chair.

Visiting researchers may only use radioactive materials under the authorization and control of a currently Authorized User. No provision exists for granting a temporary authorization.

B. PURCHASING

It is the responsibility of each employee to comply with the following requirements regarding the purchase of radioisotopes and irradiation services at The University. In no event is any employee authorized to purchase, receive or transfer radioactive materials or irradiation services except after having obtained the written approval of the Radiation Safety Officer or his/her designee; or, in an emergency, the employee may submit the request to the Chairman of the Radiation Safety Committee for approval.

After obtaining an Authorization to Use Radioactive Materials, the following procedures shall be observed in purchasing radioisotopes or sources of ionizing radiation:

1. A departmental requisition shall be prepared through the University's secure mainframe system and indicate the radioisotopes to be purchased, the activity of each radioisotope required, and the name or unique authorization number of the Authorized User purchasing the radioisotope. The mainframe system maintains the Authorized User's authorized radioisotopes, activity limits, and current inventory. The system automatically limits the purchase of each radioisotope such that the summation of the proposed purchase and the current inventory does not exceed the activity limit.

2. The requisition is electronically forwarded to the Purchasing Office for processing and creation of a purchase order.

3. The Purchasing Office electronically forwards the purchase order to Radiation Safety for approval electronically.

4. No person shall circumvent the approval process, whether the approval is automatic, electronic, or on paper.

Repetitive or standing purchase orders with vendors to automatically replenish radioactive material inventories will not be authorized.

C. SHIPPING

Shipments of radioactive materials from or by The University shall comply with the requirements of the appropriate regulatory agencies. A file of applicable regulations is maintained by Radiation Safety. A Radioactive Material Shipment Form or equivalent shall be completed for each shipment and all shipments shall be approved by Radiation Safety and/or other University personnel possessing the appropriate US Department of Transportation training and certified by the Office of Environmental Health & Safety.

D. RECEIVING

Incoming shipments of radioactive material shall be delivered to Central Receiving (2200 Comal Street) unless prior arrangements have been made with Radiation Safety.

Radiation Safety shall be notified as soon as possible of incoming packages of radioactive material. Radiation Safety personnel will pick up the package, deliver it to the Radiation Safety Receiving Area, log in the material, check for external damage, open the package and check for leakage and/or contamination, measure the surface dose rate if applicable, and deliver the package to the laboratory (25 TAC §289).

A Radioactive Material Disposition Form or equivalent will be completed and delivered with the radioactive material to the User. Disposition of the radioisotopes received in the shipment shall be recorded on the form for each shipment.

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 that 2 mrem/hr (0.02 mSv/hr). Posting of signs, storage, and security requirements must be in compliance with 25 TAC §289.

Any questions concerning the regulations involving purchase, shipping, receiving, or storing and posting of warnings should be referred to Radiation Safety for information or clarification.

F. INVENTORIES

The Quarterly Inventory of each radioisotope performed per Section VI of this Manual shall be checked by the Authorized User or the User's delegate to verify accuracy. Any shortages or overages of radioactive materials shall be reported to Radiation Safety. The Authorized User or delegate shall sign the inventory and return to Radiation Safety. Failure to complete and return an inventory may be cause for suspension of purchasing radioactive materials by the User, and may result in termination of the User's Authorization.

A listing of the inventory of sealed sources is shown in Appendix VII. This listing may be revised at the discretion of the Radiation Safety Officer and may require prior DSHS approval.

V. INSTRUMENTATION

A. GENERAL

Radiation Detection Instruments are used to provide information on the type and quantity of radioactive materials present. Various types of radiation detection instruments and equipment are used by and retained in Radiation Safety. The principal use is for routine monitoring and to provide additional monitoring in the event of a radiation emergency. Radiation Safety maintains calibration facilities suitable for calibrating most types of detectors.

B. INSTRUMENTS AND DETECTORS

Although a basic instrument may be provided by Radiation Safety for an Authorized User, a User is required to purchase and use an instrument(s) specific for the Laboratory's needs, and must use a detector appropriate for the type of radiation to be detected. If a detector appropriate for the specific type of radiation present in the User's laboratory exceeds the capabilities of the basic instrument provided by Radiation Safety, the User must provide an appropriate instrument to detect the radiation present in the lab. For information on manufacturers of the types of detection equipment, contact Radiation Safety.

C. INSTRUMENT CALIBRATION METHODS

Radiation survey instruments at The University shall be calibrated to read within ±20% of the correct exposure reading every twelve (12) months, and after each instrument repair. Calibrations shall be made by Radiation Safety personnel designated by the Radiation Safety Officer, or by individuals who are authorized by the Texas Department of State Health Services, another Agreement State, or the U.S. Nuclear Regulatory Commission. Calibration shall be made using an appropriate radiation source depending on the type of radiation the instrument is designed to detect. At least two radiation exposure values shall be checked for each meter scale on instruments used for measuring radiation fields. Instruments utilized for surface contamination measurements are typically calibrated with a pulser and checked with appropriate calibrated sources to determine efficiency. Both the pulser and calibration sources are traceable to the National Institute of Standards and Technology (NIST).

Records shall be established and maintained for each calibration at the main offices of Radiation Safety and at any remote site. Each instrument shall be marked with a calibration sticker showing the date of calibration, the date the next calibration is due, and the name of the person performing the calibration. Further specific instructions for calibrating instruments are found in Appendix II of this Manual.

D. INSTRUMENT TYPE FOR USE

The instrument used to survey for radiation shall be the correct type to detect the radiation in question. For most purposes, a G-M "pancake" detector is preferred. Phosphorous-32 and -33, Sulfur-35, and Carbon-14 may be detected with a "pancake" probe or a thin end-window. Carbon-14 emits a relatively weak beta; therefore, a survey should proceed carefully and slowly to allow detector response. Tritium must be detected using a scintillation counter or special detector approved by Radiation Safety. Isotopes which emit gamma radiation or a combination of beta and gamma, such as Iodine, Cesium, and Cobalt, may be detected with a Geiger-Muller tube such as the one found on Eberline and Ludlum meters found on campus. Any isotope or combination of isotopes which emits an alpha radiation or neutron radiation must be detected with a detector approved by Radiation Safety. If any question arises regarding the type of detector to be used to perform a survey, contact Radiation Safety for advice and assistance.

VI. TESTS AND RECORDS

A. GENERAL

The Texas Department of State Health Services requires that certain tests be made and records maintained of the results of these test. The requirements for radiation surveys and records of these surveys are covered under 25 TAC §289. This same regulation specifies the requirements for personnel monitoring with indirect and/or direct reading dosimeters, area posting, source storage, and waste disposal. Radioactive Material License No. L00485 (The University of Texas at Austin) defines the requirements for leak testing of sealed sources. Each employee at The University who is authorized to use radioisotopes shall become familiar with these regulations and shall see that they are followed by others who work for them. In addition, all individuals must have adequate training and testing prior to working with radioactive materials or radiation.

B. LEAK TESTS

The Radiation Safety Officer is responsible for the sealed radiation source leak testing program at The University. When leak tests are due, arrangements shall be made with the Authorized User for Radiation Safety to perform the test.

The following procedures shall be followed in leak testing sealed sources:

1. Wetting the filter paper with alcohol or water should be considered; moister allows contamination to stick better.

2. If the radiation source can be removed from the irradiation unit, wipe the surface of the source with a filter paper.

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

4. Wear a dosimeter during testing operation if appropriate or required. Use long-handled tongs or suitable method to limit exposure to hands and body and to wipe filter over surface of source or source holder.

5. Radiation Safety personnel shall evaluate the wipe test by counting the test filter in an appropriately calibrated laboratory instrument capable of detecting 0.005 microcuries of removable activity. The results shall be maintained as a permanent record.

6. If counts detected above background, repeat the leak test. If leaks confirmed, notify the Radiation Safety Officer or his/her designee immediately.

C. INTERNAL INSPECTIONS

The Radiation Safety Officer or a designated alternate shall 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 regulations. Laboratories and facilities where radioactive materials are used or stored shall be surveyed periodically in order to detect any changes in radiation levels and to prevent the spread of radioactive contamination. The frequency of the surveys shall be determined by the Radiation Safety Officer based on the isotope and quantity in use, the history of the laboratory, and the general level of radiation hazard presented by the laboratory's working environment. Records of these surveys shall be maintained by Radiation Safety.

D. RADIOACTIVE WASTE DISPOSAL

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

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

Further requirements for records are detailed in Section VII.

E. INVENTORIES

A computerized Quarterly Inventory of each radioisotope, by Purchase Order Number, shall be sent to each Authorized User in January, April, July and October. The data includes all transactions including decay except sewer disposals. It is the responsibility of the Authorized User or designate to check the accuracy of the inventory, complete the sewer disposal section, and promptly return it to Radiation Safety. An inventory of Sealed Sources shall be conducted each six months, which will include the quantities and kinds of radioactive materials, the location of the sealed source, the name of the individual taking the inventory, and the date of the inventory. The Sealed Source inventory may be conducted concurrently with the Quarterly Inventory or with the six month leak test. Records of the Sealed Source inventory shall be maintained for a minimum of three years.

F. DOSIMETRY AND REPORTS

A centralized dosimetry service is available to authorized users of radioisotopes at The University.

Arrangements have been made with a National Institute of Standards and Technology National Voluntary Laboratory Accreditation Program accredited company to furnish dosimetry service for The University. Under this arrangement each group will receive dosimeters and invoices directly from the company. Payments for this service shall be made directly to the company. Requests for additions and deletions of dosimeters shall be made through Radiation Safety. All reports on dosimetry provided by the service will go to Radiation Safety, and a copy of the dosimetry report will be forwarded to the Authorized User.

F. DOSIMETRY AND REPORTS (Cont'd)

To initiate the dosimetry service, please send to Radiation Safety information on the number of dosimeters you will need, including the name, date of birth, and social security number for each assigned dosimeter. This can be accomplished by completing and submitting the Dosimetry Service Request found on the Environmental Health & Safety website at http://www.utexas.edu/safety/ehs/radiation/. If any dosimeters are to be unassigned, simply designate "unassigned." This information will be forwarded to the vendor with a request to begin service effective as of the date you specify. For more information on the dosimetry service, please contact Radiation Safety.

Indirect and/or direct reading dosimeters are to be worn by University personnel who may be working in areas where the following conditions exist:

1. Any person likely to receive 10% of the annual allowable limit.

2. Any person working with millicurie quantities of a beta emitter with energies greater than 0.5 MeV.

3. Any person working with greater than 5.0 millicuries of a gamma emitter with energies less than 0.1 MeV.

4. Any person working with millicurie quantities of a gamma emitter with energies greater than 0.1 MeV.

G. BIOASSAY PROGRAM ^{125}I and ^{131}I

Because radioiodinated solutions and compounds undergo decomposition which may result in the volatilization of radioiodine, individuals working with these materials have a potential for accidental uptake of radioactive iodine. Once inside the body, the iodine concentrates in the thyroid, contributing to the radiation dose received by that organ. This bioassay program will enable the Radiation Safety staff to determine an individual's radioiodine thyroid burden, so that a thyroid organ-dose can be determined for those who have had an uptake. In addition, the program will monitor the effectiveness of isotope handling procedures.

TABLE I

ACTIVITY LEVELS ABOVE WHICH BIOASSAY FOR

^{125}I OR ^{131}I IS REQUIRED

TYPE OF OPERATION	ACTIVITY HANDLED IN UNSEALED FORM	
	Volatile or Dispersible	Bound to Non-Volatile Agent
Process in open room or bench with possible escape of iodine from process vessels	0.1 mCi	1.0 mCi
Process with possible escape of iodine carried out within a fume hood of adequate design, face velocity and performance reliability	1.0 mCi	10 mCi
Processes carried out with gloveboxes, ordinarily closed, but with possible release of iodine from process and occasional exposure to contaminated box and box leakage	10 mCi	100 mCi

PROGRAM REQUIREMENTS

1. PROGRAM PARTICIPATION:

   a. Individuals who handle unsealed quantities of ^{125}I and ^{131}I in excess of the quantities listed in TABLE I, and those individuals who work close enough to such handling that uptake is possible (within a few meters) should participate in this bioassay program. The quantities in TABLE I apply to that amount handled either in a single usage or the total amount handled over a period of three consecutive months.

   b. It shall be the responsibility of individual authorized users to notify the Radiation Safety Office of the names of those individuals working under his/her authorization who require bioassay for radioiodine.

2. FREQUENCY OF BIOASSAY:

a. Prior to beginning work with ^{125}I or ^{131}I in quantities which require participation in the bioassay program, individuals shall be given a "baseline" or "preoperational" bioassay.

b. A "routine" bioassay shall be performed within 72 hours (but not less than six hours) on individuals following commencement of work with quantities of radioiodine necessitating participation in this program. Bioassays shall continue on a biweekly schedule as long as conditions exist which necessitate an individual's participation in the program. When work with radioiodine is less frequent than every two weeks, a bioassay shall be performed within 10 days of the end of radioiodine operations. Individuals who work under conditions which present a high potential for uptake may be required to submit to bioassay more frequently than biweekly.

c. After three months of routine biweekly bioassays the frequency of bioassay may be reduced to quarterly, at the discretion of the Radiation Safety Officer.

d. An "emergency" bioassay shall be performed on any individual as soon as possible following an incident in which that individual may have received an uptake in excess of 0.5 uCi of ^{125}I or 0.14 uCi of ^{131}I.

e. Individuals who are required to participate in this program shall undergo a "postoperational" bioassay within two weeks (but not less than six hours) after discontinuing operations with radioiodine. This bioassay shall be performed prior to an individual's termination of employment with, or withdrawal from The University.

3. ACTION LEVELS AND CORRESPONDING ACTIONS:

a. When the thyroid burden at the time of measurement exceeds 0.12 uCi of ^{125}I, 0.04 uCi of ^{131}I or a corresponding appropriate amount of a mixture of these two isotopes, the following actions shall be taken:

(1) An investigation of isotope handling procedures shall be conducted. If this investigation indicates that a continuation of current operations would cause further uptake of radioiodine in excess of the above limits, operations using radioiodine in that lab shall be discontinued until corrective actions can be implemented that will lower the potential for uptake.

(2) Restrict the affected individual from further work with radioiodine until the thyroid burden is less than the above limits.

(3) Perform "diagnostic" bioassays on the affected individual at biweekly intervals until the thyroid burden is less that the above limits.

G. BIOASSAY PROGRAM ^{125}I and ^{131}I (Cont'd)

(4) Calculate the committed thyroid dose base on biological half-life determined from follow-up bioassays.

(5) Make exposure record entries and notify state or federal agencies as appropriate.

b. In addition to the actions in 3.a, when the thyroid burden exceeds 0.5 uCi of ^{125}I, 0.14 uCi of ^{131}I or a corresponding appropriate amount of a mixture of these two isotopes, the following actions shall be taken.

(1) Refer the case to appropriate medical consultation.

(2) Perform diagnostic bioassays at weekly intervals until the thyroid burden is less than the values stated in 3.a.

c. If the affected individual and others working in the same area were on a quarterly bioassay schedule at the time the limits of 3.a were exceeded, reinstate biweekly bioassay schedule until it has been demonstrated that further exposures will not cause the limits of 3.a to be exceeded.

4. BIOASSAY PROCEDURES:

Bioassay procedures are contained in Appendix III to this Manual.

H. PROGRAM AUDITS

The Radiation Protection/Safety Program will be audited annually per 25 TAC §289. The areas which will be audited will include, but are not limited to, the following:

Radioisotope Receipt and Delivery
Laboratory Inspections
Instrument Calibrations
Sealed Source Leak Tests
Sealed Source Inventory
Water Samples
Dosimetry and exposures (Non-Confidential Documents Only)
Environmental surveillance
Application for Authorization to Use Radioactive Materials
Excess Materials Pickup, Processing, and Waste Shipments
Shipping of Radioactive Materials
Training Records
Radioisotope Inventory

An Audit shall consist of a review of records of each of the above areas which show that the actions specified for execution of each area have occurred. An auditor will review the appropriate documents, note deficiencies, and sign the name of the auditor and the date of the audit.

I. RADIATION WORKER TRAINING

Faculty, staff, and students who do not have formal training in radiation safety must attend the University's Basic Radiological Health course. The course is eight hours in length and may be split into two 4-hour lectures given on separate days. The Radiation Safety Officer may waive the course if the individual can provide evidence of equivalent training and/or experience. If the Radiation Safety Officer waives the course, the individual must take the Basic Radiological Health Refresher course.

The Basic Radiological Health Refresher course is one hour in length and addresses topics specific to the University such as dosimetry, waste disposal, purchasing, emergency procedures, the Radiation Safety Manual, record keeping, as well as a basic review of radiation safety techniques.

Attendees to either course must take a written test and correctly answer 70% of the test questions to pass. Upon successful completion of either course, credit is posted to the individual's electronic training history in the campus-wide training database. If requested, the successful graduate is issued a certificate of completion.

Both radiation safety courses are typically offered on a monthly basis and taught by senior staff of the Radiation Safety Office. Subjects covered in the basic course include as a minimum the following:

Atomic Structure and Radioactivity
Interactions of Radiation with Matter
Quantities and Units of Radiation
Basic Principles of Radiation Protection
Safe Handling of Radioactive Materials and Sources
Radiation Detection Instruments and Surveys
Dosimetry
Waste Disposal
Purchasing and Receiving Radioactive Materials
Sections of 25 TAC §289 and the Radiation Safety Manual
Emergency Procedures
Record Keeping

The Radiation Safety Officer may also require Radiation Workers to be trained in other areas, such as general hazard communication (Texas Hazard Communication Act) and laboratory safety.

The Radiation Safety Office shall maintain records of course attendance and test results.

VII. DISPOSAL OF EXCESS MATERIALS AND RADIOACTIVE WASTE

A. GENERAL

Each Authorized User who generates excess materials which are candidates for disposal as waste shall determine the category of the excess materials and document the actions taken with the materials. The types of excess materials are Liquids, Dry Solids, Sharps, Sealed Sources, and Animal Waste.

A.1 Liquids

Liquid excess materials generally fall into two categories: Aqueous and non-aqueous. The two types are handled in a different manner. Liquid excess materials to be picked up by Radiation Safety shall be placed in non-breakable containers furnished by Radiation Safety. If a breakable inner container is used, the non-breakable outer container shall have a sufficient amount of absorbent to absorb all of the liquid in the event of an inner container breakage.

Radioactive liquid wastes consisting of other hazardous materials, such as solvents (toluene and xylene) used for scintillation counting, shall not be disposed via the sanitary sewer. These liquids must be collected by Radiation Safety for analysis and proper disposal.

A.1.1 Aqueous Liquids

Aqueous biodegradable solutions which are considered excess materials and which contain radioactive materials may be disposed by laboratory personnel or Radiation Safety staff via the sanitary sewer system in accordance with §289.202(gg) if the material is readily soluble, or is readily dispersible biological material, in water.

Each Authorized User shall record the quantity of radioactive materials disposed by the sanitary sewer on the Radioactive Material Quarterly Inventory form and return the completed form to Radiation Safety. If the Authorized User has aqueous liquids picked up by Radiation Safety, a determination of the disposition will be made by Radiation Safety. The aqueous liquids may be disposed via sanitary sewer if the above criterion is met, or may be held for decay until decay reduces the concentration for sanitary sewer disposal. The latter applies only to radioisotopes with half-lives < 90 days.

Radiation Safety shall be responsible for collecting sanitary sewer release data to determine compliance with the monthly concentration limits (§289.202(ggg)(2)(F), Table III) and the sum of fractions requirement specified in §289.202(gg). Notwithstanding §289.202(gg)(1)(D), the total radioactivity released into the sanitary sewer under The University's Radioactive Material License cannot exceed one Curie per year. Radiation Safety shall generate and retain records to demonstrate compliance with these requirements.

A.1.2 Non-Aqueous Liquids

All non-aqueous liquids considered excess materials shall be collected in dedicated, marked containers for pickup by Radiation Safety. The contents of the containers shall be documented and reported to Radiation Safety prior to pickup. Radiation Safety shall make a determination of the suitability of the liquids for further use, and shall recycle or dispose of the non-aqueous liquids per requirements of the 25 TAC §289. Non-Aqueous liquids may be disposed as regulated or deregulated waste. If disposed as deregulated waste per 25 TAC §289.202(fff)(1), all procedures per Part E.3 of this Section will be followed.

B. DRY SOLIDS

Excess materials generated in University activities which are dry, or contain liquids in absorbed, adsorbed, or sequestered form, may be transferred to Radiation Safety for processing and recycling or disposal. Each Authorized User shall collect the excess materials in a dedicated, marked container. The contents of the container shall be documented on the Radioactive Materials Pickup form or equivalent and reported to Radiation Safety prior to pickup. Radiation Safety shall make a determination of the suitability of the materials for further use, and shall recycle, transfer, or dispose of the materials per requirements of the 25 TAC §289 per the instructions provided in section E.3 of this Manual.

The following instructions shall be observed when packaging excess dry solid materials for pickup by Radiation Safety:

1. Solids shall be placed in approved radioactive materials containers with double plastic bag liners.

2. No liquids or sharps capable of penetrating the plastic liners shall be in the dry solids.

3. All containers shall be marked as radioactive materials, unless specifically exempted from such markings by this Manual.

B.1 Scintillation Vials

Used liquid scintillation vials which do not meet the specific disposal criteria may be emptied of liquids and replaced into the original vial cartons and secured. The Radioactive Materials Pickup form shall note that vials are to be picked up.

C. SHARPS

A Sharp is generally defined as that which will penetrate the double plastic liners placed in a dry solid container with minimal effort. Examples of sharps are broken glass, syringes, and Pasteur Pipette tips.

Specific definitions of sharps are defined in the Environmental Health and Safety Laboratory Safety Manual which can be found at the EHS website, http://www.utexas.edu/safety/ehs/lab/labman/index.html. Sharps must be packaged in specially designed containers and must be free of any chemical or infectious materials prior to pickup. For ease of handling, the volume of the Sharps containers should not exceed two cubic feet.

Sharps contaminated with radioactive materials must be packaged for pickup by Radiation Safety, who will make determination of the classification of the sharps, and will recycle or dispose as waste. The radioisotope contaminating the sharps shall be recorded, and an estimate of the amount and type of chemical contamination shall be recorded and reported to Radiation Safety prior to pickup.

D. SEALED SOURCES

All sealed sources which are considered excess materials shall be held for pickup by Radiation Safety. A determination will be made by Radiation Safety as to the disposition of the source. Under no circumstances shall a sealed source be disposed as waste by any Authorized User.

E. SPECIFIC EXCESS MATERIALS AND SEPARATION AND DISPOSAL

E.1 Specifically Deregulated Materials

25 TAC §289.202(fff)(1) provides for the disposal of certain excess materials without regard to its radioactivity.

1) 0.05 microcurie or less of H-3, C-14, or I-125 per gram of medium used for liquid scintillation counting or in vitro clinical or laboratory testing;
2) 0.05 microcurie or less of H-3, C-14, or I-125 per gram of animal tissue, averaged over the weight of the entire animal.

All excess materials containing radioactive materials shall be picked up by Radiation Safety and a determination made by Radiation Safety personnel as to the qualification of the materials with regard to 25 TAC §289.202(fff) per the procedure in E.3. of this Section. Documentation shall be generated and maintained to verify qualification of this waste as deregulated waste.

E.2 Short-Lived Isotopes (T ½ < 300 days)

Solid materials containing radionuclides with half-lives less than or equal to 300 days (e.g. ^{32}P, ^{33}P, ^{45}Ca, ^{35}S, ^{125}I, etc.) may be disposed as "Less than Regulated Amounts" provided concentration and annual curie limits as described in the 25 TAC §289.202(fff)(4) and The University's Radioactive Materials License are not exceeded. The solid radioactive excess materials which contain only radioisotopes with half-lives less than or equal to 300 days and no other hazardous materials will be separated and placed into containers provided by Radiation Safety for disposal. All markings denoting the material as Radioactive Materials shall be removed from items placed into the waste. All pertinent data for routine disposal of these materials shall be recorded on the Radioactive Materials Pickup form. Upon classification of these materials as waste, disposal of this waste shall be by Radiation Safety in accordance with 25 TAC §289.202(fff)(4) and the procedure described in E.3 of this Section. Short-lived radioisotopes of $\leq$ 90 days which exceed concentrations or amounts for disposal as non-radioactive materials may be held for Decay-In-Storage per Section E.3 of this Section.

The Radiation Safety Office must be contacted prior to the generation of wastes containing radioactive materials and other hazardous materials.

E.3 Separation and Disposal of Waste

All radioactive excess materials which are declared to be waste shall be separated by Radiation Safety for disposal per the following procedure:

E.3.1 Preparation of Waste

A. **Initial Waste Survey**

All excess materials which are classified as waste will be processed by Radiation Safety at the waste preparation facility. The Radioactive Materials Pickup form will be used to initially separate the waste types into T1/2 >300 day and T1/2 $\leq$ 300 day materials. The waste will then be further separated into candidates for disposal per 25 TAC §289.202(fff) and (gg) and candidates for disposal as radioactive materials. A thin window (1.5-2.0 mg/cm^2) G-M detector and a NaI(Tl) scintillation detector will be used as appropriate to survey the waste for separation into isotope types. The surveys shall be sufficient to separate "pure beta emitters" from "gamma emitters", and to determine if "pure beta emitters" are present in "gamma emitter" waste or vice versa. If any "unusual readings" occur (e.g., gamma readings from a package containing only "beta emitters"), the package will be investigated. If materials with T1/2 > 300 days are mixed with materials with T1/2 $\leq$ 300 days, the package will be disposed as radioactive materials.

B. **Specifically Deregulated Waste**

The excess materials classified as waste per the description of 25 TAC §289.202(fff) and (gg), will be separated from other radioactive waste by Radiation Safety at the waste preparation facility. All signs, labels, or other markings which would indicate that the materials were radioactive shall be permanently and completely defaced or removed. The waste will be placed in plastic containers with a total thickness of not less than 5.0 mils, consisting of an inner bag which is sealed with a tie-strap or tape, and the minimum of a 4.0 mil outer bag which is sealed with a tie-strap or tape. No package will be sent for disposal until it is ascertained that all conditions of 25 TAC §289 are satisfied. If the waste is a non-aqueous liquid as defined in Part A.1.2, it will be transferred in containers with no radiation markings to University EHS Hazardous Materials Section for disposal.

E.3.2 Disposal into a Type I Landfill

All materials disposed in a Type I landfill shall meet the requirements of 25 TAC §289(fff)(4), and shall not exceed the concentration and curie limitations of The University's License. The Type I landfill shall be a Type I Municipal solid waste site as defined in the Municipal Solid Waste Management Regulations of the Texas Commission on Environmental Quality (TCEQ), unless the waste contains a hazardous waste as defined in the Solid Waste Disposal Act. Hazardous waste will be disposed at a facility authorized to manage hazardous waste by the TECQ, US Environmental Protection Agency or other appropriate state agency.

E.3 Separation and Disposal of Waste: Procedure (Cont'd)

E.3.3 Delivery Procedure to a Type I Landfill

Delivery of waste to the Type I landfill shall comply with the following procedure:

1. No liquid wastes are allowed,
2. Solid waste shall be containerized in cardboard, wooden or metal containers and free of radioactive material labels,
3. Only Radiation Safety staff assigned whole body dosimeters may transport waste,
4. University owned or leased vehicle shall be used for transport,
5. Waste holding area of vehicle shall be secured to prevent unauthorized access to the waste following loading and during transport.
6. Waste containers shall be secured in holding area to prevent movement normal to transport.
7. Radiation Safety staff shall have a radiation survey meter, such as a Ludlum Model 3 with a Model 44-9 G-M pancake probe, in the vehicle to perform contamination surveys.
8. Upon return from the landfill, perform and document a direct survey of the vehicle's waste holding area.
9. Remove any contamination resulting from the transport of the waste, and
10. File the survey results with the copy of the waste manifest.

E.3.4 Disposal into a Licensed Radioactive Materials Landfill

Any radioactive materials classed as waste which do not meet the criteria specified in 25 TAC §289.202(fff) or (gg) shall be disposed at a landfill licensed to accept radioactive materials for disposal. The materials shall be packaged according to USDOT, waste processor, and disposal site requirements as applicable, and shall be identified by isotope, quantity, chemical form, and any other requirements which are levied for the proper manifesting, processing, and disposal of these items. Radiation Safety may compact the materials for disposal. Transportation shall be via a carrier licensed to accept and deliver radioactive materials. The University currently uses the services of a licensed waste broker for the off-site treatment and/or disposal of radioactive waste.

Infrequent transfers of solid radioactive waste may be received from the Nuclear Engineering Teaching Laboratory NETL, USNRC License No. R-129, located at the University's J.J. Pickle Research Campus. The radioactive waste is generated by research and educational activities and limited primarily to activated components and compactable materials, such as laboratory protective clothing and paper. Prior to any transfer of solid radioactive waste from NETL, the waste shall be characterized to determine for each radioisotope the quantity in micro or millicuries, physical and chemical form, as well as volume and/or weight. The RSO shall review the characterization for adequacy and determine whether the radioactive material is within the material authorizations of License No. L00485. Upon written approval from the RSO, the transfer may then occur. Immediately upon receipt, the radioactive material inventory records shall be increased based on the waste characterization. The waste shall be disposed in the same manner as described in the previous paragraph.

E.3 Separation and Disposal of Waste: Procedure (Cont'd)

E.3.5 Decay-in-Storage (DIS)

Radioisotopes with half-lives $\leq$ 90 days (e.g. ^{32}P, ^{33}P, ^{35}S, ^{125}I, etc.) may be held for decay by storing in a secure area for greater than ten half lives. If more than one isotope is included in the materials held for DIS, the materials shall either be segregated or the longest half-life isotope shall be used to compute the amount of time required before disposal may occur. Records shall be generated to document and verify the isotope, quantity, chemical and physical form, and relevant dates. After ten half-lives, the waste shall be surveyed in a low background area with a portable survey instrument to ensure that readings are indistinguishable from background. Defacing or removing radiation labels is not required if the labels are otherwise obscured in containers which are not designed to be opened (e.g. sharps or medical waste containers).

F. ANIMAL TISSUE AND CARCASSES

All animal tissues, carcasses, excrement, and bedding which have been contaminated with radioisotopes must be disposed through Radiation Safety. These items must be double bagged to prevent leaks and tears. All description requirements of the Radioactive Waste Pickup form must be met for pick-up. Radiation Safety will pick up the items and determine the proper type of disposal based on the isotopes and concentration. Animal disposal will follow the procedures in E.3 of this document, except animals which meet the requirements of 25 TAC §289.202(fff)(1) or (gg) may be macerated for disposal via the sanitary sewer. Additional requirements are found in Appendix VI of this Manual.

G. RELEASE INTO THE ATMOSPHERE

Release of radioactive materials into the atmosphere shall only be incidental to working with radioactive materials in solid or liquid form, unless specific permission is given to use radioactive gases by Radiation Safety. Although limitations on the atmospheric effluent are given in 25 TAC §289.202, Radiation Safety shall be contacted prior to using any radioactive materials in a situation where release to the atmosphere may occur. Any actions which might result in release of radioactive materials into the atmosphere shall be conducted in an area with a forced ventilation system such as a fume hood, ventilated greenhouse, or other area where characteristics of the airflow are known.

H. FACILITY DECONTAMINATION

The Authorized User shall decontaminate any laboratory or facility which becomes contaminated. Assistance with decontamination is available from Radiation Safety. On vacating premises where radioactive materials have been used, the Authorized User shall ensure that all residual radioactivity is removed and disposed in accordance with this Manual and the 25 TAC §289, and the User shall contact Radiation Safety for a final survey of the vacated facility.

I. RECORDS

All excess radioactive materials shall be documented prior to pick-up by Radiation Safety on the Radioactive Materials Pickup form. Radiation Safety will retain the Pickup form and document the isotope and quantity, chemical form, volume, physical form, date received, Purchase Order Number (if available), the type of disposition, date of disposal, the concentration in uCi/gm if 25 TAC §289.202(fff)(1) is used for disposal, the concentration in µCi/ml and Ci/yr of 25 TAC §289.202(fff)(4) is used for disposal, and will retain copies of these records. Information for the instrument used to survey the materials for separation and disposition will be recorded, including the name of the surveyor, the date of survey, the instrument type, model number, serial number, and the date of calibration. Records may be kept electronically, but paper copies of the electronic records must be retained until such time as the DSHS allows no further retention of paper records.

J. REGULATORY RESPONSIBILITY

Nothing in this Section relieves the authorized user of the responsibility for maintaining appropriate records as required by 25 TAC §289 and this Manual.

NOTE: Contact Radiation Safety if your waste disposal problem is not covered by any of the above mentioned alternatives.

VIII. EMERGENCY PROCEDURES

A. GENERAL

A.1 Available Resources

In the event of an emergency involving radiation, the following materials can be obtained by contacting the Radiation Safety Office: coveralls, disposable gloves and shoe covers, respirators, decontamination wash materials, pocket dosimeters, high-and-low-range survey instruments, radiation signs, tags, labels, aprons, handling tongs, plastic bags, high volume air samplers, filters and vacuum cleaning equipment.

A.2 Radiation Incident

A radiation incident shall be defined as an accident or unusual occurrence that causes unplanned, exposure to personnel or results in a spill of material in excess of 100 microcuries. In the event of a radiation incident, the procedures outlined in subsequent parts of this Section shall be followed immediately. A current list of Emergency Phone Numbers for Radiation Safety shall be posted in each area where radioisotopes are used.

B. RADIOISOTOPES

B.1 Minor Spill

A minor spill is defined as a spill of less than 100 microcuries. The laboratory shall initiate and complete cleanup operations, document the spill and cleanup, and notify Radiation Safety.

B.2 Injuries Involving Radioactive Materials

If a person is both injured and contaminated, the following listed action will vary with different accident conditions.

1. Provide emergency medical care immediately for serious injuries and preserve vital functions.

2. Notify Radiation Safety. (After normal working hours use emergency phone list). Radiological assistance may be needed to advise medical personnel that patient trauma treatment should take precedence over almost all concern for contamination control and radiation exposure.

3. If necessary, call a doctor and an ambulance by calling 911 or 9-911.

4. If necessary, arrange to transport the patient to Brackenridge Hospital or the designated emergency receiving point. NO TRANSPORT RESTRICTIONS SHOULD BE IMPOSED THAT WOULD SERIOUSLY COMPROMISE THE PATIENT'S MEDICAL CARE.

B.2 Injuries Involving Radioactive Materials (Cont'd.)

5. When transporting a contaminated patient to Brackenridge Hospital emergency room or the designated emergency receiving point, the following procedures should be followed:

   a. Contaminated clothing should be removed if, possible.

   b. If skin decontamination is necessary, wash the patient thoroughly with soap or detergent and water.

   c. Wrap patient in a clean sheet or blanket (obtainable from an ambulance).

   d. A representative from Radiation Safety should accompany the patient, but do not delay transport if Radiation Safety personnel are not present.

6. External contamination is not immediately harmful to the patient unless the skin is badly punctured or wet.

7. Minor injuries can be treated at the scene and can usually wait until after an initial radiation survey has been completed.

8. Cuts which penetrate the skin offer a point of easy access to the body for radioactive materials. Radioisotopes should not be allowed to come in contact with a cut anywhere on the body. If a person is cut by a contaminated article, this should receive immediate treatment. It should first be cleansed very thoroughly. Free bleeding should then be encouraged to cleanse the wound. The wound should 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. Cuts involving possible contamination should be reported to Radiation Safety so that necessary steps can be taken immediately to evaluate the contamination.

C. EMERGENCY NOTIFICATION

The Texas Department of State Health Services has established a 24-HOUR RADIOLOGICAL EMERGENCY ASSISTANCE telephone number:

(512) 458-7460

This number shall be used for emergency assistance reporting only. For routine business matters call (512) 834-6688. Additional assistance may be obtained if necessary by contacting the University Fire Marshal, University Police Chief or **911**.

The Radiation Safety Officer shall notify the Radiation Safety Committee immediately of the occurrence of any radiation incident that may affect the health or well-being of any individual.

D. **EMERGENCY PHONE NUMBERS** (You may copy this list and post.)

RADIATION SAFETY

EMERGENCY PHONE NUMBERS

Environmental Health and Safety 24-hour Immediate Response Pager and Phone

Pager: 9-875-0911

Phone: 9-658-2411

Radiation Safety Personnel

Name	Position	Office	Alternate
Scott Pennington	Radiation Safety Officer	471-2042	935-9015
Tracy Tipping	Deputy Radiation Safety Officer	471-1496	935-9044
DeWayne Holcomb	Radiation Safety Specialist	471-2038	935-9023
Ryan Green	Radiation Safety Specialist	471-2029	935-9047
Donna O'Kelly	Reactor Health Physicist	232-4174	947-6762

University Emergency Phone Number **911**

Off-Campus Emergency Response **9-911**

Area code for Austin is 512.

The Radiation Safety Officer may revise this page as needed.

APPENDIX I-A

Radiation Safety Committee Membership Roster June 2009

Chair

Dr. Gerald Hoffmann	Professor Department of Physics	471-1769 M/C C1600 Fax 471-9637 RLM 10.308 hoffmann@physics.utexas.edu

Vice-Chair

Dr. Juan M. Sanchez	Vice President for Research Office of the Vice President for Research	471-0091 M/C C2200 Fax 471-7681 ETC 9.150 jsanchez@mail.utexas.edu

Members

Dr. Neal E. Armstrong	Vice Provost for Faculty Affairs Office of the Executive Vice President and Provost	471-4616 M/C G1000 Fax 475-7385 MAI 201 neal_armstrong @mail.utexas.edu
Dr. Jon Robertus	Benjamin Clayton Centennial Professor in Biochemistry Department of Chemistry and Biochemistry	471-3175 M/C A5300 Fax 471-8696 WEL 5.266 jrobertus@mail.utexas.edu
Dr. Bob G. Sanders	Professor Section of Molecular Genetics Microbiology and Immunology	471-7441 M/C C0900 Fax 471-9651 PAT 522 bgsanders@mail.utexas.edu
Dr. Steven Biegalski	Director, Nuclear Engineering Teaching Laboratory Associate Professor Department of Mechanical Engineering	232-5380 M/C R9000 Fax 471-4589 NEL 2.100 biegalski@mail.utexas.edu
Dr. Kevin Dalby	Associate Professor College of Pharmacy	471-9267 M/C A1935 Fax 232-2606 BME 6.202B dalby@mail.utexas.edu

Ex-Officio Members

Mr. W. Scott Pennington	Assistant Director, MS, MSM, CHP Radiation Safety Officer Environmental Health and Safety	471-2042 M/C C2600 Fax 475-6383 SER 109 spennington@austin.utexas.edu
Dr. G. Robert Harkins	Associate Vice President Campus Safety and Security	471-5767 M/C D3000 Fax 471-4227 TRG 1.202H bharkins@austin.utexas.edu

June 25, 2009

APPENDIX I-B

Procedure for Remote Site Use of Radioactive Materials

1. PURPOSE

The purpose of this procedure is to provide control for the use of radioactive materials by The University of Texas at Austin at sites in the State of Texas other than the specific locations listed on State of Texas Department of State Health Services, License L00485.

2. LICENSE REFERENCES

The University of Texas at Austin is licensed to use radioactive materials at temporary sites throughout Texas per the Radioactive Materials License: Open form amounts of radioactive materials, specifically Carbon-14 (C-14) and Tritium (H-3) labeled reagents, 6.0 millicuries total.

3. DISCUSSION

3.1 Marine Research with Open Form Materials

Field research is performed by The University of Texas Marine Science Institute aboard two seagoing vessels, R/V (Research Vessel) *Longhorn* and R/V *Katy*, while at sea. During the research protocols, small marine life and water samples are taken, brought aboard ship, tagged with radioactive materials, processed in experimental conditions, and then stored for proper disposal on return to shore. This research may be performed in international waters, in which case a Form NRC-241 is submitted to the United States Nuclear Regulatory Commission requesting reciprocity.

3.2 Procedures for Control

The procedures detailed here are designed to assist the researcher in achieving proper safety and in complying with relevant regulations. No procedures can fully replace cognizance and awareness of safety, therefore the procedures are designed to reinforce training and heighten attention to the requirements of using radioactive materials.

4. Procedure - Open Form Radioactive Materials

1. Confirm the presence of the following items on the vessel:

    A. Copy of The University of Texas at Austin Radioactive Materials License, including the Radiation Safety Manual.

    B. Storage containers for radioactive waste.

    C. Labels and signs to denote containers with radioactive materials and cabins which have radioactive materials, and postings required by the 25 TAC §289, specifically including the Notice to Employees and Students.

D. Protective wear, including gloves, coats, glasses, and any other garments or wear to prevent contamination of an individual using radioactive materials.

E. Tools used to properly handle radioactive materials during the experimental protocol.

F. Adequate space dedicated to radioactive materials use, storage, and handling.

G. Detection equipment suitable for detecting the radioactive materials used in the experiment (Pancake detector, or for C-14, end window detector).

H. Cleanup equipment to clean spills.

2. Confirm all protocols and procedures are approved by the Authorized User of Radioactive Materials.

3. Confirm all individuals who will be performing the protocol have proper training in the use of radioactive materials.

4. Move the radioactive materials to the vessel, post the cabin in which the materials are located, and ensure proper marking of equipment to be used during the protocol.

5. Perform the experiment per requirements of the protocol. During the experiment, ensure containment of all radioactive materials.

6. After completion of the experiment or of the day's work, perform wipe tests of work areas and equipment and analyze with pancake detector or scintillation counter to determine levels of contamination, if any.

7. During decontamination, clean all equipment, and place all cleaning solutions, materials, and equipment which are contaminated into marked containers for disposal/cleanup onshore.

8. Check all personnel involved in the experiment for contamination on hands, feet, and other areas, and decontaminate if required.

9. At termination of cruise, perform complete survey of equipment and work areas. If wipe samples indicate contamination levels of 1000 dpm/100 cm^2 of surface area, clean the area until the contamination is reduced significantly below this level. NOTE: Copies of all survey data shall be maintained at MSI and sent to the Radiation Safety Office in Austin.

10. On return to shore, dispose of all radioactive waste in proper containers. Record the disposed amounts for pickup by Radiation Safety. Document the surveys and swipes in the Radiation log book. Remove all radioactive materials from the vessel. Perform final survey of the vessel, and record survey readings. Remove cabin postings and markings from cleaned containers.

APPENDIX II

Procedure for Calibration of X- and Gamma-Ray Survey Meters

1. Calibration shall be performed with a radioisotope source with source activity traceable within 5% accuracy to a National Institute of Standards and Testing Technology calibration. The recommended isotope for the calibration source is Cs-137.

2. The source will be an approximate point source.

3. Each scale of the instrument will be calibrated at least at two points located approximately 1/3 and 2/3 of full scale. For logarithmic rate-changing instruments, a calibration will be made near the mid-range of each decade and two points will be calibrated on at least one of the decades.

4. The true exposure rate at any distance from the source shall be calculated based on known decay characteristics of the source and the inverse square law on the date of the calibration of the instrument.

5. The exposure rate measured by the instrument under calibration shall not differ from the true exposure rate by more that 20% at any point of measurement. The activity of the source shall be sufficient to calibrate the instrument on all ranges, or at least up to 1 R/hr on the higher ranges. Attenuators may be used to reduce the exposure rate to acceptable rates for calibration.

6. Records of the calibration shall be maintained for the instrument at the site of calibration and at the site where the instrument is used. The records shall include at a minimum the make/model/serial number of the instrument, the detector type, the date of calibration, the location where the instrument is to be used, the individual performing the calibration, and measurements taken on each scale.

7. The date of calibration of the instrument, the initials or other designator of the calibrating individual, and the date the next calibration is due shall be affixed to the instrument on completion.

8. If repairs are made to an instrument, the instrument shall be recalibrated, records shall be generated, and the instrument may or may not be taken out of its regular twelve month calibration cycle. At no time shall the calibration of an instrument exceed twelve months, with allowance for grace periods as specified in this Manual.

9. The check source attached to some instruments is not acceptable for calibration purposes.

APPENDIX III

Bioassay Program Procedures

3H (Tritium) Bioassay Procedures

For the purpose of regulatory compliance, all Tritium Bioassays shall be performed by an outside testing agency, which has been certified by the appropriate regulatory authority for testing of Tritium bioassays. In-house bioassays may be performed for screening purposes.

^{125}I and ^{131}I BIOASSAY PROCEDURES:

A. Prior to commencement of operations using quantities of ^{125}I or ^{131}I in excess of those listed in TABLE I of Section VI, licensees shall notify the Radiation Safety Office of such and provide the names of those individuals who meet the criteria of G.1 of Section VI. Authorized users shall not permit any individual who meets the criteria of G.1. to work with or near radioiodines until they have undergone a baseline bioassay.
B. The Radiation Safety Office shall contact these individuals and schedule baseline bioassays at a time and place convenient to both parties.
C. Individuals participating in this program shall notify the Radiation Safety Office following their initial contact with radioiodine to schedule the first routine bioassay (to be performed within 6-72 hours). Upon completion of this first bioassay, a bioassay schedule shall be established for the individual in accordance with G.2.b. and G.2.c. of Section VI.
D. Any individual involved in a radiological incident who may have exceeded the limits of G.3.b. of Section VI shall notify the Radiation Safety Office immediately.
E. Any individual who is participating in this program shall notify the Radiation Safety Office prior to terminating employment with or otherwise leaving the University.
F. Bioassay shall be performed by individuals designated by the Radiation Safety Officer and shall be conducted in accordance with the detailed bioassay test instructions as modified to the specific test area.
G. A background shall be taken of the room environment, a reading shall be taken of the individual's thigh, and a reading of the individual's thyroid for each bioassay.

Calibration The instrument used to assay the biological activity in an individual for ^{125}I shall be calibrated by use of an ^{129}I source. A Ludlum Model 2200 scalar and model 44-3 detector shall be used. If ^{131}I is to be assayed, a ^{133} Ba source will be used for calibration.

The scalar shall be set using the following initial parameters:

		^{125}I (^{129}I)	^{131}I (^{133}Ba)
1.	Window On-Off Switch:	OFF	OFF
2.	Ratemeter range selector :	X 10	X 10
3.	Threshold Dial:	3.50 (35 keV)	3.46 (34.6 keV)
4.	Window Dial:	0.50	0.20
5.	High voltage:	0.00	0.00
6.	Fast-slow response:	F (Fast)	F (Fast)
7.	Ratementer function switch:	Rate	Rate

Calibrate using the following instructions:

1. Expose the detector to the appropriate source.
2. Increase High Voltage setting until the ratemeter begins to respond to the source
3. Turn Window On-Off switch to ON.
4. Increase High Voltage until count rate peaks on ratementer (Increase ratemeter range as necessary), and begins to decline. Use peak count setting for background and counts.

Efficiency determination:

1. Control Settings:

	^{125}I (^{129}I)	^{131}I (^{133}Ba)
a. Set High Voltage settings:	As determined in Calibration procedure	
b. Energy window	15-60 keV	250-450 keV
c. Threshold dial	1.50	2.50
d. Window dial	4.50	2.00
e. Window On-Off switch:	ON	ON
f. Time:	As necessary for statistically significant counts	

2. Count background with no standards in phantom
3. Count standard in phantom
4. Calculate the activity in the standard using known decay factors for the isotope.
5. Calculate the average net efficiency of the detector.
6. Calculate the average net uCi/CPM. This value will be used to determine the System Efficiency Correction Factor (SECF)

System Efficiency Correction Factor (SECF)

	^{125}I (^{129}I)	^{131}I (^{133}Ba)
1. Effective Phantom depth	2.123 cm	2.123 cm
2. System Efficiency	1.55 E-5	5.75 E-5
3. Energy window range	15-60 keV	250-450 keV
4. Calculate SECF	uCi/CPM	uCi/CPM
	---	---
	1.55E-5	5.75E-5

5. Record SECF on Bioassay Record sheet.

APPENDIX IV

RADIOISOTOPE LABORATORY AUDIT FORM

March 28, 2005

THE UNIVERSITY OF TEXAS AT AUSTIN
ENVIRONMENTAL HEALTH AND SAFETY
Radiation Safety
(Revised: March 2005)

Radioisotope Laboratory Audit Form

In order to ensure that operations are carried out safely and in compliance with The Texas Department of State Health Services regulations, as well as UT policies and procedures, Radiation Safety staff conducts periodic audits of laboratories. During the course of each audit both external radiation levels and surface contamination levels may be monitored. Also reviewed are the lab's radionuclide inventory, survey records, and training records. Any discrepancies encountered during the audit will be discussed with the authorized user or designee.

Building(s): _____ **Room(s):** _____

Authorized User: _____ **Isotope(s):** _____

YES: Satisfactory Compliance NO: Unsatisfactory Compliance N/A: Not Applicable / Not Observed

	YES	NO	N/A			YES	NO	N/A	
1.	☐	☐	☐	Lab Signs and Postings	11.	☐	☐	☐	RAM Security
2.	☐	☐	☐	Radiation Safety Manual	12.	☐	☐	☐	Proper Shielding
3.	☐	☐	☐	Copy of Authorization	13.	☐	☐	☐	Use Areas Demarcated
4.	☐	☐	☐	RAM Inventory Records	14.	☐	☐	☐	RAM Container Labels
5.	☐	☐	☐	RAM Waste Records	15.	☐	☐	☐	Survey Instruments
6.	☐	☐	☐	Receipt/Use/Waste Records match	16.	☐	☐	☐	U.A. Eating, Drinking, Etc.
7.	☐	☐	☐	User Surveys	17.	☐	☐	☐	X-ray Interlocks
8.	☐	☐	☐	Training Records	18.	☐	☐	☐	X-ray User Records
9.	☐	☐	☐	Dosimetry Records	19.	☐	☐	☐	X-ray Leakage Surveys
10.	☐	☐	☐	Dosimeters Properly Worn					

Comments:

See continuation sheet as necessary for further detail

Report Attachments: _____

Inspection Date: _____

Audited by: _____ **Signature:** _____ **Date:** _____

Reviewed by: _____ **Signature:** _____ **Date:** _____

THE UNIVERSITY OF TEXAS AT AUSTIN
ENVIRONMENTAL HEALTH AND SAFETY
Radiation Safety
(Revised: March 2005)

Radioisotope Laboratory Audit Form
Continuation Sheet

Authorized User: _____

APPENDIX V

APPLICATION TO USE RADIOACTIVE MATERIAL AND/OR IONIZING RADIATION PRODUCING EQUIPMENT

APPLICATION TO USE RADIOACTIVE MATERIAL AND/OR IONIZING RADIATION PRODUCING EQUIPMENT

(Revised: March 2005)

THE UNIVERSITY OF TEXAS AT AUSTIN
ENVIRONMENTAL HEALTH & SAFETY
RADIATION SAFETY SECTION
SER 221, Mail Code C2600
471-3511, FAX: 475-6383

This form shall be completed and returned to the Radiation Safety Officer (RSO). (It is suggested that an electronic draft be submitted to the RSO for review and comment prior to obtaining the required signatures.) Only upon notification of approval shall use of radioactive material and/or radiation producing equipment be permitted. Please type or electronically submit this form. Hand-written forms will not be accepted.

1) Name, department, campus address, phone number, and email:

2) Laboratory or place of use address, if different from 1):

3) Name, UTEID and title of individual(s) who will use or supervise the use of radioactive material or radiation producing equipment:

4) Previous permits, authorizations or equivalent obtained under a NRC or Agreement State license or registration:

5) Radioactive material and/or radiation producing equipment for which authorization is desired. (Be specific. If isotopes, list each isotope with quantity and chemical/physical form of each. If equipment, give machine specifications along with manufacturer and control panel model and serial number.):

6) Describe, in detail, proposed uses for items in 5) (use additional sheets if necessary):

7) Describe procedures which will provide **As Low As Reasonably Achievable** (ALARA) radiation exposures to faculty, staff and students:

8) Describe type of radioactive waste to be generated and radioactive waste collection and handling procedures.

9) Describe personnel training and experience. Include at a minimum individual(s) in 3):

10) Type and number of radiation detection instruments available for surface contamination and area surveys:

11) Proposed personnel monitoring devices (>1 mCi of P-32 requires whole body and ring dosimeters; an open beam XRD requires ring dosimeters):

12) Clearly identify place(s) of use and describe facilities (include fume hoods, sinks, refrigerator/freezer, etc.). Include a detailed sketch of the facility with this application:

13) Describe radiation survey procedures, methods of locating contamination, and record keeping of survey results:

14) If animals are to be used, describe procedures (handling, disposal, etc.):

15) In the even of an accident, describe emergency procedures:

_____	_____
Applicant's Signature	Date
_____	_____
Dean or Department Chairperson's Signature	Date
_____	_____
Reviewed, Radiation Safety Officer's Signature	Date

APPENDIX VI

Procedures for Laboratory Animal and Veterinary Medicine Uses

This procedure provides additional information on the use of byproduct materials in laboratory animals, in animals used for research in the environment, and by veterinarians.

Training

Before allowing an individual to care for animals used in studies with or treated with licensed material, the Radiation Safety Officer (RSO) and Authorized User (AU) shall ensure that the user has sufficient training and experience to maintain doses ALARA, control contamination, handle waste appropriately, etc.

Classroom training will be in the form of lecture, videotape, and will cover the following areas:

- Principles and practices of radiation protection.
- Radioactivity measurements, monitoring techniques, and using instruments.
- Mathematics and calculations basic to using and measuring radioactivity.
- Biological effects of radiation.

Appropriate on-the-job-training will consist of:

- Observing authorized personnel using survey equipment, using proper contamination control techniques, and proper disposal of radioactive material.
- Using survey equipment, proper contamination control techniques, and proper disposal of radioactive material procedures under the supervision of, and in the physical presence of, and individual authorized to handle animals treated with licensed material or otherwise containing licensed material.

Laboratory Animals

Contamination Control and Waste Handling

In order to minimize the spread of contamination, animals used in studies with or treated with licensed material should be housed in cages or stalls separate from other animals. The cages or stalls shall be secured to prevent unauthorized access to the animals. Individuals caring for these animals should reduce the chance of personal contamination by wearing gloves, lab coat, and eye protection, as appropriate.

Special care should be observed when cleaning the cage or stall. The cage or stall, the bedding, and waste from the animal may contain radioactive material. Any radioactive material should be properly disposed of as described in the section waste processing procedures for animal materials.

Laboratory Animals (Cont'd)

Contamination Control and Waste Handling (Cont'd)

Disposal of laboratory animals that contain radioactive material require special procedures. Animal carcasses that contain less than 1.85 kBq/gram (0.05 microcuries/gram) of carbon-14 or hydrogen-3 may be disposed of by the same method as non-radioactive animal carcasses. Animal carcasses that contain byproduct material with a half-life of less than 90 days may be allowed to decay-in-storage in a freezer dedicated for radioactive material. Animal carcasses must be held for a minimum of 10 half-lives of the longest lived isotope. After 10 half-lives, the animal carcasses may be disposed as non-radioactive, if radiation surveys (performed in a low background area and without any interposed shielding) of the carcasses at the end of the holding period indicate that radiation levels are indistinguishable from background.

Veterinary Use

Training

All veterinary personnel that come in contact with animals that have been treated with radioisotopes will have taken the Radiation Worker training specified in Section VI. of this Manual.

Animal Materials

I. No animal waste will be picked up for disposal prior to suitable deactivation of infectious agents. Four types of radioactive waste are generated from animal experiments; bedding, dry, blood/urine, and carcasses. Each type is to be segregated and prepared for disposal.

II. Bedding

1. This consists of bedding material only. Bedding is to be double bagged in plastic bags.
2. Separate the bedding material by the half-life of the isotope that was used on the animal. (Greater than or less than 300 day half-life)

III. Solid or dry waste also follows the Waste Processing Procedures located in Section VII. of this Manual.

IV. Blood/Urine

1. Collect blood/urine separately in plastic container.
2. Follow the bulk liquid waste procedures located in Section VII. of this Manual.

V. Carcasses

1. Separate carcasses with a half-life less than 90 days and place them in double bagged plastic bags. These can be held at your site until it is decayed 10 half life's. Then dispose as you would a regular carcass.
2. Separate carcasses with a half-life greater than 300 days and those that are less than 0.05 uCi for H-3, C-14, and I-125. These carcasses should be placed in double-bagged plastic bags with as much of the air removed as possible.
3. For those that have content greater than 0.05 uCi for H-3, C-14, and I-125 label high concentration and separate from the other carcasses.
4. All carcasses should be kept frozen until Radiation Safety picks them up.

APPENDIX VII

Sealed Source Inventory
(As of April 2007)

This appendix has been deliberately left blank. For information regarding sealed sources, contact the Radiation Safety Officer.