

RADIATION

SAFETY MANUAL

Environmental Health, Safety & Risk Management

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A. Introduction

All policies, procedures, and guidelines outlined in this manual are in effect and must be followed by all personnel who acquire, handle or dispose of radioactive materials. Compliance with the contents of this manual will be verified through surveillance on the part of the Department of Environmental Health, Safety & Risk Management. Any questions regarding the content of this material may be addressed by calling the Department of Health, Safety & Risk Management (956) 665-3690.

B. Responsibilities

1. Radiation Safety Officer

The Radiation Safety Officer (RSO) oversees the daily activities regarding the safe use of radioisotopes and sources of radiation, including non-ionizing radiation on The University of Texas Rio Grande Valley (UTRGV) campus. The RSO also serves as the liaison between the UTRGV and the Texas Department of State Health Services – Radiation Control Program.

The RSO is ultimately responsible for the following:

- Terminating any operations that are deemed radiation hazards.
- Performing periodic inspections of areas where sources of radiation are stored and used
- Notifying the UTRGV Department of Environmental Health, Safety & Risk Management (EHSRM) when radioactive materials are present on campus.
- Maintaining records of radiation surveys and inventories of radioactive materials.
- Developing the rules and procedures needed to control the procurement and use of radioisotopes and sources of radiation at the UTRGV.
- Preparing instructions that ensure adequate protection of University personnel in compliance with all state and federal regulations.
- Providing a service for periodic calibration of survey instruments or have the instruments calibrated by a service licensed by the Texas Department of State Health Services. All instruments must be calibrated annually.
- Ensuring all radiation sources and areas are properly labeled.
- Maintaining a comprehensive file on personnel radiation dose records, receipt, use, storage, and disposal of radioisotopes; and all other matters pertinent to the Radiation Safety Program involving radiation control.
- Periodically evaluating the results of leak tests on sealed sources and recommend action to comply with state and federal regulations.
- Arranging for the disposal of radioactive waste.
- Advise and assist University personnel in matters of radiation safety and in the procurement, use, storage, and disposal of radioactive material.
- Providing overall administrative direction of the UTRGV Radiation Safety Program.

2. Department of Environmental Health, Safety & Risk Management – Radiation Safety Program (RSP)

The Radiation Safety Program is responsible for ensuring that radioactive material (RAM) and are used in accordance with local, state, and federal regulations.

In fulfilling this responsibility, the (RSP):

- Formulates general policy governing the use of radioactive materials, including non-ionizing radiation.
- Determines that all individuals authorized to use RAM have sufficient training and experience to enable them to perform their duties safely.
- Reviews all requests to use RAM at the University and send applications to the Texas Department of State Health Services for approval.
- Establishes a program to ensure that all individuals who may be required to work in the vicinity of RAM or radiation producing machines are properly instructed on all appropriate health and safety matters.
- Conducts an annual review of the Radiation Safety Program to determine that all activities are being conducted safely and in accordance with Title 25 of the Texas Administrative Code, Chapter 289 (25 TAC §289) and the conditions of the UTRGV radioactive material license.

3. Authorized User

All authorized users (AU) of radioactive materials must comply with the conditions of their authorization and the radioactive material license of the UTRGV.

The AU is responsible for:

- Providing instructions on safe and proper radiation practices to all persons working within the facilities of the AU.
- Assuring that areas beyond the control of the AU are not affected by the use of RAM.
- Providing necessary equipment to work safely with RAM.
- Securing all RAM against theft or unauthorized use.
- Contacting the RSO for proper disposal of all radioactive waste.
- Notifying the Radiation Safety Officer of any accident or abnormal incident involving or suspected of involving RAM.
- Complying with 25 TAC §289, conditions of the UTRGV radioactive material license, and policies of the EHSRM.

C. Procurement of Radioactive Materials

The University of Texas Rio Grande Valley (UTRGV) has been issued a license to possess and use radioactive materials (RAM) by the Texas Department of State Health Services, Radiation Control Program (TDSHS – RCP). This license permits the use of radioactive isotopes in research and teaching activities. At the same time, it requires UTRGV to maintain a well-managed and documented program to ensure that all RAM is used safely.

1. Authorization for Use

Any qualified person who wishes to use RAM must submit an application for the non-human use of radioactive materials form to the Radiation Safety Officer (RSO) describing their training and experience. The letter of application must also contain detailed information on the facilities, proposed experiment, radiation measuring instrumentation, any special safety devices, and procedures for the control of radiation, emergency procedures, and waste disposal methods.

The RSO will review the application, inspect the applicant's facilities and obtain any additional information that may be required. If the application is complete, it will be forwarded to the Texas DSHS – RCP for final approval. The permit issued by the TDSHS-RCP will include the AU, the RAM authorized for use, and any special conditions to be followed.

2. Purchasing Radioactive Materials

Only authorized users (AU) may request the purchase of radioactive materials (RAM). Radioactive materials may be purchased using the following steps. Failure to do so may result in a delay in receiving the material.

- The requestor will request to purchase radioactive materials through iShop, at which time the RSO is included in the approval process. Upon receipt, the RSO will examine their records to determine if approval will exceed the type or quantity limit as outlined in the RAM license. The Purchasing Department will not process any DPR for radioactive materials or sources without prior approval by the RSO.
- Radioactive materials or sources are to be shipped directly to EHSRM, for processing and may not be received directly by an AU. In the event a package is shipped directly to the AU, then the AU is instructed to notify the EHSRM immediately for processing.
- The shipping address must be the following:

**The University of Texas Rio Grande Valley
Department of Environmental Health, Safety & Risk Management
1201 West University Dr.
Edinburg, TX 78539
Attn.: Richard Costello**

3. Receipt of Radioactive Material

Upon receipt of radioactive material or sources by Central Receiving the RSO will be notified so the material can be checked in. No weekend shipments will be accepted by Central Receiving.

When notified, the RSO will:

- Travel to Central Receiving.
- Survey the outside packaging for leakage, unless the contents are exempt by 25 TAC §289.202(ee). Those packages that require surveys shall be surveyed as soon as possible, but no later than four hours after it was received by Central Receiving. A receipt of radioactive material form will be completed for all packages received that are not exempt.
- After the required surveys are completed and documented, the shipment will be given an Inventory Number. This number will be placed on the primary container, the inventory forms, and all subsequent paperwork related to that item.
- A "*Radioactive Material Utilization Log*" form will be prepared and issued to the authorized user for each inventory number assigned. This form will be used to monitor the amount of activity used for the subsequent experiments and the remaining activity in the original container.
- The RSO will promptly notify the appropriate person when a shipment of radioactive material is ready for distribution. It will be the responsibility of the individual to make arrangements to pick up the RAM or have it delivered.

D. Precautionary Measures

1. Training Requirements

Training is required for all individuals working with radioactive materials and for those persons who frequent areas where radioactive material or sources are used. Training is provided by the EHSRM. Training must include the following topics:

- The UTRGV Radiation Safety Manual.
- How the source(s) of radiation are stored, used, or transferred.
- Health problems associated with the exposure to such radiation or radioactive sources.
- Precautions and procedures to take to minimize exposure.
- Purpose and function of protective devices and personal protective equipment.
- All applicable regulations concerning the use of radiation or radioactive sources.
- Use of instrumentation.
- Radioactive waste disposal.
- Procedures to report any conditions which may lead to or cause a violation of the above mentioned regulations or result in unnecessary exposure to radiation or radioactive sources.
- Emergency procedures.
- Whom to contact for additional information about radiation safety.

General awareness training is required for those personnel that share a laboratory with persons using radioactive materials.

The authorized user is responsible for seeing that all personnel working under his/her supervision receive this training.

2. Posting Restricted Areas

Areas in which access is controlled by the authorized user for purposes of protection of individuals from exposure to radiation and radioactive material will be designated as "Restricted Areas". These areas or rooms must be posted with the appropriate radiation caution signs or labels according to 25 TAC §289.202(aa).

3. Personnel Radiation Monitoring

Radiation cannot be seen and affects none of the senses. Therefore, it is necessary to use special methods of recording exposures to individuals. Commonly, film badges, pocket ionization chambers, or thermoluminescent dosimeters (TLDs) are used. Film badges and TLD's are used to monitor an individual's whole body exposure over a long period of time, usually one month to a maximum three months. Pocket ionization chambers are used over short periods of time and/or when immediate readings are required. Personnel dosimetry records are maintained and kept by the Radiation Safety Officer (RSO). An individual who would like to review their dosimeter records may do so by contacting the RSO 25 TAC §289.202(q)(1) states that each licensee or registrant shall monitor exposures from sources of radiation and shall supply and require the use of individual monitoring devices for:

- Adults likely to receive, in 1 year, a dose in excess of 10% of the outlined limits;
- Minors likely to receive, in 1 year, a deep dose equivalent in excess of 0.1 rem (1 mSv) , a lens dose equivalent in excess of .15 rem (1.5 mSv) , or shallow dose equivalent to the skin or extremities in excess of 0.5 rem (5 mSv);
- Declared pregnant women likely to receive during the entire pregnancy, a deep dose equivalent in excess of 0.1 rem (1 mSv); and
- Individuals entering a high or very high radiation area

Personnel monitoring devices must be used in accordance with the following rules:

- "Whole body" monitors are worn at collar level outside any shield such as aprons and lab coats.
- Monitors are worn at all times while in radiation areas except where an individual is not likely to receive, in 1 year, a dose in excess of 10% of the outlined limits, or minors and declared pregnant women likely to receive, in 1 year, a dose in excess of 10% of the outlined limits. In this case, appropriate documentation in the form of dose calculations or previous monitoring will be maintained and available for inspection.
- Monitors should be stored in a safe place away from radiation when not in use.
- Monitors are issued to one person and may not be worn by another individual.
- Monitors should not be washed.
- Whole body monitors that utilize film or TLD finger dosimeters are worn for one month and then changed.
- Notify the RSO immediately if you lose your personnel monitoring device or if any other incident occurs.

4. Area Surveys

Areas where radioactive materials are stored, handled, or used must have radiation level surveys and contamination level surveys conducted on a regular basis. The frequency of surveys depends on the amount and type of radioactive material used. The following table outlines the minimum frequency in which surveys should be conducted. It is prudent, however, to conduct a survey after each experiment. All surveys results should be given to the RSO.

Survey Type and Frequency

Isotope Type	Survey Type	Instrument Type	Minimum Survey Frequency	
			0- 200 uci / procedure	> 200 uCi / procedure
Low Energy Beta Emitting Isotopes (³ H, ¹⁴ C, ³⁵ S)	Contamination	Liquid Scintillation Counter (1)	Monthly	Weekly
High Energy Beta Emitting Isotopes (³² P)	Contamination Radiation Level	Liquid Scintillation Counter (1) Survey Meter (2)	Monthly	Weekly
Gamma Emitting Isotopes (⁵¹ Cr, ⁸⁶ Rb)	Contamination Radiation Level	Liquid Scintillation Counter(1) Survey Meter(2)	Monthly	Weekly
Sealed Sources	Leak Test	Outsourced		

(1) Beckman Liquid Scintillation LS 6500 Counter or similar.

(2) Ludlum GM Detector M-14C with Pancake probe or similar.

Suggested methods for conducting radiation level surveys and contamination level surveys are outlined below. All results should be recorded on the on a standard form showing the location, date, person performing survey, instrument used and calibration date, and radiation levels. Surveys should be conducted in areas that are most likely to be contaminated including, but not limited to, laboratory benches, fume hoods, storage locations, door knobs, telephones, sinks etc.

- Radiation Level Surveys* – A radiation level survey is conducted with a survey meter capable of measuring radiation levels as low as 0.1 mR/hr. Radiation levels are measured one three inches from the surface. **If radiation levels exceed 2x background, then the surface is considered contaminated, and should be decontaminated, including the conduction of a contamination survey to assess surface contamination levels.** Maintenance of the meter should be in compliance with TAC 289.202(p)(2).
- Contamination Surveys* – A series of wipes using filter paper or other material should be taken from surfaces where contamination could exist or where radiation levels are fairly high. The wipes should be rubbed over an area of about 100 cm² to maintain consistency. **If surface contamination levels exceed 100 DPM/100 cm² in any location, then actions should be taken to decontaminate the surface.** By using the appropriate scintillation counter, the level of contamination can be determined. All results are recorded on a form entitled Laboratory Survey Form, or similar.

E. Laboratory Procedures

1. Written Procedures

A set of written procedures is required for each laboratory or area where radioactive material is used. These procedures must describe specific rules governing the storage, use, handling and disposal of radioactive materials in that area. All individuals working in the laboratory or area must know where the written procedures are located.

General Rules of Conduct:

- The use of radiation detection device (survey meter) should be available to the laboratory personnel. The survey meter is to be used to monitor the work area and an individual after using radioactive material before the individual leaves the area.
- Absorbent paper shall cover workbenches, trays, and other work surfaces where radioactive materials are handled.
- The laboratory should be kept clean and orderly at all times.
- Avoid carelessness in handling radioactive materials. Do not splash, splatter, or spill radioactive liquid.
- Always handle volatile material or potentially airborne radioactive material in appropriate fume hood.
- Notify the Radiation Safety Officer (956-665-3690) immediately in the event of a spill or an accident.
- Disposable gloves shall be worn while working with radioactive solutions, when hand contamination is deemed possible.
- All laboratory personnel working with radioactive material must wear some type of outer-garment to prevent contamination of personal clothing. Never wear a contaminated coat
- Pipetting by mouth is prohibited. Use mechanical pipetters.
- Every bottle, flask, tube, etc. which contains radioactive material shall be identified by a proper radiation warning label.
- When storing radioactive material, always cover or stopper the container.
- Bottles, flasks, beakers, and other vessels which contain more than 100 microcuries of activity should not be picked up by hand for more than a few seconds; for longer period of time, tongs or forceps should be used, whenever practical.
- Glassware containing radioactive material is never to be turned in to a central washroom, unless it has been decontaminated first.
- All radioactive waste and contaminated material must be placed in receptacles especially marked for radioactive material storage.
- When a procedure is completed –before leaving the lab, thoroughly wash hands and monitor for radioactive contamination.
- Decontamination of the hands is not easy and may require repeated washings. Wash hands over the sink in full stream of water; use cool water, non-abrasive soap, and a soft surgical scrub-brush, taking care to not abrade the skin.
- No food or beverage is to be stored in the same refrigerator or freezer as radioactive material.

- No eating, drinking, smoking, or applying of cosmetics is allowed in a laboratory using or storing radioactive material.
- The proper radiation caution signs are to be posted in the appropriate areas containing radioactive materials.
- A "Notice to Employees" sign must be posted in a sufficient number of places so that employees may observe a copy on their way to and from their place of employment.
- Radioactive materials, which emit penetrating radiation, and whose activity exceeds 500 microcuries, shall be kept behind lead shields or inside of lead-lined vessels. Plastic shielding will be used with high-energy beta emitters, i.e. 32P
- Protective eyewear is to be worn when working on the open bench top with more than 10 millicuries of a beta emitter. It is recommended that the eyewear be worn anytime > 1 millicurie of a beta emitter is to be used on the bench top.
- Radioactive material is to be stored in a secured manner.

2. Storage Requirements

Radioactive materials must be kept in leak proof containers using the appropriate shielding. Liquid waste should be stored in secondary containment. All containers must be labeled with the appropriate radiation symbol with at least the following information:

- the radionuclide,
- the activity, and
- the date.

Refrigerators, freezers, and any other type of storage unit must have a sign that states "Caution Radioactive Material". Any unit that is used for the storage of radioactive material may not contain food or beverages for human consumption. All radioactive material must be secured from unauthorized access. All areas where radioactive materials are handled and stored must have non-porous flooring and work surfaces.

3. Handling Radioactive Material

Disposable gloves must be worn when handling unsealed radioactive material. In some instances, remote-handling devices, such as tongs, may be required. Some materials may require the use of shielding. The use of volatile radioactive material must be done in a fume hood specifically approved for such use by the Radiation Safety Officer (RSO).

Notify the RSO prior to the repair or removal of any equipment that may be contaminated with radioactive material. The RSO must conduct surveys to determine the level of contamination, if any.

F. Disposal Methods

1. Waste Minimization

All authorized users should practice basic waste minimization principles of source substitution, reduction, segregation, and minimization when conducting activities using radioactive materials. The EHSRM will work with the authorized user to determine the best mechanisms for reducing waste generated. In as much as possible the following principles should be:

- a. Substitution of a non-radioactive material for radioactive materials in experiments
- b. Substitution of a short-lived radioactive material for radioactive materials with long half-lives.
- c. Use of radioactive materials in quantities, which will result in waste at exempt levels for H-3; C-14; and I-125.
- d. Segregation of long-lived radioactive materials from short-lived radioactive materials
- e. Use of microscale techniques to minimize the quantity of radioactive materials used.

2. Disposal Procedures

All radioactive waste streams should be disposed of through the EHSRM.

- Place the material in the appropriate container. Properly label each container with the appropriate isotope, activity (Ci or Bq's), and date. For gamma emitting isotopes it is also advised to put the maximum radiation reading and mark that specific location with an X.
- Contact the EHSRM for collection (x3690 or email the waste line (waste@utrgv.edu))

Upon collection, the EHSRM can use a variety of options to dispose of the radioactive material which is dependent on the isotope, form, activity, and half-life. Radioactive material should be disposed of by one of the following methods. In all cases, the appropriate documentation for the characterization, quantification, and ultimate disposal of all radioactive waste streams must be maintained and available for inspection.

a. Exemption of Specific Wastes

In some cases, certain isotopes in certain concentrations can be disposed of "without regard to its radioactivity". They include:

.05 microcurie or less of hydrogen-3, carbon-14, or iodine-125 per gram of medium used for liquid scintillation counting or in vitro clinical or in vitro laboratory testing; and .05 microcurie or less of hydrogen-3, carbon-14, or iodine-125 per gram of animal tissue averaged over the weight of the entire animal and :

b. Decay in Storage

For some materials with a short half-life, it may be practical to store the waste until it has undergone sufficient radioactive decay to background levels and disposed of as non-radioactive in the regular trash. It will only be disposed of as non-radioactive waste, after a minimum 10 half-lives, and if survey readings cannot be distinguished from background. At that time the waste may be disposed of as non-radioactive provided all radioactive markings have been defaced.

c. Release into Sanitary Sewer

Radioactive material may be discharged into the sanitary sewer system provided the material is soluble or dispersible in water and the amount disposed does not exceed limits outlined in 25 TAC §289.202(gg).

d. Transfer to an Authorized Recipient

If the waste cannot be disposed using one of the previous methods, then it is disposed of via an offsite contractor generally to a low Level waste disposal facility for land disposal, or incineration. Disposal of these waste streams are arranged by the EHSRM with an offsite vendor.

G. Emergency Information

1. Emergency Telephone Numbers

Radiation Safety Officer – Dr. Richard Costello	457-2357
Department of Environmental Health, Safety & Risk Management Radiation Safety Program	665-3690
The University of Texas Rio Grande Valley Police Department	911 or 665-7151

<i>In the Event of:</i>	
Radioactive Spill	911 or 665-3690
Chemical Spill	911 or 665-3690
Medical Emergency	911 or 665-4357

Information that will be needed:

1. Your name
2. Your location (room and building)
3. The phone number you are using

Describe the nature of the emergency

2. Emergency Procedures for Minor Spills

Minor spills can generally be considered as those that contaminate small areas of laboratory surfaces or equipment, but **do not** result in:

- Contamination of personnel,
- Excessive external exposure to personnel, or
- Internal contamination of personnel.

Procedure:

1. Notify all persons in the area that a spill has occurred.
2. Cover the spill with absorbent paper or pad.
3. Using disposable gloves and remote handling tongs, carefully fold the absorbent paper or pad, insert in a plastic bag.
4. In another plastic bag insert all other materials that have been contaminated, i.e.: disposable gloves.
5. Report the incident to the Radiation Safety Officer (RSO) and Authorized User. The RSO will decontaminate the area, and arrange for disposal of contaminated articles. The RSO will also survey any affected personnel to determine the extent, if any, of any contamination.

3. Emergency Procedures for Major Spills

Major spills can generally be considered as those that:

- Contaminate large surface areas,
- Contaminate personnel,
- Provide excessive external exposure to personnel, or
- Internally contaminate personnel.

Procedure:

1. Notify all persons not involved in the spill to vacate the room.
2. Cover the spill with absorbent paper or pad. **Do not attempt to clean up the spill.**
3. Prevent potentially contaminated personnel from leaving the room. Prevent personnel from entering the area.
4. Notify the RSO and the Authorized User.
5. The RSO will conduct the appropriate surveys and decontamination as necessary.

H. Inspection Criteria

The following inspection form outlines the inspection criteria in which the RSO will assess compliance with the rules and regulations mandated by the Texas Department of State Health Services - Bureau of Radiation Control and the Radiation Safety Manual. Inspections by the RSO will be conducted on an annual basis. All records are to be available and in orderly fashion for inspection by the RSO. Because the inspection criteria parallel the rules and regulations mandated by the BRC and the Radiation Safety Manual, they can also be used as a guide for conducting activities in the laboratory.

Radiation Inspection

Description	Citation	Y	N	N/A	Comments
General					
Laboratory posted with appropriate caution signs?	TAC289.202(aa)				
Laboratory posted with emergency contact and numbers?	RSM Section G				
Laboratory posted with "Notice to Employees"?	RSM Section G				
Is the Radiation Safety Manual available?	RSM Section E				
Have all personnel attended Radiation Safety Class?	RSM Section D				
Receipt and Use					
Compliance with requirements for the receipt of radiation sources?	TAC289.202(ee)				
Are laboratory procedures being adhered to?	RSM Section E				
Is the principle of ALARA being adhered to?					
Is the proper PPE worn? (lab coats, gloves, safety glasses)	RSM Section E				
No evidence of eating drinking or smoking or food storage?	RSM Section E				
Is liquid R/A stored in secondary containment?	RSM Section E				
No mouth pipetting?	RSM Section E				
Are contaminated items labeled?	RSM Section E				
Is radioactive material secure from unauthorized removal or under constant surveillance in unrestricted areas?	TAC289.202(y)				
Are containers labeled "Caution, Radioactive Material"?	TAC289.202(cc)				
Are containers labeled with the isotope name and quantity?	TAC289.202(cc)				
Are empty container labels defaced prior to disposal?	TAC289.202 (cc)				
Surveys and Monitoring					
Are laboratory surveys appropriate for radiation types and quantities use?	RSM Section D				
Is instrumentation and equipment used appropriate, operable, and calibrated?	TAC289.202(p)				
Are radiation levels and surface contamination limits in compliance with RSM requirements? (Attach survey)	RSM Section D				
Are dose levels to individual member of the general public in compliance? (2 mr/hr and 50 mrem/yr)	TAC289.202(n)				
Occupational Dose Limits					
Demonstrated compliance with occupational exposure limits?	TAC 289.202(f)				
Is appropriate occupational monitoring in place or appropriate documentation for external or internal dose?	TAC289.202(q)				
Release					
Is waste minimization being practiced?	RSM Section				
Is waste disposed of in accordance with TDSHS-RCP-BRC regulations?	TAC289.202(ff)				
Is waste properly segregated?	RSM Section				