



RADIATION SAFETY MANUAL

University of North Texas Health Science Center at Fort Worth

This document is designed to serve as the minimum established radiation safety standards for the use, storage, and disposal of radiology materials.

HSC laboratories handling radiological hazards may use this manual to create a laboratory-specific standard operating procedure (SOP) for handling radiological hazards. However, all modifications must ensure radiological safety at or above the level provided by the best practices described in this document. The containment, safety equipment, personal protective equipment (PPE), and procedures included here assure that investigators can manage radiological materials safely according to guidelines from the following sources:

- Texas Department of State Health Services (DSHS), Radiation Control Program
- Title 25 of the Texas Administrative Code (TAC), §289.201
- Title 25 of the Texas Administrative Code (TAC), §289.202
- Title 25 of the Texas Administrative Code (TAC), §289.227
- Title 25 of the Texas Administrative Code (TAC), §289.252
- Texas Bureau of Radiation Control (BRC), a division of the Texas Department of Health.
- Title 25 of the Texas Administrative Code (TAC), §289.301 is based upon American National Standards Institute (ANSI) documents.
- US NRC Regulatory Guide 8.29
- HSC Policies

The determination of the containment level, equipment, and PPE needed will be defined by the HSC Radiation Safety Committee (RSC), The Office of Research Compliance (ORC), and The Office of Environmental Health and Safety (EH&S). For questions regarding this document, please contact HSC EH&S at (817) 735-5431.

APPLICABILITY

This institutional radiation safety manual must be adopted as a policy and utilized in conjunction with all Hazard Registrations. These documents must be readily accessible to all laboratory personnel

APPROVAL AND IMPLEMENTATION

This Radiation Safety Manual is hereby approved for the University of North Texas Health Science Center. This plan shall apply to all HSC personnel participating in all scientific and medical research activities at HSC facilities or sanctioned activities. The details of this plan are the institutional policies directing the safe use of radioactive materials and radiation producing device in research. This plan is effective immediately and supersedes all previous editions.

Approved: _____



Date: _____

10/19/2020

Brian Gladue, PhD

Vice-President for Research and Innovation

University of North Texas Health Science Center

Table of Contents

APPROVAL AND IMPLEMENTATION	2
LIST OF TABLES	6
CONTACT INFORMATION	7
RESPONSIBILITIES	8
RADIATION SAFETY PROGRAM ORGANIZATIONAL CHART.....	8
VICE PRESIDENT OF RESEARCH AND INNOVATION (VPR&I)	9
VICE PRESIDENT OF OPERATIONS.....	9
RADIATION SAFETY COMMITTEE.....	9
Current membership of the Radiation Safety Committee	10
RESPONSIBILITIES OF RADIATION SAFETY OFFICER (RSO)	11
General.....	11
Personnel dosimetry	11
Acquisition of radioactive materials	11
Receipt of radioactive materials.....	12
Quarterly inventory summary.....	12
Annual inspection of areas where radioactive materials are used	12
Sealed sources	13
Leak testing for sealed sources	13
Calibration of Geiger counters	13
Waste Management	14
RESPONSIBILITIES OF AUTHORIZED USERS	14
General.....	14
Worker Safety.....	14
Acquisition of radioactive materials	15
Transfer from other licensees	16
Receipt of radioactive materials.....	16
Running inventory of radioactive materials.....	18
Quarterly inventory of radioactive materials	18

Storage of radioactive materials	20
Labeling and posting requirements	20
Labeling of radioactive materials containers	20
Waste disposal.....	22
Shipping radioactive materials to other institutions	22
DISPOSAL OF RADIOACTIVE MATERIALS.....	22
General.....	22
Labeling of Radioactive waste	22
Segregation of wastes by form and isotope.....	23
Disposal of liquid wastes.....	23
Disposal of Solid wastes.....	25
Disposal of animal carcasses	27
Disposal of Specific wastes.....	29
Use of the sanitary sewer	29
GUIDE ON HOW TO PERFORM SPECIFIC RADIOLOGICAL SAFETY PROCEDURES.....	31
Obtain a radiation badge	31
Become an authorized user.....	31
Transfer radioactive material to another authorized user at UNT Health Science Center	32
PREGNANT AND FERTILE WOMEN	32
Policy on Radiation dose limits for pregnant women	32
METHODS TO REDUCE RADIATION EXPOSURE	34
General.....	34
Precautions to be observed when working with radioactive materials	35
Precautions to be taken with X-ray producing devices	40
Figure 13 C-arm X-ray machine	42
EMERGENCY PROCEDURES	43
ACCIDENTS INVOLVING THE SPILLS OF MATERIALS LABELED AS RADIOACTIVE:	43
APPENDIX A – Forms, Signs and labels	46
Running radioisotope inventory form	46

Monthly wipe test form	47
Quarterly radioisotope inventory form	48
Solid and liquid waste sticker and transfer form	49
Animal carcass tag	50
Monthly sink disposal form.....	51
Notice to employees	52
HSC radiation notice	53
Request for Radiation Badge Service.....	54
Signage for sink for radioactive waste disposal	55
APPENDIX B	56
Isotopes that may be disposed in sanitary type I landfill	56
APPENDIX C	59
Special Instructions to Central receiving and Campus Police.....	59
APPENDIX D.....	61
EXEMPTION FROM EXTERNAL PERSONAL DOSIMETRY	61
APPENDIX E	63
X-RAY USER COMPLIANCE GUIDE	63
Darkroom QA.....	64
APPENDIX F	65
RADIATION SAFETY TRAINING COMPLIANCE AND REVIEW.....	65
Adopted 10 October 2000 Meeting	65
APPENDIX G.....	68
Progressive Discipline for food and drinks	68
APPENDIX H.....	71
Progressive Discipline for Monthly Area Surveys.....	71
Appendix H Revised Version	73
APPENDIX I	74
Prohibited use of tritium Isotopes.....	74
APPENDIX J.....	75

Prohibited uses of Radioiodine 125-I and 131-I	75
APPENDIX K	76
Radioisotope usage history for unused isotope that is stored for more than 2 years.	76
APPENDIX L	77
RESEARCH INVOLVING USE OF RADIOISOTOPES IN ANIMALS	77
Radiation Safety Proposal Registration Form	77

LIST OF TABLES

TABLE V- 1 WORKER EXPOSURE LIMITS.....	15
TABLE V- 2 GOODS CATEGORY CODES.....	16
TABLE V- 3 SIGNAGE AND NOTICES	21

CONTACT INFORMATION

Subject	Office Name	Telephone	Email
Radiological Safety Program	Director, Radiation Safety Officer (RSO)	817-735-5431	Maya.nair@unthsc.edu
Radiological Hazards and Waste	Assistant Director Assistant Radiation Safety Officer(ARSO)	817-735-2697	Alan.Corbitt@unthsc.edu
Safety	Director	817 -735 -2245	Christopher.erickson@unthsc.edu
Occupational Health	Occupational Health	817 -735 -2273	

Emergency Phone Numbers

Police/Fire Emergency	Police Dispatch	In-house phone: Ext 2600 or 911 Cell phone: 817-735-2600
Emergency Power Outage	Facilities	Ext: 2181 / 817-735-2181
Hazardous Material Release/Spill	Police Dispatch	In-house phone: 2600 Cell phone: 817-735-2600
Hazardous Material Exposure: Skin, Eyes, Ingested, Inhaled, Injected	Occupational Health	Ext. 2273 / 817-735-2273

Other Important Institutional Phone Numbers

Hazardous material/ Waste	Ext: 2697 / 817-735-2697
Facilities Non-Emergency	Ext: 2181 / 817-735-2181
Environmental Health and Safety	Ext: 2245 / 817-735-2245
Radiation Safety	Ext: 5431 / 817-735-5431
Campus Police/Security Non-Emergency	Ext: 2210 / 817-735-2210

HSC Relevant Website links

Report an Ethics Compliant	https://secure.ethicspoint.com/domain/media/en/gui/54789/index.html
First Report of Injury	https://www.unthsc.edu/administrative/wpcontent/uploads/sites/23/WC_Employee_Forms.pdf
Student complaints	https://unthsc.qualtrics.com/jfe/form/SV_1Mn0lIToxTH3QF?Q_JFE=qdg
Waste Pickup Requests	https://forms.unthsc.edu/view.php?id=240571
UNTHSC IACUC	https://www.unthsc.edu/research/animal-research/iacuc
UNTHSC Radiation safety	https://www.unthsc.edu/safety/radiological-and-biosafety/radiation-safety-manual

This Manual specifies the minimum criteria to be met with any covered potentially radioactive materials and radiation producing devices. Individual PIs and laboratory managers may set more stringent criteria if and when it is considered prudent. This Manual should not be considered final or all-inclusive, however, since all possible situations can never be foreseen.

The administrative framework under which potentially radiation hazardous activities within UNTHSC laboratories by UNTHSC faculty, staff, students, contractors and visitors will be carried out is described below. This section outlines the basic roles and responsibilities of persons involved at each level of the approval, the monitoring or the supervision of radiation safety activities at the University. Further clarification and interpretation of these roles and responsibilities may be obtained by contacting the University's Radiation Safety Officer (RSO).

```
graph TD; VPRI[Vice-President for Research and Innovation] --- RSC[Radiation Safety Committee]; VPRI --- AU[Authorized User]; VPRI --- RS[Researcher and students]; VPO[Vice-President of Operations] --- EHS[EHS Director]; VPO --- RSO[RSO]; VPO --- ARSO[ARSO]; EHS --- RSC; EHS --- AU; EHS --- RS; RSC --- AU; RSC --- RS; RSO --- ARSO; RSO --- AU; RSO --- CM[Consultants, Radiology and Lab Animal Medicine]; AU --- RS;
```

The organizational chart for the Radiation Safety Program is structured as follows:

- Vice-President for Research and Innovation** oversees:
 - Radiation Safety Committee**
 - Authorized User**
 - Researcher and students**
- Vice-President of Operations** oversees:
 - EHS Director**
 - RSO**
 - ARSO**
- EHS Director** oversees:
 - Radiation Safety Committee**
 - Authorized User**
 - Researcher and students**
- Radiation Safety Committee** oversees:
 - Authorized User**
 - Researcher and students**
- RSO** oversees:
 - ARSO**
 - Authorized User**
 - Consultants, Radiology and Lab Animal Medicine**
- Authorized User** oversees:
 - Researcher and students**

VICE PRESIDENT OF RESEARCH AND INNOVATION (VPR&I)

The VPR&I is the primary oversight official for all research activities occurring on the HSC campus. The VPR&I has the responsibility and authority to perform the following actions relevant to the Radiation Program including but not limited to:

- Revoke, retract, and/or modify any research activity occurring on the HSC campus.
- Monitor all human and non-human research activities occurring on the HSC campus.
- Appoint RSC members, including the Chair, Vice-Chair, and *Ex Officio* members.
- Retract or modify IBC charters, policies, and procedures.
- Review documentation created, maintained, and/or authorized by the RSC.

VICE PRESIDENT OF OPERATIONS

The Vice President of Operations (VPO) is the primary oversight official for EH&S. The VPO has the responsibility and authority to perform the following actions relevant to the Radiation Safety Program including but not limited to:

- Review the EH&S Program.
- Review any documentation created, maintained, or authorized by the RSC.

RADIATION SAFETY COMMITTEE

The Radiation Safety Committee (RSC) is responsible for all policies and practices regarding the license, purchase, shipment, use, monitoring, disposal, and transfer of radioisotopes or sources of radiation at the health science center. The program's day-to-day details are delegated to the Radiation Safety Officer (RSO), who is also the liaison with the Bureau of Radiation Control. This responsibility rests with the Assistant Radiation Safety Officer (ARSO) and then with the RSC members in his absence. The RSC comprises one working member from each department that uses radioactive materials, and an administrative chairman. The committee membership will be drawn from the pool of approved isotope users and other faculty or staff who qualify based on their experience or expertise. One member will be designated the RSO. Members are appointed by the President for terms not to exceed three years. Members may be reappointed if necessary. The committee will meet a minimum of four times each year at the beginning of each calendar quarter (usually the second or third week in January, April, July, and October). Additional meetings can be called as deemed necessary. Minutes will be recorded.

More specifically, the RSC and RSO will see that:

1. Any operations felt to be radiation hazards are halted.
2. Inspections of areas where radioisotopes are stored and used are carried out a minimum of once yearly.

3. Each authorized user of radioactive materials and sources of radiation will maintain records of radiation surveys and radioisotope inventories.
4. Rules and procedures necessary to control the procurement and use of radioisotopes and radiation sources at the health science center are followed.
5. Instructions are provided as needed to assure adequate protection of health science center personnel and facilities in compliance with State and Federal regulations.
6. Comprehensive records on the acquisition, use, storage, and disposal of radioisotopes, and on all matters pertaining to the program involving radiation control are maintained.
7. The results of leak tests on sealed sources are periodically evaluated, and appropriate action is recommended to comply with State and Federal regulations.
8. Safety precautions and procedures for each prospective user of radioactive materials and radiation-producing equipment are reviewed before purchasing radioisotopes or the operation of ionizing radiation sources. (Safety precautions and procedures must be approved by the Radiation Safety Committee before and forwarded to the Bureau of Radiation Control for authorization to use radioisotopes. Isotopes or radiation-producing machines can be approved.
9. Radioactive waste materials are disposed of safely and timely by State and Federal regulations.
10. All health science center personnel (who use or plan to use radioactive materials or radiation-producing equipment) receive appropriate assistance and advice in radiation safety (protection, radiation monitoring, area posting, and record-keeping) and procuring, using, storing, and disposing of radiation sources.
11. The acquisition or transfer of all radioactive materials or radioactive producing equipment is authorized by the RSC and approved by the RSO.
12. Qualitative and quantitative limitations of the health science center's license are not exceeded and those placed on individual users by the RSC.
13. All machines which produce radiation are appropriately registered with state and federal Licensing Agencies.

Any committee member may prohibit the use of radioactive or radiation-producing devices in his/her judgment if such usage would violate the TAC rules governing the use of isotopes or the regulations outlined in this manual. This prohibition is immediately binding but may be appealed to the full RSC.

Current membership of the Radiation Safety Committee

Chairman: Authorized user appointed by Vice President for Research & Innovation. Members:
The current membership of the RSC is given on the Health Science Center's website
<https://www.unthsc.edu/safety/radiological-and-biosafety/radiation-safety-manual/>
Consultants: Jeff Beeson, DO Radiology

Egeenee Daniels, D.V.M Director of Animal Facilities

RESPONSIBILITIES OF RADIATION SAFETY OFFICER (RSO)

General

The day to day details of the radiation safety program at the University of North Texas Health Science Center are delegated to the Radiation Safety Officer (RSO) by the institutional Radiation Safety Committee.

Personnel dosimetry

The RSO shall contract with an NVLAP certified vendor for appropriate personal dosimetry services. Dosimeters shall be issued to all laboratory personnel working with radioactive materials, except as provided for by regulation and for those workers who work exclusively with tritium or carbon-14. Services, reporting intervals, and quality assurance shall comply with the conditions outlined in 25 TAC 289.202(p)(3) (Figure 1).

The results of all personal dosimetry shall be kept on file in the office of the RSO. These records shall be retained until the Bureau of Radiation Control authorizes their disposition.



Figure 1 Personal radiation dosimeter

Acquisition of radioactive materials

The acquisition of all radioactive material requires the prior approval of the RSO. Materials are to be acquired within the limits of the institutional license to possess such materials. The RSO shall stamp, date, and initial all approved requisitions and retain a copy of the requisition.

The RSO shall provide vendors and other licensees with copies of the institutional license when requested to do so as a condition of possessing radiation-containing materials shipped from vendors or other licensees.

Prior approval by the RSO is required to acquire all gas chromatographic equipment or scintillation counters containing radioactive sources. Approval by the RSO is required before acquisition of all devices that produce ionizing radiation.

Receipt of radioactive materials

Radioactive material shall be shipped to the health science center at the following address:

Radiation Safety Officer
UNT Health Science Center Central Receiving
3420 Darcy Street
Fort Worth, Texas 76107

Central Receiving shall receive all radioactive materials shipped via commercial carriers. Packages shall be picked up from Central Receiving unopened and taken to the RSO's laboratory for inspection and check-in. In the event of deliveries made during an official health science center holiday, during a severe weather closing, or on the weekend, Campus Police shall receive the package and immediately notify the RSO. See Appendix C (C-1) for special instructions to Central Receiving and Campus Police.

When materials are received, receiving records shall be photocopied and affixed to the requisition. These ordering and receiving records shall be kept on file in the RSO office for two years and made available to inspectors from the Bureau of Radiation Control.

All packages shall be inspected in compliance with 25 TAC 289.202(ee). For those packages that are exempted from wipe test requirements under this rule and which contain either gamma-emitting material or phosphorous-32 or sulfur-35, the RSO shall use a Geiger counter with a low energy scintillation probe (Ludlum 14C with a 44-3 probe or equivalent) to check for overt leakage inside the outermost container. No written record of such additional inspections is required unless contamination is detected. Reports of leaking packages shall be made in accordance with 25 TAC 289.202(ee).

Quarterly inventory summary

The RSO shall compile all quarterly inventory reports made by authorized users into a quarterly summary report for the institution. This summary report shall contain the types and quantities of received materials, used, on hand, and transferred to the RSO for disposal during a calendar quarter. Reports shall be made available to inspectors from the Bureau of Radiation Control.

Annual inspection of areas where radioactive materials are used

The RSO shall survey all areas where radioactive materials are used on an annual basis. This survey shall be performed in the spring, usually during February through May. The RSO will notify authorized users if any wipe tests reveal contaminated areas, and authorized users shall immediately clean the area until removable radioactivity is 100 DPM or twice background

levels, whichever is smaller. Results of the inspection shall be made available to inspectors from the Bureau of Radiation Control.

Sealed sources

Users possessing a sealed source shall report the exact location of such sources to the RSO twice yearly in January and June. During the annual inspection of areas where radioactive materials are used, the RSO shall verify sealed sources' location and identity.

Leak testing for sealed sources

RSO is responsible for periodical leak testing for any sealed sources. The results of the tests shall be made available to inspectors from the Bureau of Radiation Control. Gas chromatographs containing Ni-63 foil is an example of a sealed source (Figure 2).



Figure 2 Gas Chromatograph

Calibration of Geiger counters

The RSO shall contract with a vendor approved by the Bureau of Radiation Control for annual calibration of all Geiger counters used at the health science center (Figure 3). These calibrations shall be performed annually, usually in February and March. Institutional funds shall be expended to the extent possible to support this activity. Authorized users may be charged the actual cost of such calibrations should institutional funds not cover this requirement. Calibration records shall be retained for two years and be made available to inspectors from the Bureau of Radiation Control.



Figure 3 Geiger Counters

Waste Management

The RSO shall transfer and dispose of radioactive materials following the provision of Section VI of this manual and with applicable provisions of the Texas Regulations for Control of Radiation (TRCR). The RSO shall implement prudent and safe waste management practices as developed by the institutional Radiation Safety Committee and authorized by this manual and the Bureau of Radiation Control.

RESPONSIBILITIES OF AUTHORIZED USERS

General

Each faculty member authorized to use radioisotopes or sources of radiation (authorized user) is responsible for their safe use. Each user must carry out the required administrative and safety procedures, select applicable laboratory practices, train and supervise the laboratory personnel, acquaint them with proper radiation safety practices, and see that these practices are observed. Authorized users and their staff are required to attend orientation and annual refresher training sessions, which may be required by the RSO in consultation with the RSC. Each user must maintain a record on the receipt, use, transfer, storage, and disposal of radioisotopes, and the radiation. Also, the record of surveys conducted in his/her work areas and provide such information to RSC each quarter, or more often if deemed necessary. Each user must see that his/her laboratory is correctly posted with the Caution Radioactive Materials signs and Notice to Employees as required by state regulation. Any user must immediately notify the Radiation Safety Officer or a member of the Radiation Safety Committee if, during an experiment, unexpected difficulties might affect personnel's safety.

The General Accounting Office has determined that waste disposal costs for federal grants shall be an indirect cost of the grant. An authorized user will conduct no work with radioisotopes unless timely disposal is available. Every effort will be made to expend institutional funds prudently to serve the needs of as many users as possible. If authorized users anticipate unusual disposal needs, they must seek prior approval of the Radiation Safety Committee. **All users who generate animal carcasses must seek approval from the Radiation Safety Committee for such experiments before their initiation**

Worker Safety

The safe use of radioactive material or radiation in the laboratory is generally a matter of the proper attitude, informed personnel, planning, common sense, and adherence to laboratory rules and safety regulations. There are strict limitations placed on the amount of exposure workers are permitted to receive in any calendar year. 25 TAC 289.202(f) requires that:

Table 1 Worker exposure limits

The annual limit shall be the lesser of	The annual limits for skin, lens of the eyes, and extremities
(a) the total effective dose equivalent is no more than five rems (0.05 sievert)	(a) an eye dose equivalent of 15 rems (0.15 sievert)
(b) the sum of the deep dose equivalent and the committed dose equivalent to any individual organ or tissue other than the lens of the eye is no more than 50 rems (0.5 sieverts)	(b) the sum of the deep dose equivalent and the committed dose equivalent to any individual organ or tissue other than the lens of the eye is no more than 50 rems (0.5 sieverts)

These doses are to be considered absolute maxima. Every effort is to be made to conduct experiments and operations at levels, resulting in exposure of the lowest order of magnitude.

Minors and pregnant women require special consideration when working with or around sources of radiation. All such cases should be reported to and discussed with the RSO

Authorized users shall request radiation dosimetry services from the RSO for all persons who use radioactive materials or who work in restricted areas where there is a reasonable possibility that an individual could receive one-fourth of the exposure limits stated in Table -1 above. Please refer to appendix D for typical working situations that allow exemption from personal dosimetry.

Individuals who work in restricted in restricted areas where only tritium and carbon-14 are used do not require radiation dosimeters. Current technology does not allow accurate quantification of the radiation exposure to these low energy beta-emitting isotopes. Good working practices and wipe tests must be performed in such areas to assure worker safety. Authorized users may wish to badge these individuals if they also perform tasks in other authorized users' laboratories where other isotopes may be in use. Authorized users should seek the advice of the RSO in such cases.

Acquisition of radioactive materials

Authorized Users are responsible for following proper administrative procedures when ordering radioactive materials. **All orders require the prior approval of the RSO.** Users **may not** use a procurement card to purchase isotopes. Users must order radioactive materials through the ePro system.

For ePro orders, the item's single line description must include the catalog number, isotope name, chemical name, and radioactive quantity (each). For example, BLU013Z,[32P]dCTP,500µCi. In the justification text box on the Justification Summary page of the ePro order, type the following on the top line, followed by your other information:

RADIOACTIVE MATERIAL - Deliver to Safety Office

To have your radioactive materials order routed automatically to the RSO and his staff for approval, you **must** use one of the following goods category codes given in Table -2.

Table 2 Goods category codes

Goods Category	Description
193-80	Radioactive chemicals
269-78	Radioimmunoassay Kits

ePro orders that are approved by the account holder to the Safety Office for RSO approval. Either the RSO or the assistant RSO acting on behalf of the RSO may electronically approve the order. If ePro becomes unavailable due to emergency or disaster situations, the Purchasing Department will notify ePro users of alternative methods for submitting radioactive orders.

Orders are routinely approved for all authorized users who maintain a good safety record and compliance with regulations and established procedures, provided the amounts ordered are considered normal and routine. Suppose an authorized user wishes to order quantities of radioactive material that are well above those routinely ordered by that user. In that case, the RSO will consult with the authorized user regarding the order. The RSO will determine that the authorized user has a genuine need for such material and that adequate shielding and technique ensure worker safety. If the authorized user and RSO cannot agree, the matter will be referred to the Radiation Safety Committee. The committee shall make the necessary determinations if needed and the adequacy of procedures in consultation with the authorized user and the RSO. Such decisions shall not violate any part of state regulations governing radioactive material.

Transfer from other licensees

Authorized users who wish to obtain radioactive research materials from researchers at other institutions must contact the RSO before materials are shipped. The authorized user should have the name and phone number of collaborators at other institutions, the name and phone number of the RSO at that institution, and a description including amounts of the material to be sent. The RSO will contact the RSO of the other institution, send a copy of the health science center radioactive materials license to the other institution, and arrange for the materials to be shipped to the health science center at the address given below in the section entitled to receipt of radioactive materials.

Receipt of radioactive materials

All radioactive materials are to be shipped from vendors, or other licensees addressed to the RSO at the following address:

Radiation Safety Officer
UNT Health Science Center Central Receiving
3420 Darcy Street
Fort Worth, Texas 76107

All radioactive materials shall be picked up from Central Receiving by Safety Office staff, unopened, and transported to the RSO's laboratory for check-in. The RSO staff will inspect packages for damage and perform any required wipe tests. The RSO or a qualified member of the Safety Office staff will deliver the checked radioactive material to the authorized user's laboratory. See Appendix C for special instructions to Central Receiving and Campus Police personnel.

All radioactive materials shall be logged into the authorized user's running inventory of radioisotopes the same day they are delivered to the user's laboratory. A copy of the form for this purpose is in Appendix A this manual. It should be duplicated as needed. One log sheet shall be completed for each primary container of radioactive material received. For example, if you receive one bottle of radioactive material containing 5 mCi, you should complete one inventory sheet. If, on the other hand, you receive five bottles containing 1mCi each, you should complete five log sheets, one for each primary container. Log sheets and boxes of isotopes shall be labeled such that it is easy to match log sheets with containers.

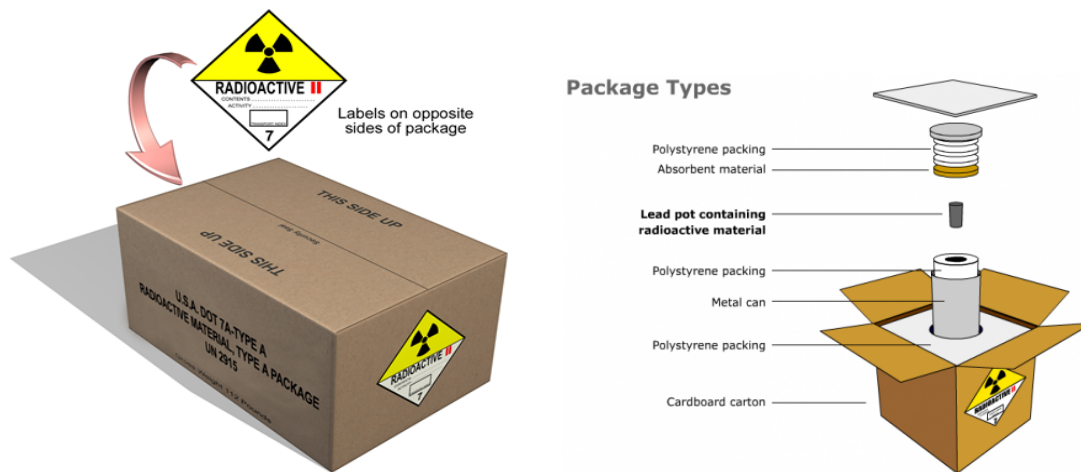


Figure 4 Radioactive package and 3-levels of containment

Authorized users and their staff shall inspect containers of radioactive materials closely. The RSO inspects all packages in compliance with 25 TAC 289.202(ee). However, this inspection is limited to the box's external surface, a check of the inside of the outermost container. Most packages are assembled with three levels of containment (Figure 4). Authorized users should

use caution when opening the second and third inner packages since the RSO's survey would not detect a leak at this level. Authorized users shall report leaking inner packages immediately to the RSO for follow-up.

When required, the RSO or his staff utilize beta scintillation counters and gamma counters capable of detecting the isotopes being survey (Figure 3). These devices possess sufficient sensitivity to assess packages' contamination levels, as outlined in 25 TAC 289.202(ee). When the package received is exempt from such wipe tests, and it contains gamma or moderate or high energy beta emitters, the RSO or his staff monitors the inside of the outermost package for overt contamination with a Geiger counter equipped with a low energy scintillation probe (Ludlum 14C with 44-3 probe or equivalent).

Running inventory of radioactive materials

Authorized users and their staff shall log radioactive material out of their current inventory when radioactive materials are removed from their primary containers. The inventory shall be kept in units of μCi or mCi . Volume quantities may also be indicated on logs but shall NOT be used for isotope inventory purposes. All information about the receipt of radioactive material at the top of the running inventory shall be completed when the material is received from the RSO. A copy of this form is in Appendix A of this manual.

Quarterly inventory of radioactive materials

Quarterly, authorized users shall prepare a decay-corrected inventory of all radioactive materials purchased during the quarter, used during the quarter, and remaining activities. Additionally, users shall indicate quantities of radioactive materials that were transferred to the RSO for disposal. A copy of this form is located in Appendix A of this manual. Inventories are due at the start of each quarterly Radiation Safety Committee meeting. Authorized users will be sent notice of such meetings and shall have at least one week to prepare inventories. Users should retain a copy of the inventory for their logbooks, and the RSO will retain one copy.

Monthly wipe tests

Authorized users and their staff shall perform wipe tests in all restricted areas under the control of the authorized user in which radioactive material is used during any calendar month. Monthly wipe test documentation must be turned in to the RSO on a timely basis. Wipe tests or documentation of no use during the calendar month is due the first working day of the next month and will be considered timely if received in the Safety Office by the close of business on the third working day of the following month. Refer to Appendix H of procedures and sanctions related to monthly area surveys.

If more than 1mCi of an isotope is used in a restricted area in any one month, a wipe test after each mCi of use shall be performed. For example, if you conduct ten experiments in one

month in which you use 100 μCi in each experiment, you would need to perform only one wipe test at the end of the tenth experiment. On the other hand, if you conducted ten experiments in which 1 mCi of isotope was used in each experiment, you would need ten wipe tests—one after each 1 mCi experiment. A copy of the wipe test form can be found in Appendix A. Workers should duplicate this form as necessary. This form contains spaces to identify laboratory locations, counts per minute (CPM) detected, calculated disintegrations per minute (DPM), and cleaning results, if needed. Persons performing wipe tests must count a background sample that can be subtracted from wipe test samples. Equally important is the need to set the scintillation counter's counting windows to detect the isotopes used in the laboratory. For example, it is NOT correct to use a narrow tritium window setting to count wipe test samples in a laboratory that uses tritium and one or more other isotopes such as carbon-14 or phosphorous-32. Multiple counting windows must be used in laboratories that use more than one isotope so that isotopes can be identified and appropriately quantified.

To perform a wipe test, use a piece of filter paper to swab a 10-cm x 10 cm section of a restricted area (Figure 5). Since the purpose of the monthly wipe test is to assure laboratory cleanliness and worker safety, workers should test areas where isotopes were actually used AND areas where isotopes should not be found – such as the handset of telephone, the door knob, or the keyboard of a computer in the restricted area.



Figure 5 Wipe test procedure and wipe test plate

If wipe tests reveal locations in the restricted area that have radiation levels more than twice background or 100 DPM, whichever is smaller, workers shall clean those contaminated surfaces with appropriate detergents and/or solvents until the removable contamination is less than 100 DPM or twice background. The contaminated locations shall be wiped again after cleaning and the results recorded on the wipe test form. All wipe tests shall be reported in DPMs!

Storage of radioactive materials

Authorized users shall ensure that all radioactive materials are secured in the areas that are designated for the use of radioactive materials. Hallway freezers, coolers and cabinets are NOT to be used for the storage of radioactive materials. When not in use or unattended by qualified laboratory workers, all materials shall be secured behind locked laboratory doors. If isotopes are stored in restricted areas, not under the exclusive control of the authorized user of the materials such as, the cabinet, cooler or freezer. In that case, it must be equipped with a lock and secured from unauthorized entry.

Labeling and posting requirements

Labeling of radioactive materials containers

All radioactive material All radioactive material containers shall bear the international radiation symbol, identity of the isotope, and amount (Figure 6 and Figure 7).

Labels Used on Radioactive Materials Packages

Standard size is approximately 4 inches x 4 inches.




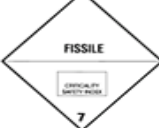

Label	Label Information	Example
Radioactive White-I	Extremely low radiation levels 0.5 mrem/hr (0.005 mSv/hr) maximum on surface	
Radioactive Yellow-II	Low radiation levels >0.5 - 50 mrem/hr (0.5 mSv/hr) maximum on surface; 1.0 mrem/hr (0.01 mSv/hr) maximum at 1 meter	
Radioactive Yellow-III	Higher radiation levels >50 - 200 mrem/hr (2 mSv/hr) maximum on surface; 10 mrem/hr (0.1 mSv/hr) maximum at 1 meter Also required for <i>HRCQ</i> shipments, regardless of radiation level	
Fissile	Applied to packages that contain <i>fissile materials</i> . The Criticality Safety Index (CSI) for each pack- age will be noted on the label. When used, the fissile label will appear adjacent to the radioactive material label.	
Empty	Applied to packages that have been emptied of their contents as far as practical but may still contain regulated amounts of internal contamination and minimal radiation levels detect- able outside the package (<0.5 mrem/hr).	

Figure 6 Labels used on radioactive materials

This labeling requirement includes the following:



1. Primary containers of radioactive materials
2. Stock solutions made from primary containers
3. Samples created from stock solutions
4. Autoradiography cassettes
5. Packages of radioactive wastes

Figure 7 Radiation hazard symbol

Authorized users are responsible for obtaining tape and stickers needed for this section.

Labeling of equipment with the designated use

All equipment used exclusively for work with radioactive materials must have a label with the international radiation symbol attached to the equipment, stating which isotopes are present. Such equipment includes, but is not limited to, vacuum manifolds used in filter binding assays, autoradiography cassettes, cell harvesters, aspirator flasks, etc. Authorized users are responsible for purchasing tape and stickers needed for the purposes of this section.

Required notices and signage for restricted areas

Authorized users shall ensure that each laboratory which is designated for radioisotope use under their control shall have the following signage and notices (Table V- 3).

Table V- 3 Signage and Notices

Sign Text	Where used
Caution radioactive materials	Sign at the entrance to each laboratory Obtain from the RSO
Appendix A	Notice to Employees from the Bureau of Radiation Control in each laboratory usually taped to the inside door or affixed to the interior wall.

Sign Text	Where used
Appendix A	UNTHSC Radiation Notice: In each laboratory, usually taped to the inside face of the door or interior wall

Waste disposal

Authorized users and their staff are responsible for contacting the RSO for pickup of radioactive wastes. Wastes must not be allowed to accumulate in a laboratory such that a health hazard exists. Workers can arrange pickup of wastes by calling the RSO.

Authorized users are responsible for the proper packaging and labeling of all wastes transferred to the RSO.

Shipping radioactive materials to other institutions

The institutional radioactive materials license allows for the shipment of radioactive materials to other licensees, provided that all state, DOT, and NRC requirements are met. Authorized users who wish to ship radioactive research samples to other institutions must do so via the RSO.

Authorized users are financially responsible for all packaging, containers, and shipping charges. Radioactive materials to be shipped off-site shall be inspected, packaged, and delivered to Central receiving for shipment by the RSO.

The institutional license does NOT currently authorize the transfer of radioactive materials for which compensation is exchanged. Depending on the activities' scope, the Department of State Health Services may assess an additional fee. Additional rerecord-keeping may be required, and an amendment to the license will be required. Under the existing institutional policy, authorized users would be financially responsible for additional fees to support such activities. Authorized users must consult the RSO before beginning such operations.

DISPOSAL OF RADIOACTIVE MATERIALS

General

To dispose of radioactive material cost-effectively, the health science center utilizes certain approved management practices to segregate waste, hold wastes, and dispose of waste. If followed by authorized users and their staff, these practices will make the most efficient use of the institutional waste disposal budget. Significant deviations from these practices will require charging users a fee to dispose of radioactive wastes.

Labeling of Radioactive waste

All waste containers for radioactive materials shall have affixed to the exterior of the container a sticker or tape with the international radiation symbol and the words:

Caution Radioactive Material

Figure 6 Caution radioactive material sign

The container shall be labeled to identify the isotope(s) and each isotope's total activity in μCi or mCi . A special tag for animal carcasses is available from the RSO for this purpose.

Segregation of wastes by form and isotope

To comply with state and federal rules and regulations on the packaging of radioactive wastes and provide cost-effective waste management, authorized users and their staff must aggressively segregate waste. An outline of waste segregation plan for liquids and solid waste is provided in Figures 9 and 10.

In general, solids must be segregated from liquids. Likewise, short half-life isotopes must be segregated from long half-life isotopes. Authorized users should refrain from generating waste that is a mixture of short and long half-life material, except when double-label experiments are necessary. The RSO is always available to help authorized users and workers determine how best to segregate wastes.

Disposal of liquid wastes

Liquid waste containers shall be labeled by laboratory personnel, as described above. Workers may call the office of the RSO and schedule a waste pick up. Workers must have available for the RSO's inspection the scintillation counting results from samples of each container of waste. The RSO will confirm that proper counting channels were set and that the wastes are correctly identified and quantified. Wastes will not be accepted from authorized users unless these requirements are met.

Biodegradable liquids

Biodegradable liquid wastes that contain radioisotopes in solution may be transferred to the RSO as bulk liquid wastes. These wastes, including biodegradable scintillation fluid, should be in sturdy one-gallon plastic or plastic-coated glass bottles.

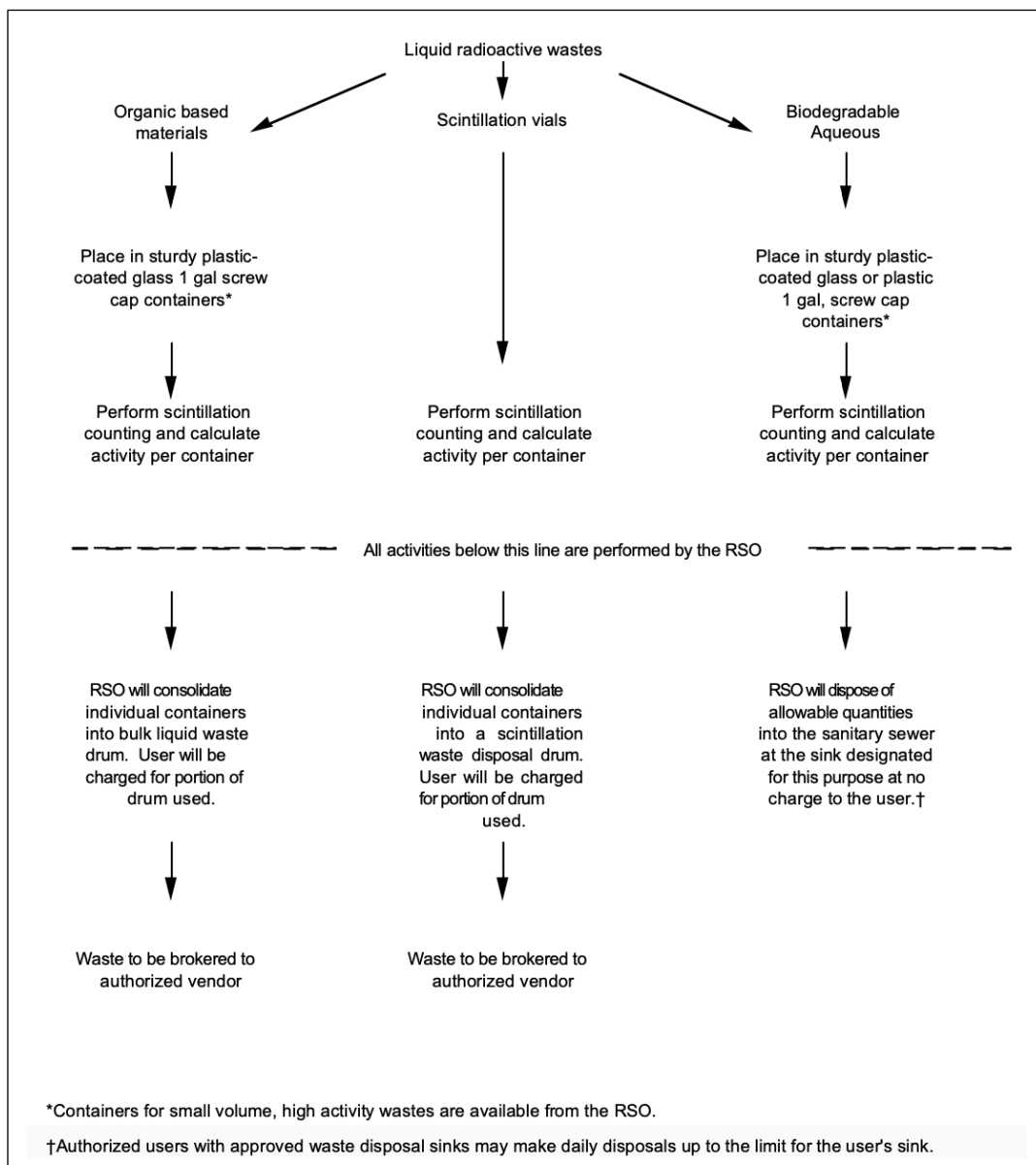


Figure 7 How to segregate liquid radioactive wastes

These bulk liquids shall be disposed of by the RSO by either disposal into the sanitary sewer or holding short lived isotopes for decay and subsequent disposal as non-radioactive wastes or as specific wastes as described in *Disposal of specific wastes*. In the event that wastes are held, the RSO shall attach a sticker identifying the waste, date of transfer, and who generated the waste. A photocopy of such a sticker can be found in Appendix A (A-4).

Authorized users who have an approved waste disposal sink may dispose of certain isotopes in the quantities specified by the RSO as described in *use of the sanitary sewer* section of this manual. No authorized user may dispose of radioactive material into the sanitary sewer without prior approval of the Radiation Safety Committee.

Organic-based or contaminated liquids

Organic-based scintillation cocktails and aqueous solutions containing chlorinated organic solvents, solvents that are not miscible in water, or which contain other environmental toxins shall be segregated by authorized users and their staff from other biodegradable liquid wastes.

Workers shall determine the isotopes and quantities of radioactive materials by appropriate scintillation counting techniques. These materials shall be labeled as described above and packaged in solvent resistant containers. These organic based wastes shall be transferred to the RSO at the expense of the authorized user.

The RSO shall maintain a bulk liquid type disposal barrel for such wastes. These wastes will be transferred to a radioactive waste broker approved for such business by the Bureau of Radiation Control.

Scintillation vials containing solvents

Scintillation vials containing radioactive materials and solvents of any type may be transferred to the RSO at the user's expense. Such wastes shall be held in barrels for this type of waste and then it will be brokered by the health science center to a waste vendor approved for such business by the Bureau of Radiation Control.

Disposal of Solid wastes

“Empty” scintillation vials

Empty scintillation vials may be discarded into the regular trash provided they meet the requirements of specific wastes as described below in *disposal of specific wastes*. Empty vials that do **not** meet these requirements must be double bagged in sturdy plastic bags and transferred to the RSO just like other paper, glass and plastic items which are contaminated with radioactive materials.

Paper, plastic and glass

Paper, plastic and glass contaminated with radioactive materials that do not meet the definition of specific waste as described in disposal of specific wastes shall be double bagged in plastic and placed in sturdy cardboard containers and labeled as described above.

Isotopes with half-lives longer than 89 days and which are not listed in Appendix B of this manual must be in bags not to exceed twelve inches on a side. Users shall identify isotopes and amounts to the RSO at the time of transfer. The RSO will attach a waste disposal sticker to each cardboard container. A photocopy of such a sticker can be found in Appendix A (A-4). Such materials are compacted by the RSO prior to placement in waste drums. These wastes will be transferred to a radioactive waste broker approved for such business by the Bureau of Radiation Control.

Paper, glass and plastic wastes contaminated with isotopes with half-lives less than 89 days shall be double bagged in plastic and placed in a cardboard container. The package is then transferred to the RSO. Users shall identify isotopes and amounts to the RSO at the time of transfer. The RSO will attach a waste disposal sticker to each cardboard container. A photocopy of such a sticker can be found in Appendix A (A-4). These wastes shall be held for ten half-lives. The packages will then be opened by the RSO and his staff, a survey of the exterior of the package with a thin window Geiger counter made and the results recorded. All identifying tape, marks etc. shall be removed from the contents and the contents of the package disposed in the regular garbage as non-radioactive wastes. Packages found to contain isotopes other than those identified to the RSO will result in a temporary halt to ordering of isotopes for the authorized user whose package was mislabeled. This halt to ordering shall continue until the RSO and Radiation Safety Committee are satisfied that steps have been taken to prevent recurrence of the incident.

Paper, glass and plastic wastes that meet the definition of specific wastes as described in *disposal of specific wastes* shall be discarded into the regular trash by laboratory personnel. Laboratory personnel must consult with the RSO if there is any question regarding whether items meet the specific wastes definition.

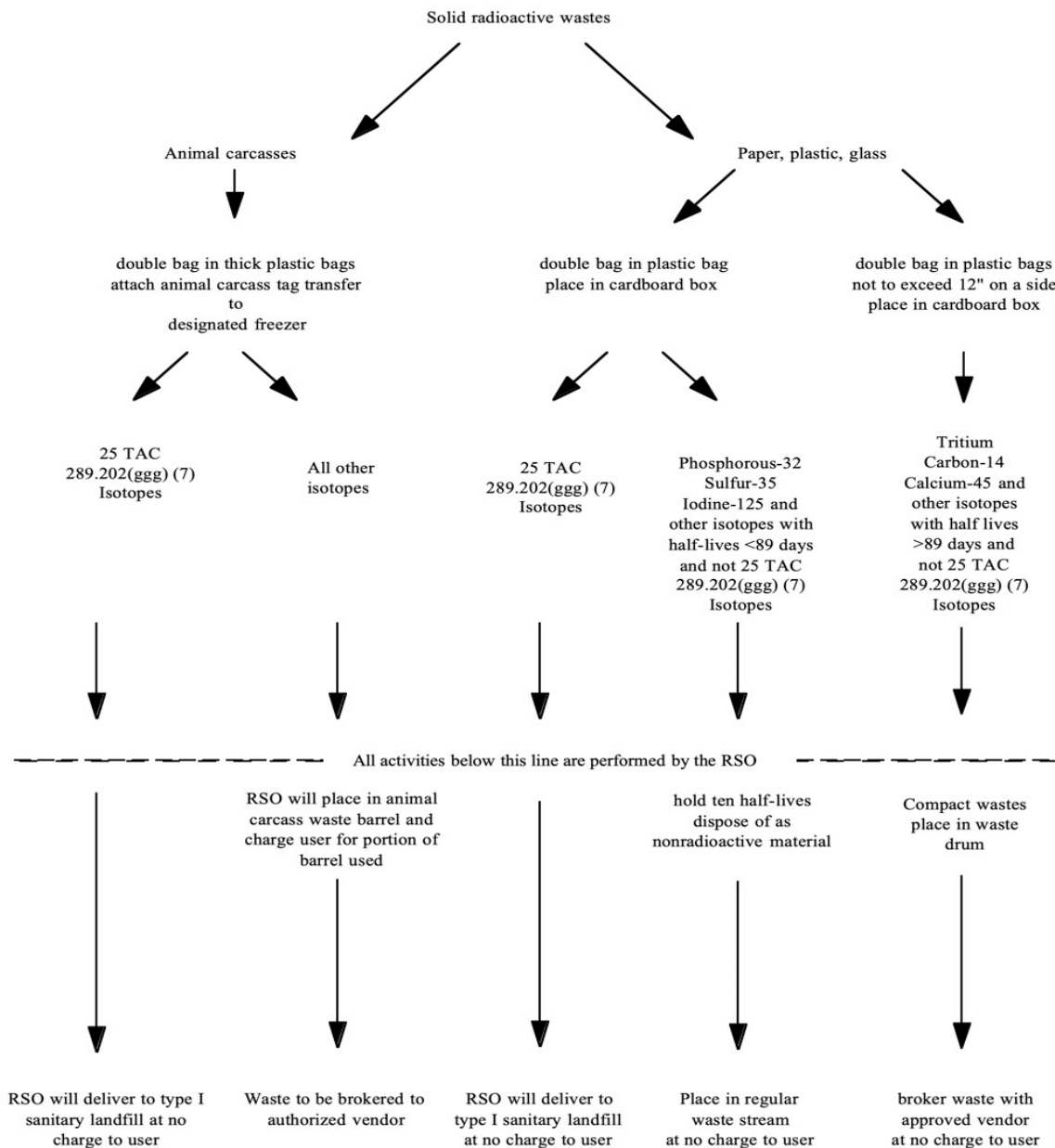


Figure 8 How to segregate solid radioactive waste

Disposal of animal carcasses

Authorized users may not generate animal carcasses contaminated with radioactive materials without prior approval of the Radiation Safety Committee. Researchers are cautioned to also seek the approval of the Animal Care and Use Committee.

Animal carcasses that do **not** meet the definition wastes as defined in *Disposal of Specific Wastes* and contain isotopes not listed in Appendix B of this manual shall be double bagged in sturdy plastic bags to which an animal carcass tag shall be affixed. An example of this tag shall be found in Appendix A (A-5) of this manual. Tags are issued to authorized users in serial order by the RSO. Carcasses are then transferred to a designated freezer for holding.

An example of this tag can be found in Appendix A (A-5) of this manual. Tags are issued to authorized users in serial order by the RSO. Carcasses are then transferred to a designated freezer for holding. Such carcasses will be placed in special waste drums at the authorized user's expense and transferred to a waste vendor approved for such business by the Bureau of Radiation Control.

Animal carcasses that do **not** meet the definition of specific wastes and contain ONLY those isotopes listed in Appendix B of this manual shall be double bagged in very sturdy plastic bags to which an animal carcass tag shall be affixed. An example of this tag can be found in Appendix A (A-5) of this manual. Tags are issued to authorized users in serial order by the RSO. Carcasses are then transferred to a designated freezer for holding. Carcasses shall not be generated which will require more than 180 days holding prior to disposal into a type I sanitary landfill. Disposal of these carcasses shall be governed by the provisions of 25 TAC 289.202(fff) (4):

Each carcass must meet the sum of the fractions rule for all isotopes in the carcass within 180 days of the death of the animal and prior to the disposal process. These wastes will be transferred to a radioactive waste broker approved for such business or by as per the Bureau of Radiation Control rules. RSO will make carcass disposal arrangements based on the provisions of 25 TAC 289.202:

The RSO shall survey five percent of the carcasses in any transfer. Such surveys shall be made with a thin window Geiger counter at 1 meter from the carcasses. Radiation levels shall be consistent with those quantities listed on the tag. Because carcasses routinely contain four or more isotopes with varying energies and because isotopes are generally not uniformly distributed, more invasive investigations of packages is not practical. A record of the surveys shall be made, and a copy given to the landfill operator upon request. A copy will be retained in the office of the RSO and made available to inspectors from the Bureau of Radiation Control.

Animal carcasses which meet the definition of specific wastes may be bagged in plastic bags and transferred to the Animal Facility personnel for disposal as special waste in a type I landfill. Such carcasses and bags shall NOT have any tag, tape or marking that identifies the waste as containing radioactive material or that it is from the health science center.

Disposal of Specific wastes

For the purposes of this manual, specific wastes are defined as wastes containing concentrations of tritium, carbon-14 and/or iodine-125 within limits specified by 25 TAC 289.202(fff) (1). Specifically:

- 1) 0.05 microcuries or less of tritium, carbon-14 and iodine-125, per gram of medium, used for liquid scintillation counting or *in vitro* clinical or *in vitro* laboratory testing;
- 2) 0.05 microcuries or less of tritium, carbon-14 and iodine-125, per gram of animal tissue averaged over the weight of the entire animal; provided however, tissue is not disposed of in a manner that would permit its use either as food for humans or as animal feed.

Laboratory personnel may dispose of waste which meets these criteria without regard to its radioactivity: Animal carcasses which meet the test of this section may be disposed of by incineration on campus or by burial as special wastes in a type I sanitary landfill by either the RSO or the Director of the Animal Facility and his staff.

Use of the sanitary sewer

Radioactive material may not be discharged into the sanitary sewer system of the health science center unless it is readily soluble or dispersible in water and can be released only after approval of the RSO in consultation with the Radiation Safety Committee. Short-lived radioisotopes may need to be held for decay before disposal into the sanitary sewer system. Limits for each radioisotope are specified in 25 TAC 289.202(ggg)(2)(F) Table III for use with 25 TAC

289.202(gg) (1). The gross quantity of radioisotopes released into the sanitary of the health science center must not exceed one curie per year.

Mixtures of radioisotope with environmental toxins can prevent the disposal of isotopes through this avenue. Therefore, users shall avoid contamination of radioactive wastes with environmental toxins which restrict the waste disposal. No alpha isotopes may be discharged into the sewer system.

Disposal of liquid radioactive wastes via the sanitary sewer system:

- 1) The disposal of small quantities of water soluble liquid radioactive wastes is allowed under state and federal regulations.
- 2) The disposal of any isotopic material in the sanitary sewer requires prior approval of the Radiation Safety Officer. Individuals making disposals shall demonstrate proficiency in scintillation counting prior to performing disposals.
- 3) Unless otherwise approved, this disposal will only be permitted in the stainless-steel sink in the isotope handling room RES-408

- a) Authorized users may apply to the RSO and Radiation Safety Committee for permission to designate a sink for disposal. Users will provide a rationale for their request.
- b) Authorized users with a radioactive disposal sink in their laboratories will make the disposal site available, on a reasonable basis, to other authorized users during normal working hours.
- c) The authorized user will assume the responsibility of keeping disposal records for that sink. The following information shall be recorded for every disposal on a daily log posted adjacent to the sink (see Appendix A, A-6):
 - i. The date of the disposal
 - ii. The identity of the isotope
 - iii. The number of μCi disposed
 - iv. The name of the authorized user whose isotope (s) are disposed.
- d) A space will be provided on the daily log sheet to indicate the total radioactivity disposed in the month and the quantities disposed for the month broken down by isotope.
- e) The Authorized user will forward a copy of the disposals made to the RSO at the end of each month.
- f) Sink disposal records will be reviewed at the quarterly Radiation Safety Committee meeting.
- g) Before a sink is designated as a disposal point, a plumber will inspect the sink and certify that it is sealed properly, and that the plumbing under the sink is in good repair.
- h) The sink shall be fitted with a drip pan to hold at least 1 gal of liquid. The RSO shall be immediately notified if a leak is discovered.
- i) The sink shall be prominently posted as a radiation disposal point [See Appendix A (A-10) and the allowed limits for specific isotopes will be posted in $\mu\text{Ci/day}$.
- j) If a user wishes to vacate a laboratory with an approved disposal sink or desires to convert the sink back to general use, the user will inform the RSO well in advance of the anticipated change, the user will perform wipe tests on the sink and sample the plumbing of the sink at the U-joint for radioactive contamination. Sinks and U-joints shall have less than 0.005 μCi of removable

radioactivity / 100 sq. cm. prior to being designated as general use sinks.

Following a review of wipe test data by the RSO and approval, the sink may be designated as a general use area.

- 4) The RSO will keep a permanent record of all radioisotopes disposed into the sanitary sewer system.
- 5) The RSO will perform calculations when there is a change in the number of sinks or number of isotopes disposed to ensure that the sum of fractions is never exceeded, that the total 1 Ci / yr. limit is never exceeded, and that the daily disposal limits for each sink are updated. Disposal needs will be reviewed at quarterly Radiation Safety Committee meetings and new disposal limits issued as appropriate.

GUIDE ON HOW TO PERFORM SPECIFIC RADIOLOGICAL SAFETY PROCEDURES

Obtain a radiation badge

Persons needing a radiation dosimeter should photocopy the form found in Appendix A. This form is to be completed by the authorized user for a member of his or her staff who needs the badge. The form should be sent to the office of the RSO. The RSO will issue a temporary badge and a permanent badge with the name of the worker shall be ordered. Badges may be picked up in the office of the RSO when they are ready.

Become an authorized user

UNT Health Science Center faculty members may apply to the Radiation Safety Committee for permission to become authorized users of radioactive materials. Such an application consists of the following items:

1. A memorandum addressed to the Radiation Safety Committee requesting permission to become an authorized user of radioactive materials. This memorandum should briefly list the isotopes to be used, quantities to be kept on hand and the general nature of the experiments. Describe the radiation detection devices you possess or will acquire to ensure worker safety. Also include the room numbers of laboratories in which radioactive materials are to be used and stored. The memorandum should be sent to the office of the RSO.
2. A Curriculum Vitae
3. A brief history of previous experience with radioactive materials including undergraduate, graduate and postdoctoral use. Indicate which isotopes and whether

experiments were generally in the microcurie range or in the millicurie range. Estimate, if possible, the total amount of each isotope for which you have experience. Also indicate the general nature of the experiments conducted—*in vitro* assays, short or long-term *in vivo* experiments in an animal model, etc. Also state if you have documented radiation safety training. If so, list when trained and where.

The Radiation Safety Committee will review this packet of information and recommend applicants to the Bureau of Radiation Control to become authorized users under the institution's specific radioactive materials license. The RSO will forward packets of information to the Bureau.

Transfer radioactive material to another authorized user at UNT Health Science Center

Authorized users may exchange up to 1 mCi of radioactive material per calendar quarter with other authorized users at the center without notification of the RSO provided that material is logged out of one user's inventory on the date of transfer and logged into the recipient's inventory. Larger amounts require notification of the RSO.

When the Authorized radioisotope leave UNTHSC

Authorized users should notify RSO or ARSO about their termination or transfer from UNTHSC. All the isotopes and waste must be transferred to RSO. Area survey should be performed by the Investigator and submitted to RSO before the exit interview. RSO or ARSO will verify the information perform the closeout area survey and decommission the laboratory. Closeout survey will be conducted and reviewed by the same procedure used for annual area survey.

PREGNANT AND FERTILE WOMEN

Policy on Radiation dose limits for pregnant women

It is recognized that the human embryo and fetus are much more sensitive to radiation than the adult. In view of this, we recommend that occupationally exposed pregnant females' occupational radiation dosages not exceed a level that would result in exposure to the embryo and fetus of more than 500 millirem. This limit is consistent with the current annual exposure limits for minors and members of the general population, and reflects the current recommendation of the National Council on Radiation Protection and Measurement:

Occupational Exposure of Fertile Women*

Exposure of the Fetus

(240) During the entire gestation period, the maximum permissible dose equivalent to the fetus from occupational exposure of the expectant mother shall not exceed 0.5 rem.

*NCRP Report No. 39, *Basic Radiation Protection Criteria*, pp. 93 & 93

Comment

(241) The need to minimize exposure of the embryo and fetus is paramount. It becomes the controlling factor in the occupational exposure of fertile women. In effect, this implies that such women should be employed only in situations where the annual dose accumulation is unlikely to exceed 2 or 3 rems and is acquired at a more or less steady rate. In such cases, the probability of the dose to a fetus exceeding 0.5 rem before a pregnancy is recognized is negligible. Once a pregnancy is known, the actual approximate dose can be reviewed to see if work can be continued within the framework of the limit set above. It should be particularly noted that paragraph 240 reads that the dose equivalent should not exceed 0.5 rem. In terms of conventional NCRP usage, the word "should" as be used here is less restrictive than the word "shall" which appears in other statements of maximum permissible dose equivalent. The purpose of this is to acknowledge that the method of application (as suggested above) is speculative and needs to be tested for practicality in a wide range of occupational circumstances. For conceptual purposes the chosen dose limit essentially functions to treat the unborn child as a member of the public involuntarily brought into controlled areas. Despite the use of the permissive "should" terminology, the NCRP recommends vigorous efforts to keep exposure of an embryo or fetus to the very lowest practicable level.

If necessary, to stay below this dosage limit, pregnant females shall be given the opportunity to transfer to other jobs not involving occupational exposure. As a minimum, all pregnant females shall be advised of the possible adverse effects upon the embryo and fetus due to radiation. No pregnant employee shall be allowed to exceed the occupational exposure limit of 1.250 rem in any calendar quarter without careful consideration and weighing of the possible benefits and hazards associated with such exposure.

PERSONAL POLICY MEMORANDUM

TITLE: Radiation Exposure of Pregnant Employees

PURPOSE: Radiation exposure of the human embryo and fetus shall be avoided whenever possible, especially during the first six weeks of development when the embryo is most sensitive to radiation.

PROCEDURE: 1. Radiation monitored employees:

- a. Employees who become aware that they are pregnant shall report it to their immediate supervisor.
- b. The supervisor shall report this to the Radiation Safety Officer who will determine all dosage levels within the time frame of the employee's pregnancy so that any fetal dosage may be calculated and checked against the prescribed limits.

- c. The pregnant employee shall be assigned a workstation which will minimize the possibilities of radiation exposure to the fetus. The radiation exposure will be monitored very closely.

METHODS TO REDUCE RADIATION EXPOSURE

General

Each faculty member authorized to use radioisotopes or sources of radiation (user) is responsible for their safe use. Each user must carry out the required administrative and safety procedures, select applicable laboratory practices, train and supervise the laboratory personnel, acquaint them with proper radiation safety practices, and see that these practices are observed. Each user must maintain a record file on the receipt, use, transfer, storage, and disposal of radioisotopes, and on the radiation surveys conducted in his/her work areas and provide such information to RSC each quarter, or more often if deemed necessary. Each user must see that his/her laboratory is properly posted with the Radiation Caution Signs and Notification to Employees as required by state regulation. Any user must immediately notify the Radiation Safety Officer or a member of the Radiation Safety Committee if, during an experiment, unexpected difficulties might affect the safety of personnel.

The maximum permissible radiation level for unrestricted areas and maximum permissible dose for individuals as listed in state regulations 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 an order of magnitude lower. Minors and pregnant women require special consideration when working with or around sources of radiation. All such cases should be reported to and discussed with the RSO.

Special use of laboratory RES-408

Laboratory RES-408 is available and intended for the following uses:

- a) Liquid waste disposal at or below allowed levels in the sewer system. This procedure is prohibited elsewhere, except as approved by the Radiation Safety Committee.
- b) Experiments employing gamma or penetrating beta emitting isotopes when an investigator does not wish to use these in his/her own assigned laboratory. Such use will be of short duration, not to interfere on a long-term basis with other uses of the laboratory.
- c) For use by authorized users whose own laboratories may not be properly equipped for handling radioisotopes. Such use will be of short duration, not to interfere on a long-term basis with other uses of the laboratory.

- d) All hazardous processes such as iodination and work with millicurie amounts of DNA precursors must be confined to the hoods in RES-408.

Precautions to be observed when working with radioactive materials

The safe use of radioactive material or radiation in the laboratory is generally a matter of the proper attitude, informed personnel, planning common sense as well as adherence to laboratory rules and safety regulations. There are strict limitations placed on the amount of exposure users are permitted to receive in any calendar quarter. Because very little is known about the effects of even very small exposures to radiation, one should always strive to reduce unavoidable exposures further. There are three methods to do this:

- a) Reduce the TIME radiation sources are out or turned on
- b) Increase the distance between sources of radiation and personnel
- c) Increase the shielding between sources of radiation and personnel

To maintain compliance with the Texas regulations, and to ensure the protection for all personnel, the following procedures must also be incorporated into each authorized user's radiation safety program. The units of radiation dose and radioactivity are defined in 25 TAC §289.201(b).

1. Signs are to be posted wherever radioactive materials are present and areas shall be designated as restricted areas where a dose is above 2.0 mRem/hr. Only persons authorized to use radioactive materials or radiation-producing devices shall be allowed in restricted areas.
2. All radioisotope storage areas are to be locked when unattended.
3. In all areas where the dose rate may exceed 2.0 mRem/hr., the radiation must be monitored by appropriate methods and the results recorded in permanent records.
 - a. TLD badges and/or pocket dosimeters are to be worn by everyone who enters a radiation area, everyone who enters a high radiation area, and also everyone who uses or operates any source of radiation.
 - b. Neutron sources must be monitored by film badges and dosimeters that are capable of detecting neutrons. The health science center is NOT currently licensed to possess neutron sources.
 - c. Low-energy radiations, such as those from tritium, carbon-14, and low-energy x-rays or gamma rays, shall be monitored by methods appropriate to each of these sources of radiation; since most badges and dosimeters are ineffective.

4. No use of radioisotopes are occurring or anticipated to define a high radiation area where radiation levels are greater than 100 mRem/hr. Proposals of such anticipated usage will require submission of detailed protocols for approval by the Bureau of Radiation Control.
5. In experiments using tritium and carbon-14 in excess of 25 mCi must be approved by the Radiation Safety Committee. Bioassays in the form of pre- and post-urine counts may be required.
6. Working areas should be monitored as follows:
 - a. Not less than once a month for areas employing samples usually less than 100 microcuries each.
 - b. Before and after each use of samples containing 1 millicurie or more. The results shall be recorded in the laboratory logbook. Surfaces showing more than 0.4 mRem/hr. dose rate at one centimeter from the surface must be decontaminated. Where good machine backgrounds are obtainable, all areas with more than twice background or 100 DPMs, whatever is less, should be cleaned.
7. Survey instruments should be present during operations in which isotope concentration, chemical form or procedures are such that the RSO deems that the risk of exposure might exceed allowable limits. Survey metering shall be encouraged whenever any level of penetrating or emitting radioisotopes are used. Each investigator employing these radioisotopes is strongly encouraged to purchase and maintain his own survey instruments and check them monthly. The loan of radiation detection equipment from the office of radiation safety is possible when an investigator is, for example, conducting a one-time only experiment.
8. Minor spills as defined in section I of this manual are to be cleaned up immediately. If a major spill occurs, do not attempt to decontaminate. Isolate the area and notify the RSO immediately.
9. Protective clothing and hands are to be monitored upon completion of laboratory work involving use of any unsealed penetrating radioisotopes.
10. Smoking, drinking, or eating are not allowed in areas where radioactive materials are used or stored.

11. Employees must wash their hands thoroughly before smoking, eating, or leaving an area where unsealed radioisotopes are being used.
12. Food or drinks can not to be stored in refrigerators or freezers used for storage of radioactive materials.
13. Mouth pipetting of liquid radioisotopes is forbidden. Use a rubber bulb or a mechanical pipettor.
14. All radioisotope utilization areas must be monitored according to the guidelines on section V of this manual. The radiation detecting instrument used must be compatible with the particular type of radiation work being done in the area. When isotopes have not been in use, wipe tests may not be needed. In months when wipe tests are not needed, this must be noted, dated and initialed on the monthly wipe test form.
15. Long-handled tongs, gloves, smocks, shoe covers, glove box or fume hoods, and other equipment are to be used whenever such safety measures are needed. When it is uncertain if special equipment is necessary, the user should contact the RSO for assistance. In general, millicurie quantities of volatile hazardous materials (radioactive hydrocarbons, iodine solutions, DNA precursors, etc.) must be handled in the fume hood in Room 2-308. Tens of millicuries of any radioactive material must be handled in fume hoods.
16. Gloves and smocks shall be worn by all employees always when working with radioactive materials. Use of millicurie amounts requires second, and third line defenses such as shielding, fume hoods/glove boxes, personnel monitoring and bioassays.
17. Sealed sources will not be opened nor will radioactive materials be handled with bare hands.
18. Control of access into restricted areas is the responsibility of the individual supervising the project.
19. Radiation detecting instruments such as ionization chambers, proportional counters, and Geiger counters which are used for general radiation surveys shall be calibrated yearly. Each instrument will be calibrated to read within $\pm 20\%$ of the correct exposure reading.
20. Radioisotopes producing a radiation dose level more than 1 mRem/hr. at a distance of 1 foot from the source must be stored in shielded containers of sufficient thickness to

reduce the dose rate to 1 mRem/hr. at a distance of 1 foot from the surface of the container.

21. Unbreakable, leakproof or secondary containers should be employed to prevent accidental spillage of all radioactive materials, especially liquids.
22. Work involving liquid radioisotopes shall be performed on trays lined with absorbent paper or on surfaces protected with plastic-backed absorbent paper.
23. Radioactive materials shall not be used in or on human beings or in field applications without prior approval of the Bureau of Radiation Control.
24. Chemical hoods in which radioactive materials are used must have a minimum air velocity of 100 linear feet per minute at the face and a negative pressure differential.
25. All glassware and equipment containing radioactive material shall be properly labeled if they are to be left unattended for a period.
26. Trial runs to determine proper procedures and to evaluate necessary radiation protection shall be made whenever possible.
27. Only designated (labeled) sinks will be used for washing contaminated glassware.
28. Only a designated (labeled) storage cabinets will be used for the storage of radioisotopes.
29. All radioisotope containers must be labeled in accordance with TRC Regulations with the following information:
 - a. Radioisotope
 - b. Activity and date
 - c. Authorized user
30. All radioisotopes must be secured against unauthorized access or removal. Approved warning signs must be posted on the room and storage location.
31. In case of suspected or known overexposure to any employee, the RSO must be contacted immediately. A written report must be made in each case of overexposure by the person supervising the use of the radiation on the project. This report must explain fully why the employee involved was subjected to an excessive amount of radiation and will recommend measures to be taken to avoid a recurrence of the accident.

32. Records of the radiation exposure of all personnel utilizing radiation will be kept by the RSO. Reports of exposure history will be sent to personnel upon request.
33. The eyes are one of the most sensitive tissues to radiation damage. Safety glasses, optical glasses, or goggles are always encouraged but must be worn always when working with penetrating beta-emitting radioisotopes such as ^{32}P . Persons working with more than 0.1 mCi of ^{32}P must use adequate absorptive shielding always.
34. Proposed changes in the use for which authorization was originally granted must be submitted to the Radiation Safety Committee for approval and forwarded to the Bureau of Radiation Control for authorization. New uses in established laboratories by previously authorized users may be started after review by the Radiation Safety Committee if compatible with existing license authorizations and procedures.
35. The RSO must be notified when radioisotopes are transferred from one authorized user to another except as provided in the radioactive material section of of this manual.
36. Radioactive wastes must be disposed of in accordance with radioactive material disposal section of this manual.
37. Copies of a bulletin entitled "Notice to Employees" must be posted in a sufficient number of places in every establishment where employees are engaged in the activities using radiation or radioisotopes so that all employees entering the area may read the bulletin.
38. Every employee using radiation-producing equipment or radioisotopes must be familiar with the appropriate regulations of this Manual and state regulations. Copies of these regulations are available upon request from the RSO or from individual departmental representatives. All laboratory personnel working in areas where radioisotopes are used or stored must be instructed either by formal course work or by the laboratory director in the health protection problems associated with exposure to radioactive material and in methods to minimize exposure. Workers will also be instructed to observe the rules for protection from exposure to radiation and report to the RSO any violation or unnecessary exposure to radioactive material. Workers will also be instructed in the appropriate response to warnings of possible exposure to radioactive material and shall be advised of radiation exposure reports which workers may request according to 25 TAC §289.202(rr).
39. When radioisotopes are used in experimental animals, these animals must be confined to the authorized users' laboratory and handled only by authorized users of radioisotopes. Protocols which result in contaminated excretory products or gases must be submitted to the Radiation Safety Committee for examination and approval by the Bureau of

Radiation Control. Only experiments employing small quantities of tracer microspheres which are 100% tissue trapped can be conducted in animals without further approval. Microspheres shall not be administered orally. Contaminated tissues must be collected for proper disposal as described for liquid or solid radioactive waste. Laboratories where such animals are housed must be posted and locked with access restricted and under the supervision of an authorized user. Such areas must be monitored before and after experiments and if contaminated, they must be decontaminated with solvent or detergents appropriate to the chemical form of the isotope involved.

40. Iodine-125 or 131 in un-contained forms may be used in the hood in Room 2-308 in amounts not to exceed 10 mCi per calendar quarter per individual worker. Amounts up to 100 mCi per calendar quarter per individual worker may be used if contained in a glove box in Room 2-308. Use of radioiodine in amounts in excess of those indicated for the hood or a glove box will require establishing procedures for bioassay of workers which may require purchase of bioassay equipment at considerable expense to the institution. Prior approval of the Radiation Safety Committee and amendment of the radioactive materials license will also be necessary. Experiments employing mixtures of radioiodine isotopes are not allowed.
41. Additions and alterations to these rules may be made by the Radiation Safety Committee with approval of the Bureau of Radiation Control when in the estimation of the Committee such additions and alterations are necessary for the protection of the health science center and its employees. Authorized users will be notified of any such changes in a timely manner.
42. If radioisotopes are stored in a cabinet or refrigerator, there must be sufficient shielding around the radioisotopes such that the radiation level at the surface of the cabinet or refrigerator is less than 2 mRem/hr. or posting of the signs must be in compliance with 25

TAC §289.202(cc) and must provide adequate security as required in 25 TAC §289.202(y).

Precautions to be taken with X-ray producing devices

Only qualified personnel will be allowed to operate X-ray units or electron microscopes. A TLD badge and/or pocket dosimeter must be worn by operators of X-ray units, and a suitable area monitor be used for the general area of the generator or microscope to ensure that excessive radiation levels are not present to endanger the operator or other personnel.

X-rays may not be administered to humans except by a licensed physician or nurse or technician who is certified by Bureau of Radiation Control or registered with the Texas State Board of

Nursing Examiners or the Texas State Board of Medical Examiners and an approved hardship exemption approved by the Bureau of Radiation Control.

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

The Radiation Safety Committee must be notified whenever the shielding or the location of X-ray generators is changed.

All X-ray machines, electron microscopes and other radiation producing equipment are required to be registered with the Division of Occupational Health and Radiation Control, Texas Department of State Health Services by state regulation. Health science center personnel purchasing radiation producing equipment must contact the Radiation Safety Officer, who will submit registration forms to the State.



Figure 9 Portable X-ray machine



Figure 12 Universal X-ray System



Figure 13 C-arm X-ray machine



Figure 10 Transmission electron microscope

EMERGENCY PROCEDURES

ACCIDENTS INVOLVING THE SPILLS OF MATERIALS LABELED AS RADIOACTIVE:

NOTIFY CO-WORKERS in the immediate area about the spills and ask them to call the LABORATORY SUPERVISOR. If the laboratory supervisor is not available notify Radiation Safety Officer and EHS staff. CONFINE THE SPILL using the quickest and easiest methods available (i.e., set the spilled container upright and lay paper towels over the spilled material).

If the spill occurs after hours notify the CAMPUS POLICE at **ext. 2600** who will in turn notify the Radiation Safety Officer.

AVOID TRACKING the radioactive material to other parts of the building. Ask a co-worker to prevent others from entering or crossing the area of the spill.

If any of the materials were spilled on you or your clothing, CALMLY GO TO THE NEAREST SINK. Remove the contaminated clothing and place it in the sink. Flush surface of the skin with water and then again with soap and water. Flush the clothing with water as well.

Proceed with further clean-up ONLY under the direction of the laboratory supervisor or the Radiation Safety Office.

General

In the event of any emergency involving radiation or radioactive materials, the following materials can be obtained from the Radiation Safety Office: scrubs, disposable gloves and shoe covers, decontamination wash, pocket dosimeters, high-and low-range survey instruments, radiation signs, tags, labels, aprons, handling tongs, and plastic bags.

A radiation incident will be defined as any loss, unplanned exposure or spills involving ionizing radiation. In the event of a radiation incident, report immediately to the RSO or a Radiation Safety Committee member. The procedures outlined in Table I-1, page I-4 or in subsequent parts of this manual are to be followed.

Radiation generating machines

In the event that any person is suspected to being exposed to radiation in excess of the limits specified in Section V of this Manual, the following steps should be taken:

1. Turn off the radiation generating machine.
2. Do not change voltage or current controls or alter the position of the tube head so that the conditions of irradiation may be duplicated to determine the extent of the radiation exposure.
3. Notify the RSO of the incident.
4. Record the conditions which existed when the exposure occurred so that the RSO can determine the extent of the exposure.

Radioactive materials

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

1. If there is danger of spreading contamination, get a doctor to the patient and let the doctor render preliminary treatment at the scene. Serious injuries should be treated immediately without regard to contamination. That is, bleeding should be stopped, treatment for shock given, etc. If the injury is minor, the patient should be decontaminated first.
2. Call for a doctor and an ambulance so that the ambulance equipment will be available for treating the patient at the scene.
3. Transport the patient to the hospital in an ambulance, police car or private car.

In order to make an intelligent decision, the following factors must be considered:

1. Is external contamination immediately harmful to the patient or those aiding the patient?
2. All but a very few of the most serious accident cases can be treated successfully by medical personnel at the scene.
3. Will transport of the injured person to the hospital increase the health risk by spreading contamination?
4. There is generally little likelihood of harmful contamination to other people in the ambulance or emergency room.
5. Instruments for evaluating contamination may not be available at the hospital emergency room.

In the rare case in which it is thought advisable to take a contaminated individual to the hospital, the following actions should be taken:

1. Contaminated clothing should be removed, if possible.
2. A clean sheet or blanket should be obtained from the ambulance and placed on the ambulance stretcher before the patient is placed on it. The clean sheet should then be folded over the patient for confining all possible contamination.
3. The RSO should accompany the patient with portable radiation survey equipment with him.

Anyone who suspects that he has ingested radioactive materials should force themselves to vomit and then notify the RSO immediately. The vomit material should be retained for examination.

All cuts which penetrate the skin offer a point of easy access to the body for radioactive materials. Radioisotopes shall not be allowed to contact a cut anywhere on the body. If a person is cut by a contaminated article, they shall receive immediate attention. It shall first be cleansed 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. All cuts involving possible contamination shall be reported to the RSO so that necessary steps can be immediately taken to evaluate the contamination.

Emergency notification of other agencies

Section 21.402, 403, 405 of the Texas Regulations for Control of Radiation sets forth requirements for telephone and telegraph notification to the Agency in the event of a radiation accident or incident. Telephone communications shall be directed to a staff member of the Division of Occupational Health and Radiation Control.

APPENDIX A – Forms, Signs and labels

Running radioisotope inventory form

RUNNING RADIOISOTOPE INVENTORY

Isotope: _____	Manufacturer: _____
Chemical form: _____	Lot number: _____
Physical form: _____	Assay date: _____
Storage location: ME - _____	Amount: _____ μCi
Comments: _____	Volume: _____
_____	Signature: _____

Date	Amount Used (μCi)	Amount on hand (μCi)	Disposal Method	Initials

Appendix A-1

Monthly wipe test form

MONTHLY WIPE TEST (Radiation Safety Form Jul 2006)

Authorized
User
Faculty _____
(print)

Instrument
make and
model: _____
(print)

Person
conducting
test _____

Instrument ID: _____

Isotopes
Monitored _____
(3H, 14C, etc.)

Instrument
Efficiency _____
(specify for each isotope)

Location	CPM (DPM)	CPM (DPM) After cleaning	Date
	()	()	
	()	()	
	()	()	
	()	()	
	()	()	
	()	()	
	()	()	
	()	()	
	()	()	
Background	()	()	

You are required to monitor work areas after a single experiment of 1mCi or more and after every mCi used in a series of experiments. You are required to report your results in DPMs. Background counts are required. Clean all surfaces with more than twice background. Report results after cleaning contaminated surfaces.

CPM/efficiency = DPM. Contamination in dpm = DPM [sample] - DPM [background]

Radioisotopes were used during _____ and the work area was monitored as required.
(month / yr)

No radioisotopes were used during _____, therefore surveys were not performed.
(month / yr)

Signature of person performing surveys: _____

Appendix A-2

Quarterly radioisotope inventory form

QUARTERLY SUMMARY REPORT OF ISOTOPE INVENTORY

Authorized User: _____
(Please print)

Location of Isotopes: _____
(Please print)

Inventory
Reported by: _____
(Please print)

Date of inventory: _____
(Please print)

Signature: _____ Reported for: 1st 2nd 3rd 4th quarter 20__
(Please circle)

Isotope	Amount Purchased this quarter μCi	Amount used this quarter μCi	Amount on hand at end of quarter μCi	Loss due to decay μCi	Trans- ferred Solid Waste to RSO μCi	Liquid Waste transferred to RSO μCi	Sanitary sewer μCi
3-H							
14-C							
32-P							
33-P							
35-S							
125-I							
86-Rb							
36-Cl							
22-Na							
63-Ni							
141-Ce							
57-Co							
51-Cr							
95-Nb							
59-Fe							
113-Sn							
85-Sr							

Please report all quantities in microcuries (μCi) and corrected for decay. Note that liquid wastes means biodegradable, water soluble liquids the RSO will dispose as appropriate. Authorized users must seek approval from the RSO before using organic based scintillation fluid & vials with such fluids. Please report waste in μCi, do not use check marks! (Radiation Form 7.14.2006)

Appendix A-3

Solid and liquid waste sticker and transfer form

RADIOACTIVE WASTE MATERIAL

LABORATORY _____ Room _____
 LAB Supervisor _____
 Phone Number _____

Isotope: _____ Symbol _____
 Chemical form _____
 Total Radiation Level _____
 Maximum DPMs _____

Date the isotopes are no longer active and
 can be discarded: _____

Type of Waste Material:

1. Liquid Waste (Low DPMs) _____ mCi.
2. Liquid Waste (High DPMs) _____ mCi.
3. Solid Waste _____ mCi.
4. Scintillation Vials _____ mCi.

Signature of Lab Supervisor. _____

Date of Transfer _____ Received by: _____

IL-3-1

Top, left: Example of sticker to be applied to exterior of waste container transferred to the RSO.

Alternatively, the special yellow buckets obtained from the RSO with yellow plastic liner are labeled and numbered and may be used to identify waste. Radioactive quantities are recorded in a database that tracks the bucket and decay of the waste.

Bucket numbers to appear on waste form, bottom right, if buckets are used.



**TEXAS COLLEGE OF
OSTEOPATHIC MEDICINE**
 Fort Worth, Texas 76107
**Radioactive Waste Material
Disposal Form**

Laboratory Supervisor: _____
 Lab#(s) _____ Phone: _____
 Department _____ Account # _____
 for billing

Isotope _____ Chemical Form _____
 Quantity, Total _____ DPMs _____
 Maximum/Container (vial) _____ DPMs _____
 Type of Waste (eg Bulk Liquid, Scintillation Vials, Dry Waste) _____

Description (eg type solvent, aqueous buffer
 chloroform extract, absorbent paper, glass
 pipetts, needles, etc.) _____

Signature of Laboratory Supervisor _____

Date of Transfer _____ Received by _____
 Comments: _____

Example of waste transfer form. RSO retains top white copy, laboratory retains bottom yellow copy.

Animal carcass tag

**CAUTION
RADIOACTIVE
MATERIAL**

**DO NOT REMOVE TAG WITHOUT AUTHORIZATION
BY THE RADIATION SAFETY OFFICER.**

Isotopes:								
µCi:								
Mass (Kg):								
Faculty:								
Date:								
Tag No:	2801							

Isotopes:								
µCi:								
Mass (Kg):								
Faculty:								
Date:								
Tag No:	2801							

Appendix A-5

Monthly sink disposal form

Sink location: _____ Authorized user: _____

Isotope	Daily Disposal Limits	μCi / day

Authorized by: _____
(RSO)

MONTHLY SUMMARY

Date	Initials	Faculty	Isotope	μCi

Isotope		μCi

I certify that this record is
accurate and complete:

Authorized User signature

Date

Notice to employees

RC FORM 203-1
(October 2011)

Department of State Health Services
P.O. Box 149347
Austin, Texas 78714-9347

NOTICE TO EMPLOYEES

TEXAS REGULATIONS FOR CONTROL OF RADIATION

The Department of State Health Services has established standards for your protection against radiation hazards, in accordance with the Texas Radiation Control Act, Health and Safety Code, Chapter 401.

YOUR EMPLOYER'S RESPONSIBILITY

Your employer is required to-

1. Apply these rules to work involving sources of radiation.
2. Post or otherwise make available to you a copy of the Department of State Health Services rules, licenses, certificates of registration, notices of violations, and operating procedures that apply to your work, and explain their provisions to you.

YOUR RESPONSIBILITY AS A WORKER

You should familiarize yourself with those provisions of the rules and the operating procedures that apply to your work. You should observe the rules for your own protection and protection of your co-workers.

WHAT IS COVERED BY THESE RULES

1. Limits on exposure to sources of radiation in restricted and unrestricted areas;
2. Measures to be taken after accidental exposure;
3. Individual monitoring devices, surveys and equipment;
4. Caution signs, labels, and safety interlock equipment;
5. Exposure records and reports;
6. Options for workers regarding agency inspections; and
7. Related matters.

REPORTS ON YOUR RADIATION EXPOSURE HISTORY

1. The rules require that your employer give you a written report if you receive an exposure in excess of any applicable limit as stated in the rules, license, or certificate of registration. The basic limits for exposure to employees are stated in 25 Texas Administrative Code (TAC)

§289.202(f), (k), (l), and (m) (relating to Standards for Protection Against Radiation from Radioactive Materials) and 25 TAC §289.231(m) (relating to General Provisions and Standards for Protection Against Machine-Produced Radiation). These subsections specify limits on exposure to radiation and exposure to concentrations of radioactive material in air and water.

2. If you work where individual monitoring devices are provided in accordance with 25 TAC §289.202 or §289.231:

(a) your employer must furnish to you an annual written report of your exposure to radiation if:

- (1) the individual's occupational dose exceeds 100 mrem (1 mSv) total effective dose equivalent or 100 mrem (1 mSv) to any individual organ or tissue; or
- (2) the individual requests his or her annual dose report in writing.

(b) your employer must give you a written report, upon termination of your employment, of your radiation exposures if you request the information on your radiation exposure in writing.

INSPECTIONS

All licensed or registered activities are subject to inspection by representatives of the Department of State Health Services. In addition, any worker or representative of the workers who believe that there is a violation of the Texas Radiation Control Act, the rules issues thereunder, or the terms of the employer's license or registration with regard to radiological working conditions in which the worker is engaged, may request an inspection by sending a notice of the alleged violation to the Department of State Health Services. The request must state the specific grounds for the notice, and must be signed by the worker or the representative of the workers. During inspections, agency inspectors may confer privately with workers, and any worker may bring to the attention of the inspectors any past or present condition that the individual believes contributed to or caused any violation as described above.

POSTING REQUIREMENT

Copies of this notice shall be posted in a sufficient number of places in every establishment where employees are employed in activities licensed or registered, in accordance with 25 TAC §289.252 (relating to Licensing of Radioactive Material) and 25 TAC §289.226 (relating to Registration of Radiation Machine Use and Services), to permit employees to observe a copy on the way to or from their place of employment.

Applicable sections of 25 TAC Chapter 289 may be reviewed online, at www.dshs.state.tx.us/radiation/rules.shm. Our license and/or certificate of registration and any associated documents, our operating procedures, and any "Notice of Violation" or order issued by the agency may be reviewed at the following location:

Appendix A-7

HSC radiation notice**UNT HEALTH SCIENCE CENTER
RADIATION SAFETY NOTICE**

In accordance with 25 TAC 289 which contains the state regulations for control of radiation, this notice is to inform any approved user or radiation worker that the following documents may be found and examined, in the office of your Radiation Safety Officer:

1. Texas Regulations for Control of Radiation, in its entirety.
2. UNT Health Science Center Radioactive Material License with amendments.
3. Certificate of registration for X-ray and Laser devices.
4. Operating procedures applicable to license or registration activities.
5. Notices of violations involving radiological working conditions and responses to registrant.

Maya P. Nair, Ph.D.
Radiation Safety Officer
Safety Office
GSB110
1050 Clifton St.
Fort Worth, Texas 76107
817-735-2697

Request for Radiation Badge Service

REQUEST FOR RADIATION BADGE SERVICE

Instructions: Please supply the information requested below. Upon completion of this form, return it to the Radiation Safety Office. An appropriate monitoring device will be issued by the Radiation Safety Officer. Please print or type on this form.

Date of request: _____

Full legal name
of person to be monitored: _____

Date of birth (month/day/year): _____ Social security #: _____

Department: _____

Supervisor: _____ Initials: _____

Isotopes/device to be monitored: _____

Radiation Exposure History

Have you had any previous work experience where you were monitored for radiation exposure? _____

If you answered yes, please supply the information requested below for your last job for which you were monitored:

Company or institution:
address _____

Date you started
work for this company:

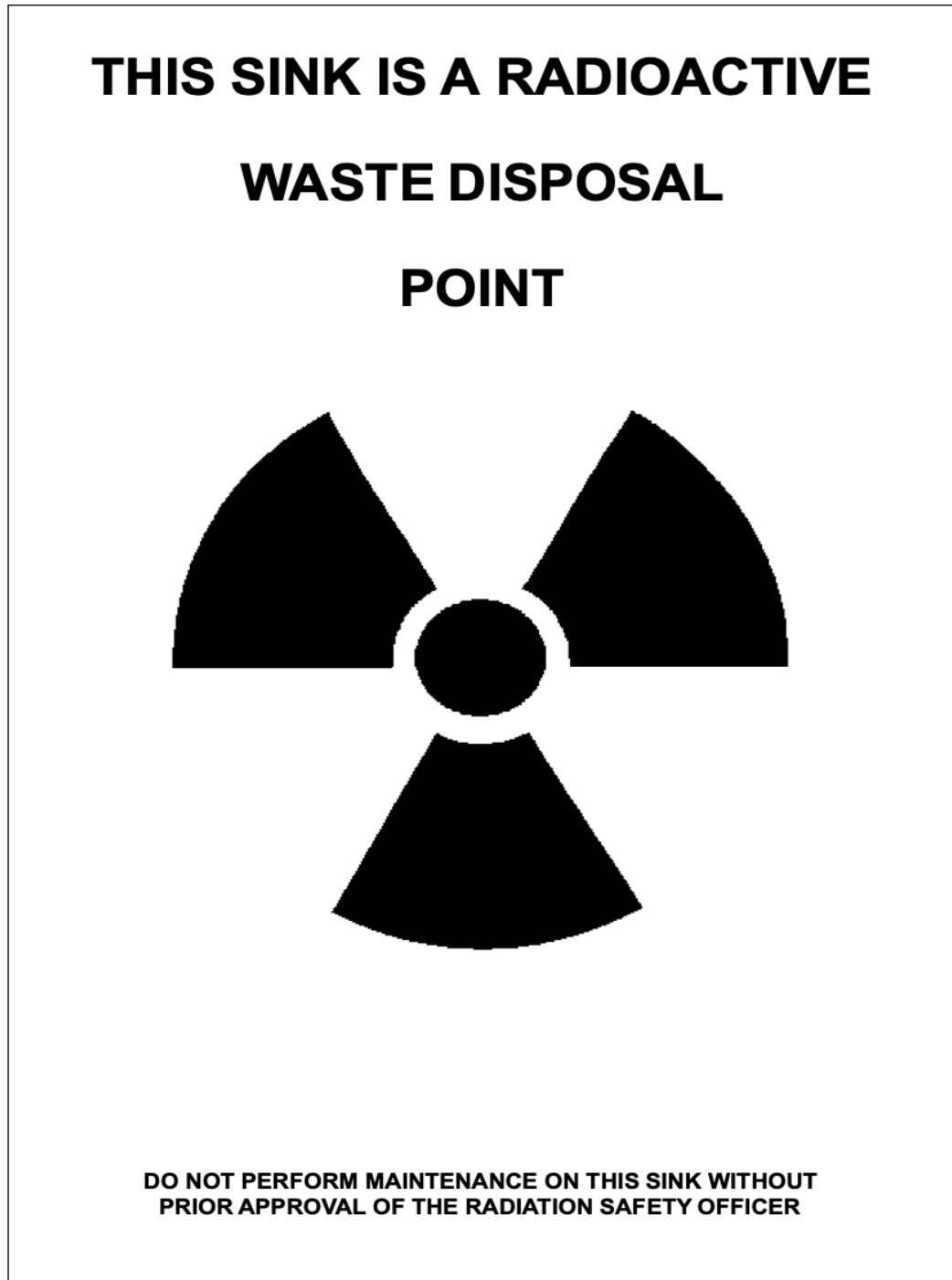
End date: _____

Your signature releasing your radiation exposure history: _____

To be completed by the Radiation Safety Office:
Badge number issued

Initials

Signage for sink for radioactive waste disposal



Appendix A-10

APPENDIX B

Isotopes that may be disposed in sanitary type I landfill - 25 TAC § 289.2029 (ggg)

Nuclides	Concentrations Limit (Ci/m ³)	Annual Generator Disposal Limit (Ci/yr)
F-18	3 μ let ⁺	8
Si-31	$\frac{1}{2} \times 10^4$	3 $\times 10^4$
Na-24	9 μ icr ⁺	2 $\times 10^4$
P-32	2	5 $\times 10^4$
P-33	10	3 $\times 10^4$
S-35	9	2 $\times 10^4$
Ar-41	3 μ let ⁺	8
K-42	2 μ icr ⁺	5 $\times 10^4$
Ca-45	4	1 $\times 10^4$
Ca-47	2 μ icr ⁺	5 $\times 10^4$
Sc-46	2 μ icr ⁺	5 $\times 10^4$
Cr-51	6 μ let ⁺	2 $\times 10^4$
Fe-59	5 μ icr ⁺	1 $\times 10^4$
Co-57	6 μ icr ⁺	2
Co-58	1 $\times 10^4$	3 $\times 10^4$
Zn-65	7 μ icr ⁺	2 $\times 10^4$
Ga-67	3 μ let ⁺	8
Se-75	5 μ icr ⁺	1
Br-82	2 μ icr ⁺	5 $\times 10^4$
Rb-86	4 μ icr ⁺	1
Sr-85	2 μ icr ⁺	5 $\times 10^4$
Sr-89	8	2 $\times 10^4$
Y-90	4	1 $\times 10^4$
Y-91	4 $\times 10^4$	10
Zr-95	8 μ icr ⁺	2 $\times 10^4$
Nb-95	8 μ icr ⁺	2 $\times 10^4$
Mo-99	5 μ icr ⁺	1
Tc-99m	1	3 $\times 10^4$
Rh-106	1	3 $\times 10^4$
Ag-106m	2 μ icr ⁺	5 $\times 10^4$
Cd-115m	2 μ let ⁺	5
In-111	9 μ icr ⁺	2

For the purposes of disposal of animal carcasses, the density of the carcasses shall be assumed to be, on average, one gram per cubic centimeter. Thus, column two of this appendix which is in units of Ci / cubic meter may also be read as microcuries / gram of tissue.

25TAC §289202<gggX7> continued:

Nuclides	Concentrations Limit (Ci/m ³)	Annual Generator Disposal Limit (Ci/yr)
In-113m	9	2 x 10 ⁺²
Sn-113	6 x 10 ⁻²	2
Sn-119	2 x 10 ⁺¹	5 x 10 ⁺²
Sb-124	2 x 10 ⁻³	5 x 10 ⁻²
Te-129	2 x 10 ⁻¹	5
I-123	4 x 10 ⁻¹	1 x 10 ⁺¹
I-125	7 x 10 ⁻¹	2 x 10 ⁺¹
I-131	4 x 10 ⁻²	1
I-133	2 x 10 ⁻²	5 x 10 ⁻¹
Xe-127	8 x 10 ⁻²	2
Xe-133	1	3 x 10 ⁺¹
Ba-140	2 x 10 ⁻³	5 x 10 ⁻²
La-140	2 x 10 ⁻³	5 x 10 ⁻²
Ce-141	4 x 10 ⁻¹	1 x 10 ⁺¹
Ce-144	1 x 10 ⁻³	3 x 10 ⁻²
Pr-143	6	2 x 10 ⁺²
Nd-147	7 x 10 ⁻²	2
Yb-169	6 x 10 ⁻²	2
Ir-192	1 x 10 ⁻²	3 x 10 ⁻¹
Au-198	3 x 10 ⁻²	8 x 10 ⁻¹
Hg-197	8 x 10 ⁻¹	2 x 10 ⁺¹
Tl-201	4 x 10 ⁻¹	1 x 10 ⁺¹
Hg-203	1 x 10 ⁻¹	3

NOTE: In any case where there is a mixture in waste of more than one radionuclide, the limiting values for purposes of this paragraph shall be determined as follows:

For each radionuclide in the mixture, calculate the ratio between the quantity present in the mixture and the limit established in this paragraph for the specific radionuclide when not in a mixture. The sum of such ratios for all the radionuclides in the mixture may not exceed "1" (i.e., "unity").

Examples: If radionuclides a, b, and c are present in concentrations Ca, Cb, and Cc, and if the applicable concentrations are CLa, CLb, and CLc respectively, then the concentration be limited so that the following relationship exists: $(Ca/CLa) + (Cb/CLb) + (Cc/CLc) \leq 1$

If the total curies for radionuclides a,b, and c are represented Aa, Ab, and Ac, and the annual curie limit for each radionuclide is ALa, ALb, and ALC, then the generator is limited to the following:

For the purposes of disposal of animal carcasses, the density of the carcasses shall be assumed to be, on average, one gram per cubic centimeter. Thus, column two of this appendix which is in units of Ci / cubic meter may also be read as microcuries / gram of tissue.

APPENDIX C

Special Instructions to Central receiving and Campus Police

The University of North Texas Health Science Center is licensed by the Texas Department of State Health Services, Bureau of Radiation Control to possess certain quantities of radioactive material. In accordance with our license agreement, all radioactive materials shipped to the health science center are sent to the following address:

Attn.: Radiation Safety Office
UNTHSC Central Receiving
3420 Darcy Street
Fort Worth, Texas 76107

Packages containing radioactive materials shall be delivered to or picked up by the Radiation Safety Officer (RSO) or staff of the RSO UNOPENED within 3 hours of receipt if received during normal business hours. UNTHSC receiving personnel shall notify the Radiation Safety Officer (Safety Office, ext. 2697) promptly. Packages delivered after hours, week- ends and holidays shall be delivered to the Safety Office no later than 3 hours from the beginning of the next working day, as described in 25 TAC 289.202(ee)(3). Items on dry ice or marked perishable or refrigerate upon arrival shall be handled by all personnel according to the package markings.

Packages may not be co-mingled in refrigerators or freezers with items for human consumption. Personnel in the Safety Office shall sign for packages. Central Receiving shall be notified by the Radiation Safety Officer in the event of duplicate shipments, damaged goods, or discrepancies in quantities. This procedure is intended to protect receiving personnel from unnecessary exposure to ionizing radiation.

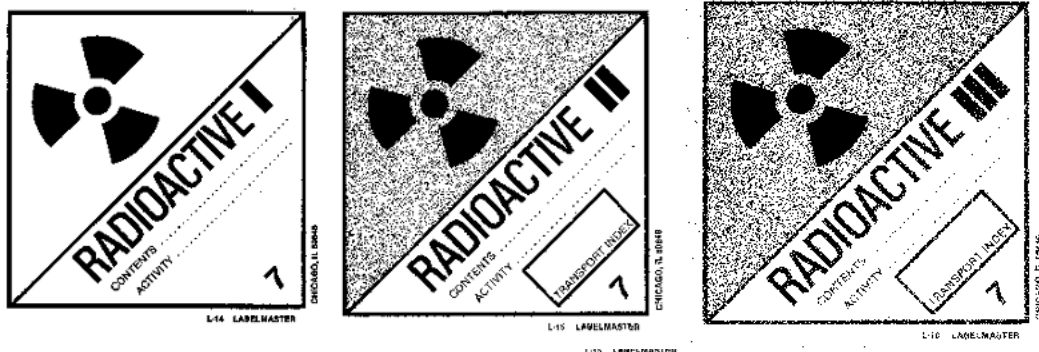
Packages of radioactive materials are commonly received from the following vendors and receiving personnel are asked to examine packages from these vendors for markings that they contain radioactive materials:

Advanced Magnetics
Alpco Diagnostics
Amersham
Nichols Institute

Electro-Nucleonics
American Radiochemicals
Bachem
Perkin Elmer Life Sci

Personnel should examine the exterior of all packages from these vendors and the packing slip, if affixed to the exterior of the package, for an indication that the material is radioactive. Not all packages from these vendors will contain radioactive materials. If the package

contains any ONE of the following labels or words on its exterior, the package should be delivered to the Radiation Safety Officer, UNOPENED:



Limited Quantity of Material

No Radioactive label Required

Shaded areas on the labels shown above will appear in yellow, the hash marks next to the word Radioactive will appear in red. Not shown is the label with no red mark. The redder the marks, the greater the radiation hazard. Receiving personnel MUST notify the Radiation Safety Officer immediately if a package is received with three red stripes.

Deliveries during holidays, severe weather and on weekends

In the event that the health science center is closed for a planned holiday during a weekday, Central Receiving shall affix a notice to the exterior of the loading dock door addressed to commercial carriers directing them to deliver all radioactive materials to the Campus Police station.

In the event of a severe weather closing, Campus Police are directed to affix the notice to the exterior of the loading dock door directing vendors to deliver all radioactive materials to the Campus Police station.

Deliveries of radioactive materials on the weekend is not routine. In the event that a commercial carrier makes a delivery of radioactive material on the weekend, the package should be received by Campus Police.

The Radiation Safety Officer shall be notified immediately of such deliveries. Campus Police maintains a card file with the Radiation Safety Officer's home phone and digital pager number. If the RSO cannot be reached, Campus Police are directed to call the home of or page the Assistant Radiation Safety Officer.

APPENDIX D

EXEMPTION FROM EXTERNAL PERSONAL DOSIMETRY

Limits on the use of radioactive materials for individuals exempted from personal dosimeter for external exposure to radiation

The University of North Texas Health Science Center has obtain a license amendment from the Texas Department of State Health Services, Bureau of Radiation Control, which states the conditions under which authorized users of radioactive materials and their personnel may work with radioactive materials without personal dosimeters (radiation badges; quarterly TLDs) for measuring external doses of radiation. These conditions are:

1. Workers who work only with 3-H and 14-C are exempt from external exposure monitoring.
2. Workers who use the following beta-emitters: 45-Ca, 32-P, 35-S and 51-Cr or other beta emitters with similar energy levels shall be exempted from external radiation exposure monitoring provided that they use shielding (plexiglass, lead or aluminum, as appropriate) and that:
 - a. An individual use an individual uses no more than 100 mCi/experiment
 - b. The annual use of these isotopes by the individual does not exceed 250 mCi

The typical experiment usually does not exceed 10 mCi and is most frequently in the μ Ci range.
3. Workers who use I-125-labeled sodium iodide for radioiodinations in accordance with the provisions as outlined in the institutional radiation safety manual shall be exempt from external monitoring provided that the annual use does not exceed 40 mCi for work in a fume hood with lead brick shielding or 100 mCi in a glove box in a hood with appropriate lead shielding.

Workers who use I-125 bound to non-volatile molecules such as proteins or some solid substrate shall be exempt from external personal dosimetry provided appropriate shielding is used and use is limited to 1mCi per experiment with the typical amount in the μ Ci range and the annual total use does not exceed 50 mCi.

4. Workers who use gamma-emitting microspheres, which qualify for disposal in a Type I Sanitary landfill, for acute *in vivo* experiments utilizing animals shall be exempt from external exposure monitoring provided that

- a. Individual experiments are limited to any combination of isotopes not to exceed 1mCi
 - b. The total annual use of all such isotopes does not exceed 100mCi.
5. Workers may use the maximum annual amounts of radioactive materials as listed in each of the use categories above without the need for external personal dosimetry.

APPENDIX E

X-RAY USER COMPLIANCE GUIDE

Requirements for the use of devices that produces X-rays

The Texas Regulations for Control of Radiation (TRCR) Part 32 has been the standard reference for requirements for all x-ray devices, operators and operations for many years. In 1998 the regulations were renumbered to match the style of the Texas Administrative Code (TAC). The new numbering system is used in this appendix.

This appendix provides guidance for the interpretation of the applicable parts of TAC to those authorized individuals who possess and/or operate X-ray producing devices in facilities owned or leased by UNT Health Science Center. **This appendix is not intended to be exhaustive.** Please refer to 25 TAC §289.227 located in the ring binder of radiation records with your machine for more information on requirements.

A red ring binder to hold records for each x-ray unit is provided by the Safety Office. This binder shall contain, but is not limited to, the following records:

1. Performance testing reports
2. Repair reports
3. Copies of personal dosimeter reports (badge reports) for the x-ray site
4. Copies of all darkroom QA records, chemical changes, maintenance
5. A copy of credentials for all non-physicians who expose humans to x-rays
6. A copy of the UNTHSC Radiation Safety Manual
7. A copy of Part 32 of TRCR now called 25 TAC §289.227

Diagnostic x-ray equipment requires performance testing as given in this section. At the health science center equipment with the exception of veterinary X-ray units are considered to be in the category of Medical Private or Group Practice (MD/DO). The interval of testing for this equipment is an interval not to exceed 2 years as per 25 TAC §289.227(cc)(4).

Performance testing of x-ray producing devices shall include those items specified in 25 TAC §289.227(q) (3) for radiographic x-ray equipment, 25 TAC §289.227(q) (4) for fluoroscopic x-ray systems. Currently there are no performance testing requirements for bone densitometers that produce x-rays electrically and do not contain a radiation source. A

record of all inspections shall be kept in the ring binder containing X-ray records for each machine.

It is the policy of the Safety Office to arrange and pay for performance testing of X-ray equipment used strictly for research. It is the policy of the Safety Office that clinical departments arrange for testing and pay for testing of devices used in patient care.

Repairs of all X-ray units found not to be in compliance with requirements must be initiated within 30 days of discovery. All repairs shall be complete within 90 days unless specifically authorized by the Bureau of Radiation Control. Records of all such repairs shall be kept in the ring binder of radiation records for that machine and available for inspection. This will assure compliance with 25 TAC §289.227(q)(2)(A,B).

It is the policy of the Safety Office that owners of the x-ray equipment pay for all repairs to their equipment from their department or grant funds.

Darkroom QA

All darkrooms used to process x-ray film automatically or by hand shall have a light leak test at intervals not to exceed 6 months as required in 25 TAC §289.227(l)(3). Corrections or repairs of the light leaks or related deficiencies related to lighting shall be initiated within 72 hours of discovery and completed no longer than 15 days from detection. Documentation of all tests and corrective actions shall be kept in the ring binder of radiation records for the x-ray device. This will assure compliance with 25 TAC §289.227(l)(5, 6).

As of June 1998, film strips are no longer required by the Bureau of Radiation Control.

All film shall be processed by a time and temperature method according to the manufacture's recommendations. Chemicals shall be replaced according to the manufacture's recommendation, but not to exceed 3 months. A record of chemical changes shall be maintained in the ring binder for the x-ray unit. This will assure compliance with 25 TAC §289.227(l)(1,2,6).

It is the policy of the Safety Office that darkroom QA will be arranged and paid for by the Safety Office. If a department does not want to use the vendor selected by the Safety Office, departments are free to arrange their own QA program at their own expense so long as it meets all the requirements set forth by the Bureau of Radiation Control.

APPENDIX F

RADIATION SAFETY TRAINING COMPLIANCE AND REVIEW

Adopted 10 October 2000 Meeting

Radiation Safety Committee

UNT Health Science Center at Fort Worth

Background

To provide timely and convenient access to radiation safety training materials, the RSO and his staff developed and implemented a web-based self-paced radiation safety training program in the fall of 1998.

The RSO and his staff also developed a quiz to test for a basic understanding of the principles of radiation safety, standard procedures of the radiation safety program and introduce calculations involving research use of isotopes, in the fall of 1998. A record of each quiz attempt is recorded in a database hosted on the Safety Office web server each time a quiz is submitted for scoring.

Philosophy of Compliance

Compliance with certain requirements of the radiation safety program is founded on the principle that compliance is a shared responsibility of authorized users, the membership of the radiation safety committee, the radiation safety officer and his staff and senior administration of this institution. The proposal below actively engages all responsible parties to improve compliance.

Rationale for changing procedures

More frequent evaluation of training compliance, more communication between the RSO and members of the radiation safety committee and the authorized users and defined consequences of noncompliance will assist authorized users to maintain compliance, the RSO and senior administration to evaluate compliance and trends in an effort reduce risk to the institution.

Procedure to improve Training Compliance

1. On a quarterly basis, during the last during the last month of each calendar quarter (March, June, September, December), each authorized user of radioactive materials is required to report to the RSO the current list of laboratory staff members including postdocs, research assistant professors, students, volunteer staff and technicians conducting work in laboratories under the authorized users' control where radioactive materials are used or stored. This list shall be provided in a format that allows the radiation safety committee and the RSO and his staff to readily determine the training compliance level.

2. A reminder to authorized users to check the personnel list required in #1 above will be sent by the RSO or his staff on the first working day of the last month of a calendar quarter.
3. The RSO or his staff will run or obtain a report showing lab staff and their training status on the first working day of the first month of each calendar quarter for the quarter just ended.
4. Training compliance levels will be formally reported at each regularly scheduled radiation safety committee meeting which occur about 14 days after the end of a calendar quarter. This shall be a standing item on the committee agenda.
5. Compliance below 100% shall be communicated to the authorized user and the authorized users' department chair with the expectation that compliance will rise to the 100% level within 30 days of notice.
6. When compliance is less than 100% users and chairs shall receive an email notice and the Safety Office will immediately suspend deliveries of radioactive materials to the authorized user until compliance is 100%. If compliance is not adequate (100%) within 30 days of notice, all use of radioactive materials by the authorized user shall be temporarily suspended until there is a return to 100% compliance.
7. Authorized users who do not review their personnel list on a timely basis as described in #1 above, shall have deliveries suspended as in #6 above, and if compliance is not restored within 30 days of notice, use of radioactive materials will be temporarily suspended as in #6 above.
8. In the event that an authorized user incurs two suspensions of use in any rolling 12month period, the facts of the compliance infractions will be referred to the department chair and to the Dean for disciplinary action under the current faculty bylaws and established processes for faculty discipline.

Methodology

1. Authorized users will use a web browser interface to enter their current laboratory staff into a database. Users will be able to add staff, indicate that staff have departed the lab group and that each lab staff member's work status has been reviewed on a quarterly basis. Users will not be required to retype all staff names each quarter but will be able to update their staff list.

2. Authorized users will be able to review the compliance level of their staff using the web browser interface at any time which they are connected to the UNTHSC intranet.
3. On the first working day of the calendar quarter the RSO and his staff shall generate a printed report sorted by lab group that indicates the training status of each lab worker for the calendar quarter. The RSO and his staff will take this report to the quarterly radiation safety committee meeting for review and inclusion in the records of each meeting.
4. The RSO and his staff will notify authorized users via email of noncompliance within 14 days following the end of a calendar quarter, with the expectation that notification will usually occur within 5 working days following the end of a calendar quarter.
5. The above methodology will allow individuals who work in laboratories of more than one authorized user to be listed on more than one lab staff list. Each user's list will be independent of other users' lists even though some staff may be shared.
6. This procedure shall become effective immediately upon approval by the Radiation Safety Committee.

APPENDIX G

Progressive Discipline for food and drinks

Adopted by Radiation Safety Committee
UNT Health Science Center at Fort Worth
January 14, 2003

Progressive discipline policy for food and drinks in laboratories posted for radioactive materials and where such materials are used or stored

Scope

This policy applies to all individuals who enter posted areas and locations where radioactive materials are used or stored.

Definitions

Authorized user — means a person whose name appears on the institutional radioactive materials license as an authorized user of radioactive materials.

Posted area — is generally a research laboratory or waste holding facility that has a placard at one entrance and the placard contains the international symbol for radiation and the words radioactive material. All interior spaces, such as tissue culture rooms, darkrooms, staff office areas that are enclosed by a larger posted area are considered to be part of the posted area. Adjacent communicating spaces (laboratory suites) that are not separated by a continuous wall running slab-to-slab are considered part of the posted area.

RSO —the radiation safety officer is the person names on the institutional radioactive materials license to act as the RSO.

Background

Food and drink may not be present, stored or consumed in posted areas and where radioactive materials are used or stored. This rule is part of the written radiation safety procedures of the institutional radioactive materials program and part of the institutional license to use radioactive materials. Similar prohibitions on food and drink in laboratories appear in the institutional chemical hygiene plan and is part of the standard operating procedures referenced for biosafety in the institutional Safety Manual.

There are at least three mechanisms to spread radioactive contamination to food and drink that may be present in a laboratory: (1) physical transfer of contamination in refrigerators and freezers when food and drink items are stored together; (2) physical transfer of radioactive

materials from contaminated hands or gloves directly to food or their wrappings when these items are handled or consumed; (3) and by dispersions of aerosols in the laboratory.

The concern regarding ingestion of radioactive materials relates to the very large localized radiation doses to internal organs or parts of organs that are possible when even very small quantities of radioactive materials are ingested. Unhealthful outcomes from such ingestion may include: (1) destruction of somatic tissue leading to acute disease; (2) injury to somatic tissue that may or may not lead to the initiation of a cancerous lesion or chronic disease; and (3) radiation dose to reproductive tissue with possible genetic consequences in subsequent generations.

Policy

The institutional Radiation Safety Committee, the organizational body with policy making authority for the radioactive materials program, has been determined that the presence, storage or consumption of food or drink by humans in posted areas and where such materials are used and stored shall be prohibited and infractions of this rule shall constitute a **serious violation** of safety protocols and institutional policy.

Policy enforcement and discipline

Enforcement of this policy is a shared responsibility of authorized users, the RSO as the agent for the radiation safety committee, and senior administration of the health science center.

Discipline shall be progressive in nature. The purpose of discipline is to protect human health and to prevent recurrence of violation of this policy.

Individuals possessing, storing or consuming food and drink in posted areas and where radioactive materials are used or stored

Progressive discipline usually takes the following form for specific individuals: oral warning for first offense; written reprimand for second offense; suspension without pay for the third offense; termination for the fourth offense.

The institutional Personnel Policy Manual, the Faculty By-laws and student handbooks shall be followed as applicable.

When an authorized user takes a discipline step under this policy, there is a duty to inform the RSO of such action.

When the RSO detects a violation, the authorized user (faculty advisor) of the offender shall be informed of the infraction and the authorized user shall be required to take the appropriate disciplinary step.

Research group discipline

When it is the RSO who detects a violation of this policy, the research group to whom the individual offender belongs shall be restricted in the following manner:

- first offense, 30-day suspension of ordering and receiving privileges;
- second offense, 60-day suspension of ordering and receiving privileges;
- third offense, loss of all privileges in the radioactive materials program, with reapplication to the radiation safety committee required.

When it is the RSO who detects a violation and the offender is not part of the research group where the offense occurred, then research group discipline shall apply to both research groups: the offenders research group and the group controlling the space where the offense occurred, each at the appropriate level based on their past histories.

Because there will be significant turnover of staff over time and in an effort not to punish research groups for infractions long past, the clock on research group discipline by the RSO shall be reset for all research groups on January first of each even numbered year, beginning with January 1, 2002. In the event that a research group disciplinary action is in progress on such dates, the disciplinary action must be completed prior to resetting of the clock for those research groups experiencing discipline on the date the clock is normally set back.

When it is the authorized user who detects a violation, there is no duty of the authorized user to restrict their research group or that of another authorized user, and the RSO shall not impose research group discipline when the authorized user(s) initiates the appropriate level of discipline in their research group and informs the RSO in a timely manner.

Authorized user discipline

Authorized users whose research group lose all privileges in the radioactive materials program under this policy (a third offense detected by the RSO) shall be referred to the cognizant Dean for discipline under the faculty by-laws. After the discipline has been administered, the faculty member may re-apply to the radiation safety committee for privileges.

APPENDIX H

Progressive Discipline for Monthly Area Surveys

Monthly area surveys reporting requirements and discipline

Adopted by Radiation Safety Committee
UNT Health Science Center at Fort
Worth January 14, 2003

Scope

This policy applies to all active, authorized users and their research groups.

Definitions

Active authorized user or research group — is an authorized user and their research group that has not been placed on inactive status.

Authorized user — means a person whose name appears on the institutional radioactive materials license as an authorized user of radioactive materials.

Inactive status — an authorized user whose research group does not possess radioactive materials or use radioactive materials on a routine basis, and who has requested inactive status in writing and such status has been granted by the RSO.

RSO —the radiation safety officer is the person named on the institutional radioactive materials license to act as the RSO.

Background

Frequent reviews of area surveys and additional discipline procedures are required to maintain an adequate level of compliance with the area survey requirements of the institutional radioactive materials license.

It is a requirement of the radioactive materials license that authorized users complete or cause to be completed monthly area surveys of all posted areas under their control. It is a requirement that each authorized research group review their activities on a monthly basis and that they generate written evidence of the monthly review:

- 1) In the case of areas where isotopes were used, documentation that wipe tests were performed is required;
- 2) in areas where no isotopes were used for the month, a form stating no isotopes were used in that area is required.

Policy and Procedure

On or by the end of business (5 PM) on the 3rd working day of each month, but no sooner than the 1st working day of each month, each authorized user shall submit or cause to be submitted the following paperwork to the RSO's for review:

- 1) At least one appropriately completed wipe test form FOR EACH room (laboratory) under their control where radioactive materials may be used or stored, the surveys having been performed in the preceding month. Attached scintillation counter/gamma counter raw data with the form when reporting wipe tests for areas where isotopes were used during the previous month.
- 2) If isotopes were used in an area between the first day of the previous month and the last day of the previous month, in addition to the required wipe test form, a copy of the map for each surveyed shall also be submitted. Maps shall denote isotope use areas and nonuse areas and where wipe test samples were taken for analysis, both in the use areas and non-use areas of the lab.
- 3) A form must be submitted for each room in which isotopes could have been used (posted areas) but were not used for the month. Document on the wipe test form that isotopes were not used in that room for that month as provided on the form.

In the event the 3rd working day is an official holiday of the organization, or the authorized user has informed the RSO in advance that such date conflicts with a religious observance day taken by the authorized user in lieu of another official holiday, the deadline for submitting the required paperwork shall be extended to the end of business on the next business day.

Policy enforcement and discipline

Enforcement of this policy is a shared responsibility of authorized users, the RSO acting as the agent of the radiation safety committee, and senior administration of the health science center.

Discipline shall be progressive in nature. The purpose of discipline is to protect human health and to prevent recurrence of violation of this policy.

Research group discipline

When the RSO detects a violation of this policy, the research group that does not submit the required timely reports to the RSO's office can expect:

first offense, 30-day suspension of ordering and receiving privileges;
second offense, 60-day suspension of ordering and receiving privileges;
third offense, loss of all privileges in the radioactive materials program, with reapplication to the radiation safety committee required.

Appendix H Revised Version

Monthly area surveys reporting requirements and discipline.

Adopted by Radiation Safety Committee UNT

Health Science Center at Fort Worth

August 01, 2017.

IT IS REQUIRED TO SUBMIT THE WIPE TEST DOCUMENT MONTHLY IN A TIMELY MANNER, EVEN IF YOU ARE NOT USING ANY ISOTOPE DURING THAT MONTH.

Violation of this policy and procedure will lead to the following disciplinary actions for the authorized user for radioisotope and his/ her laboratory personnel.

First Offense, 30 days suspension of ordering and receiving privileges;
The radiation safety committee will require the authorized user and his/her laboratory personnel to retake the online radiation safety training. The radiation safety training must be completed within 30 days of the notification of violation.

Second Offense, 60 days suspension of ordering and receiving privileges;
The radiation safety committee will require the authorized user and his/her laboratory personnel to retake the online radiation safety training. The radiation safety training must be completed within 30 days of the notification of violation.

Third offense, loss of all privileges in the radioactive materials program, with reapplication to the radiation safety committee required.
The radiation safety committee will require the authorized user and his/her laboratory personnel to retake the online radiation safety training. The radiation safety training must be completed within 30 days of the notification of violation.

Authorized user discipline

Authorized users whose research group loses all privileges in the radioactive materials program under this policy (a third offense detected by the RSO) shall be referred to the cognizant Dean for discipline under the faculty by-laws. After the discipline has been administered, the faculty member may re-apply to the radiation safety committee for privileges.

APPENDIX I

Prohibited use of tritium Isotopes

The table below is to assist Authorized Users and their staff to comply with the limitations on the use of tritium compounds at UNT Health Science Center at Fort Worth. The following quantities and patterns of use, if met or exceeded, would require routine bioassays for tritium. **Work with such materials at these levels is not currently authorized.**

Chemical Form	Action Level*	Working Situation
Tritiated water & nucleotide precursors	100 mCi	work at the laboratory bench
Tritium in gaseous form	any quantity	any working condition
Tritiated water & nucleotide precursors	1,000 mCi	work at the chemical fume hood with potential to release tritium compounds**

*The action level is the amount requiring routine bioassay in the following patterns of use: 1) the amount handled at any one time by an individual who uses tritium on an infrequent basis, or 2) the cumulative amount of activity handled during any one month when small amounts of tritium are used on a frequent basis.

** Potential to release means that the possibility of a significant airborne release of radioactive material exists because 1) the techniques used to process the material may create an aerosol, 2) the material is inherently volatile, or 3) the techniques used to process the material may increase its volatility.

APPENDIX J

Prohibited uses of Radioiodine 125-I and 131-I

The table below is to assist Authorized Users and their staff to comply with the limitations on the use of radioactive iodine compounds at UNT Health Science Center at Fort Worth. The following quantities and patterns of use, if exceeded, would require routine bioassays. **Work with such materials at these levels is not currently authorized.**

Chemical Form	Action Level	Working situation
Volatile (e.g... NaI)	1mCi	work at the laboratory bench
Bound forms (e.g... iodinated proteins)	10mCi	work at the laboratory bench
Volatile (e.g... NaI)	10mCi	work in the chemical fume hood with potential release of compounds**
Bound forms (e.g... iodinated proteins)	100mCi	work in the chemical fume hood with potential release of compounds**
Volatile (e.g... NaI)	100mCi	work in glove box with iodine trap under the chemical fume hood
Bound forms (e.g... iodinated proteins)	100mCi	work in glove box with iodine trap under the chemical fume hood

*The action level is the amount requiring routine bioassay and is considered to be the cumulative quantity handled by an individual during a 3-month period or on one or more occasions in that period by opening stock reagent containers from which radioiodine may escape.

**Possible release means that the possibility of a significant airborne release of radioactive material exists because 1) the techniques used to process the material may create an aerosol, 2) the material is inherently volatile, or 3) the techniques used to process the material may increase its volatility.

APPENDIX K

Radioisotope usage history for unused isotope that is stored for more than 2 years.

Adopted by Radiation Safety Committee UNT

Health Science Center at Fort Worth

December 9, 2019.

Isotope: _____	Manufacturer: _____
Chemical form: _____	Lot number: _____
Physical form: _____	Assay date: _____

Storage location: _____	Amount - - - - - μCi
-------------------------	--------------------------------------

Authorized User _____	Volume: _____
-----------------------	---------------

Date of last usage	
Amount on hand (μCi)	
Justification and proposed plan for future use	

APPENDIX L

RESEARCH INVOLVING USE OF RADIOISOTOPES IN ANIMALS

Radiation Safety Proposal Registration Form

Adopted by Radiation Safety Committee UNT
Health Science Center at Fort Worth
December 9, 2018.

UNTHSC Protocol Form for the use of Radioisotopes in Animal

Complete one of these forms for each radioisotope to be used in live animals. Form(s) must be signed by the licensed principal investigator responsible for radioisotope use in animals.

An approved protocol by the institutional radiation committee is required to work with radioisotope in live animals

Send completed, signed forms to maya.nair@unthsc.edu or deliver to Environmental Health and Safety Office, GSB 110.

1. Project Title

2. PI Information

Name:

Office Phone:

Dept./Institution:

Lab Phone:

Cell Phone:

Email:

3. Project summary: *(Please provide a summary of the project and your plan to use radioisotope in the proposed project)*

4. List all Authorized Users:

5. Do you use any biohazard material in this project? Yes _____ No _____

If yes, list the biohazard agent : Approved IBC protocol # _____

6. Animals to be dosed with radioisotope

Animal protocol title: _____

Animals species: _____

Total number of animals to be dosed: _____

7. Radioisotope to be used in the project _____

Chemical from _____ Source _____

Amount of activity administered to each animal : _____ uCi

Route of Administration: _____ Length of time animal kept after dosing:

8. Location (s) where animal is dosed and maintained *:

**Animals can only be maintained in a laboratory for < 24 hours. If > 24 hours housing in a laboratory is necessary, IACUC approval must be obtained prior to housing the animal in the laboratory.*

9. Describe the procedure using radioisotope:

10. Please provide justification for the use of radioisotope in animal study.

11. Describe the radioisotope waste collection and disposal process

12. Describe the spill cleanup process:

13. Describe the emergency exposure process:

14. Describe the transportation process:

15. Outline a pilot project plan to validate the safety of the process.

16. Investigator's Statement:

The information that I have supplied above is a complete and accurate description of my use of this radioisotope in this species. I certify that I will comply with all of the institutional policies and Texas State Health Department regulations regarding proper use of radioisotopes, maintenance of required records, and waste disposal. All of the individuals listed above as authorized users have received training in radiation safety practices within the past year.

Investigator's Signature

Date

17. Approvals:

Radiation safety committee comments:

Radiation Safety Officer

Date

Radiation Safety Committee (Chair)

Date