



# Radiation Safety Plan

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## Revision History

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Revision Number	Revision Date	Revised By	Description of Change
00	2/7/2020	Juliette Jones	Initial creation and implementation.
01	7/20/2020	Juliette Jones	Updates for compliance with DoH: BoRC and for concurrence with Rad Mat Use/Safety Manual
02	9/1/2022	Selvin McLean	Updates to links; typos corrected.
03	10/11/2023	Selvin McLean	Review for errors/typos and update to information

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## Introduction

Florida Tech is committed to providing a safe and healthful environment for all employees, students, and visitors.

Florida Tech is licensed by the State of Florida, Department of Health, Bureau of Radiation Control as an authorized user of radioactive materials and radiation generating devices. The primary responsibilities of Florida Tech's Radiation Safety Program are to ensure radiation controls are implemented to protect all university personnel and the public and to guarantee radiation sources are used in accordance with [Chapter 64E-5 of the Florida Administrative Code \(FAC\)](#).

Florida Tech shall use, to the extent possible, administrative and engineering controls based upon sound radiation protection principles in maintaining occupational doses and public doses as low as reasonably achievable. Florida Tech's Radiation Safety Program is consistent with the rules and regulations set forth by the U.S. Nuclear Regulatory Commission (NRC) and the Florida Department of Health, Bureau of Radiation Control. To minimize exposure risks, the radiation safety practices outlined in this program must be maintained and adhered to by individuals using radioactive materials at Florida Tech.

## Radiation Safety Program

This Radiation Safety Program sets forth policies, regulations and procedures approved by Florida Tech's Radiation Safety Committee (RSC). The Radiation Safety Program is made up of procedures and guidelines which govern all segments of isotope use on campus. The following radiation control procedures are included as part of this program.

1. ALARA Policy,
2. Administration and Authorization,
3. Radiation Safety Training,
4. Operating Procedures,
5. Procedures for Receiving, Opening Packages of Radioactive Material,
6. Instructions for Routine Usage,
7. Instructions for the Preparation of Radioactive Waste for Disposal,
8. Inventory of Radioactive Materials and Instructions for Surveys (including leak tests),
9. Emergency Procedures, and
10. Radiation Safety Program Audit.

## Radiation Safety Program Controls

Florida Tech's Radiation Safety Program has been established to protect the health and safety of users and the public. Florida Tech's radiation safety staff, which includes the Radiation Safety Officer (RSO), Environmental Health and Safety (EHS), and the Radiation Safety Committee (RSC), are empowered to assure that these controls are adhered to.

1. Florida Tech’s Radiation Safety Program will be accessible to all users. The written portions of the Radiation Safety Program are maintained in the Radiation Safety Plan and the [Florida Tech Radioactive Materials Use and Safety Manual](#). Written radiation safety procedures will be maintained by the RSO and peer reviewed by EHS. In the event changes are made to the Radiation Safety Program, the RSO shall discuss compliance with the RSC, PIs, and Authorized Users and make appropriate revisions to the Radiation Safety Plan and [Florida Tech Radioactive Materials Use and Safety Manual](#).
2. The use of radioactive material at Florida Tech is governed by rules and regulations set forth in [Chapter 64E-5, FAC](#) and provisions set forth in the specific radioactive material license issued to Florida Tech by the State of Florida, Department of Health, Bureau of Radiation Control.
3. The Florida Tech RSO/RSC shall, at intervals not to exceed 12 months, review the Radiation Safety Program content and implementation. An annual report shall be sent to the President of Florida Tech for review. The report must be signed by the RSO and the President indicating they have reviewed its contents and will address any weak areas in the program immediately.
4. The following items are defined, established, and maintained to ensure that the Radiation Safety Program mission is accomplished.
  - a. ALARA Program,
  - b. Radiation Safety Committee,
  - c. Radiation Safety Officer,
  - d. Principle Investigators,
  - e. Authorized Users,
  - f. Monitoring/survey of radioactive material labs,
  - g. Safe practices for using radioactive materials,
  - h. Safe practices for labeling and storing radioactive materials,
  - i. Identifying all areas which contain radiation producing devices, and
  - j. Training Principal Investigators and Authorized Users.

## ALARA Policy

### The ALARA Philosophy

[Part III of Chapter 64E-5, Florida Administrative Code \(FAC\)](#), establishes standards for protection against radiation hazards. Section [64E-5.303, FAC](#) requires licensees to use, to the extent practical, procedures and engineering controls based upon sound radiation protection principles to achieve occupational and public doses that are **As Low As Reasonably Achievable (ALARA)**. Management, the Radiation Safety Officer and all authorized users must participate in the

establishment, implementation, and operation of a radiation protection program that applies the **ALARA** philosophy of minimizing exposures to radiation.

The primary concept of the **ALARA** philosophy is that unnecessary exposure to radiation should be avoided even though current occupational exposure limits provide a very low risk of injury. The objective is to reduce occupational exposures (both individual and collective) as far below regulatory limits as is reasonably achievable by means of good radiation protection planning and practice.

### Management Commitment

We, the management of Florida Tech, are committed to the **ALARA** philosophy of maintaining occupational and public radiation doses as low as reasonably achievable.

1. It will be a management priority that all personnel working with radioactive material be made aware of our commitment to the **ALARA** philosophy and that they be instructed in the procedures to be used to keep their exposures as low as possible.
2. Management has delegated authority to our RSO to ensure adherence to **ALARA** principles. Management will support the RSO in instances where this authority must be asserted.
3. Management will make all reasonable modifications to procedures, equipment and facilities to reduce exposures, unless the cost is considered unjustified. We will be prepared to describe the reasons for not implementing modifications that have been recommended.

### Radiation Safety Officer Commitment

1. The RSO will emphasize the **ALARA** philosophy to all personnel working with radioactive material and will instruct workers to review current procedures and propose changes to reduce exposure levels.
2. If personnel monitoring is conducted, the RSO will review dosimetry reports for all monitored personnel upon receipt (monthly for film badges or quarterly for TLDs) to determine if unnecessary exposures are being received. The RSO will sign and date each report reviewed. The RSO will investigate within 30 days the cause of any personnel exposure considered to be excessive. If warranted, the RSO will take corrective actions to ensure that unnecessary exposures are halted, and recurrence is prevented. A report of each investigation and the actions taken, if any, will be recorded and maintained for inspection purposes by the RSO at the office of EHS.
3. At least annually, the RSO will conduct a formal review of the radiation protection program's content and implementation, as required by subsection [64E-5.303\(3\), FAC](#). The review will include an evaluation of equipment, procedures, inspection findings, and any incidents. The RSO will assess trends in occupational exposures as an index of the program's success and to determine if any modifications to the program are needed. A summary of the results of each annual review, including a description of actions proposed and taken, if any, will be documented by the RSO, discussed with management, and



signed and dated by both. A report on each audit will be maintained on file for 3 years from the date of review, in accordance with section [64E-5.335, FAC](#).

### Worker Commitment

All personnel working with sources of radiation will adhere strictly to policies and procedures applicable to activities involving radiation sources and will apply **ALARA** principles and good work practices to minimize their occupational exposures. *Time, distance* and *shielding* will be used to keep exposures **ALARA**. When working with sources of radiation, minimize the time spent near the source, maximize the distance from the source, and make use of available radiation shielding. Workers must report to the RSO any conditions in the workplace that have the potential for causing unnecessary exposures.

## Participants and Responsibilities

### Radiation Safety Officer (RSO)

Responsibility for the overall Radiation Safety Program shall rest with the RSO. The duties and responsibilities of the RSO shall include, but are not limited to the following:

1. Acts as Florida Tech's liaison officer with the Florida Department of Health on all radiation licensing matters.
2. Ensures that all terms and conditions of the license and regulations are complied with.
3. Administers the overall day-to-day radiation safety program, including but not limited to routine surveys and provision of dosimeter badges and dosimetry reports.
4. Maintains control over the procurement, use and disposal of licensed materials,
5. Furnishes guidance and direction to licensed material users on the safe operation and handling of radioactive materials and in the use of radiation survey instruments.
6. Develops and maintains current operation and emergency procedures.
7. Establishes and maintains an internal audit system that will ensure items not conforming to licensed conditions will be promptly identified and corrected.
8. Investigates the cause of any incident and determines necessary preventative measures,
9. Suspends any operation causing excessive radiation hazard as rapidly and safely as possible.
10. Maintains a list of all Principal Investigators (PI) and Authorized Users (AU).
11. Maintains an inventory of total radioactive materials and radiation producing machines at Florida Tech.
12. Establishes and maintains a radiation safety record keeping program.
13. Ensures that radioactive materials are properly secured against unauthorized access or removal.
14. Ensures that audits are performed at least annually to ensure that the Radiation Safety Program is being enacted as required.

15. Ensures that the license is amended whenever there are changes in licensed activities, responsible individuals and/or commitments provided in the licensing process.
16. Maintains current copies of pertinent regulations, the Radiation Safety Plan, and the [Florida Tech Radioactive Materials Use and Safety Manual](#).
17. Ensures that all users read and understand Florida Tech's Radiation Safety Plan and the [Florida Tech Radioactive Materials Use and Safety Manual](#).

### Radiation Safety Committee (RSC)

The RSC is responsible for the review and oversight of the overall Radiation Safety Program. The RSC will consist of at least four individuals, including the RSO, and personnel that are Authorized Users or Principle Investigators at Florida Tech.

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

1. Responsible for reviewing and implementing the Radiation Safety Program and ensuring that all radiation safety activities are performed in accordance with approved procedures and regulatory requirements.
2. Seeks ways to reduce the occupational radiation exposure dose of licensed user.
3. Prescribes special conditions and requirements which may be necessary to ensure radiation safety.
4. Prepares and disseminates information on radiological safety for the use and guidance of students and staff.
5. Reviews and approves all prospective research projects, protocols, and instructional activities involving the use of radioactive materials, and
6. Reviews all ongoing projects and protocols involving the use of licensed materials at timely intervals (at least annually).

### Principle Investigator (PI)

The PI also shares the responsibility for the safe use of radioactive materials and radiation producing devices, specifically:

1. Administer and enforce safety rules and regulations as stated in [Chapter 64E-5, F.A.C.](#), the Radiation Safety Plan, and the [Florida Tech Radioactive Materials Use and Safety Manual](#) in all areas within the scope of their authority (i.e. posted storage and use labs).
2. Inform all employees or students of potential radiological health hazards and the necessary safeguards and controls which are established to guard against them.
3. Ensure that all employees or students working with or near radioactive materials or radiation producing devices are properly trained (both initially and annually).
4. Ensure that dosimetry is appropriately used and that dosimeters are returned on time (if required).

5. Inform the Radiation Safety Office of all changes in personnel working with radioactive materials or radiation producing devices and changes in facilities or use/storage locations in a timely manner.
6. Maintain current and adequate inventory and usage records.
7. Maintain security and control over radioactive material via keeping labs and storage locations locked/secured and accessible by authorized personnel only.
8. Perform daily contamination surveys on days radioactive materials are in use, weekly contamination surveys in areas where radionuclides are in use, and monthly contamination surveys in areas where radionuclides are stored but not actively used.
9. Ensure that all radioactive waste is properly stored in labeled containers in posted and secure labs, and that the RSO and EHS are contacted when waste containers are three-quarters full.
10. Ensure safe and secure storage of all radioactive materials and maintain proper signage on all labs and storage locations of radioactive material (contact the RSO for signage).

### Authorized Users

Authorized users are PIs or individuals working under the supervision of a PI. It is the responsibility of each person working with licensed materials to follow all radiation safety procedures without deviation, for their protection and the protection of others.

### Radiation Training

At Florida Tech, all authorized users and PIs must have initial and annual refresher training. Consult the RSO/RSC or section 2.3 of the [Florida Tech Radioactive Materials Use and Safety Manual](#) for information on requirements for initial training at Florida Tech. Annual refresher training for users of unsealed radioactive materials consists of two courses (Introduction to Radiation Safety and Handling Radioactive Materials) which are available online via [Florida Tech HSI LMS](#) or in person with the RSO. All PIs and authorized users of unsealed radioactive materials must complete both courses annually either through [Florida Tech HSI LMS](#) or with the RSO in person.

Authorized users should also have training specific to their lab protocols. That might include coursework related to specific procedures as well as training through their PI. This training will be assessed by the RSO and the RSC through the Ionizing Radiation User Approval Request (RUAR) Form (See Appendix 1). This form is also available in the [Florida Tech Radioactive Materials Use and Safety Manual](#) (Appendix D-3).

Personnel and students who work in posted labs but will not handle radioactive materials are required to take the Introduction to Radiation Safety course either online or in person. This training must be refreshed annually. These personnel are not allowed to handle radioactive materials and must be supervised when radioactive materials are in use and not secured (i.e. locked in a safe or fridge).

Only the RSO (or their EHS designee) can receive, survey, and deliver packages containing radioactive materials. Thus, the shipping and receiving department will receive specialized annual training on the procedure for a campus shipment of radioactive materials. Please see the section on “Purchasing and Receiving Radioactive Materials” for further information.

Procurement staff will receive guidance from the RSO to prevent unauthorized purchases of radioactive materials.

Sealed source only PIs and authorized users have an optional initial and annual refresher training available. The Sealed Source Training is a truncated version of the Introduction to Radiation Safety and Handling Radioactive Materials courses. The RSO will provide this training upon request. Sealed source only users may also take the two courses (Introduction to Radiation Safety) in lieu of taking the Sealed Source only training. Users of unsealed sources may not take this training in lieu of the Introduction to Radiation Safety and Handling Radioactive Materials courses.

Training records must be retained for the lifetime of the university or the termination of the license with the RSO in the office of EHS: a copy of training records must be in the possession of the PI for the duration of their usage of radiation materials at Florida Tech.

## Authorization to Use Radioactive Materials

A PI must submit the Radioactive Material Use Authorization (RMUA) form (see Appendix 2 of this document or the [Florida Tech Radioactive Materials Use and Safety Manual](#) Appendix D-2) for each project requiring the use of radioactive materials. This includes detailed protocols (either in line 2.3 or attached to the form) and a list of graduate students, technicians, and research associates involved in the project as radioactive materials users under the auspice of the PI. An Ionizing Radiation User Approval Request form (Appendix 1 of this document or the [Florida Tech Radioactive Materials Use and Safety Manual](#) Appendix D-3) must be filled out for each of these individuals before they are authorized to use radioactive materials. This should include their training in the use of radioactive materials (see the [Florida Tech Radioactive Materials Use and Safety Manual](#) section 2.3 for information on acceptable initial training).

The forms should be sent to the RSO. The RSO will assess the lab to ensure radioactive materials controls are in place (i.e. segregated work areas, secured storage areas, spill trays for active work, PPE, waste containers, and shielding) and provide a text copy of the [Florida Tech Radioactive Materials Use and Safety Manual](#). If the required controls are in place in the laboratory, the RSO will present the forms to the RSC who will have final say on whether the authorization is approved or rejected.

## Purchasing and Receiving Radioactive Materials

All purchases of radioactive materials must be approved by the RSO. The RSO must also be notified about transfers of radioactive materials between PIs at Florida Tech and to and from outside institutions. Only authorized users may work with radioactive materials, and only authorized Principal Investigators may purchase radioactive materials. PIs must contact the RSO for approval before placing orders through Procurement services. Further information on ordering radioactive materials at Florida Tech is available in the [Florida Tech Radioactive Materials Use and Safety Manual](#) section 3.0.

Property Administration will notify the RSO immediately whenever radioactive materials packages are sent to the University and are prohibited from handling radioactive materials package beyond initial delivery and receipt. Property Administration will store the package for the RSO to pick-up in a secure location. The RSO (or a designated EHS specialist/technician when the RSO is out of the office) will pick up the package within three hours of delivery from Property Administration, survey the package for contamination, and check that external radiation levels are below safe transport levels before delivery to the requesting PI. The RSO (or designee) will deliver the radioactive materials to a secured and posted storage location under the auspice of the requesting PI. Further information on receipt and survey of radioactive materials packages at Florida Tech is available in the [Florida Tech Radioactive Materials Use and Safety Manual](#) section 4.0.

## Storage of Radioactive Materials

Radioactive material can only be stored and used in designated posted locations. They should be stored in posted and secured labs whenever possible. Storage in refrigerators, freezers, or storage safes in public access locations should be locked and secured to prevent removal so that only authorized users, the PI, and the RSO have access and external exposure limits are below 0.2 mR/hr at 1 cm from the surface. These storage locations are also subject to required monthly surveys. Further information on storage of radioactive materials is available in the [Florida Tech Radioactive Materials Use and Safety Manual](#) section 8.0.

## Postings

The required postings on doors and entrances to storage areas include the [Florida Department of Health Notice to Employees](#), the [Emergency Notice](#) with 24-hour emergency contact information, and a sign bearing the radiation symbol and the words "CAUTION: RADIOACTIVE MATERIALS" (See Appendix 3 in this document for an example). The RSO may also be contacted for printed and laminated postings.

## Personnel Exposure Monitoring and Bioassays

Personnel Exposure Monitoring is provided at Florida Tech. Personnel Monitoring Devices (PMDs) are film badges that are worn monthly, and reports on exposures are returned

quarterly. Most radioactive materials used at Florida Tech are very small quantities or at low energy levels and do not require the use of PMDs. PMDs at Florida Tech are required for the handling of high energy beta (200 eV or greater such as Phosphorus-32) or gamma-emitting isotopes and as area monitors for radiation producing machines. Low energy beta emitters (such as tritium and Carbon-14) and alpha emitting radioisotopes do not require PEMs. Further information on PMDs at Florida Tech is available in the [Florida Tech Radioactive Materials Use and Safety Manual](#) section 6.1.

Under special circumstances, PMDs may be required/optional. These include PEMs for visitors, minors, and declared pregnant workers. Contact the RSO before allowing any visitors into posted labs: the RSO can provide a visitor badge to monitor possible exposures.

The following are annual exposure limits. Any exposures that are 10% or greater of the exposure limits require follow-up with the RSO to investigate the exposures as well as methods to reduce exposures in the future.

	Annual Occupational Exposure Limits for Adults (in millirems)	Florida Tech Action Levels for Annual Exposures (in millerems)
Deep Dose	5,000	500
Lens Dose	15,000	1500
Shallow Dose	50,000	5000
Member of Public (Visitor Badges)	100	Any measurable dose
Minors	500	Any measurable dose
Pregnant Worker	*500 gestational	Any measurable dose

Table 1 – Annual Exposure Limits and Action Levels

Authorized users of tritium (Hydrogen 3 or H3) in their protocols may be required to participate in Florida Tech’s H3 Bioassay Program. Examples of H3 requiring participation in the H3 Bioassay Program include the use of 1 mCi or more of a tritiated nucleotide or nucleotide precursor. PIs are responsible for their Authorized Users’ participation in the Bioassay program (as required), and the RSO is responsible for performing the bioassay and updating/maintaining exposure records with bioassay results. Details on the H3 Bioassay Program are found in the [Florida Tech Radioactive Materials Use and Safety Manual](#) section 11.0.

### Declared Pregnancy and Minors

A worker in a radiation area may request a gestational PMD and declare a pregnancy. Declaring a pregnancy decreases the occupational exposure limit for the gestational period to 500 mrem. Contact the RSO if you wish to wear a gestational PMD and/or declare a pregnancy. Gestational PMDs should be worn at waist level.

No one under the age of 18 shall use radioactive materials. Under certain circumstances, a minor may be a visitor to a lab that stores radioactive materials. They are allowed in the lab provided they are wearing a visitor PMD (occupational limits for minors are 10 % that of adults), are chaperoned by an authorized user, and are not allowed to directly handle radioactive materials. Contact the RSO before a minor is expected to visit a radiation lab. Further information on minors in the lab and declared pregnancies at Florida Tech is available in the [Florida Tech Radioactive Materials Use and Safety Manual](#) section 1.7.

## Use of Radioactive Materials

All labs that use radioactive materials should have a copy of the [Florida Tech Radioactive Materials Use and Safety Manual](#). The RSO will provide a copy to all approved PIs and their laboratories during the authorization process. The manual is also available online. The RSO will review and update the manual as needed, and updated copies will be provided to current posted labs. Use procedures for specific protocols are provided by the PI through their initial usage training and should be documented by SOP. The following is a best practice for general usage of radioactive materials. More detailed general usage instructions are available in the [Florida Tech Radioactive Materials Use and Safety Manual](#) section 6.0. The following is a short best practices for use of radioactive materials, but the final authority for usage is the protocol SOP and the [Florida Tech Radioactive Materials Use and Safety Manual](#).

The best way to minimize radioactive exposures is time, distance, and shielding. To minimize the time spent on a procedure, conduct “dry runs” of the protocol without the use of radioactive materials to become practiced in the procedure and have all the material you need in the experiment ready before you start it. Do not take radioactive materials out of their storage until they are needed and maintain distances that are as far as possible during use. When there is a risk for external exposure, perform procedures behind shielding as much as possible. The type of shielding to use depends on the material.

Generally, alpha emitters and low energy beta emitters do not require shielding, but they pose a risk from internal exposure (i.e., injection, inhalation, or ingestion). General safety principles, including the prohibition of eating, drinking, smoking, mouth pipetting, applying cosmetics, and storing food or beverage containers in radioactive materials labs minimizes the risk of internal exposure. Personal protective equipment such as lab coats, safety glasses, and disposable gloves shall be worn whenever working with radioactive materials to decrease the risk of contamination.

High energy beta and gamma emitters may require shielding depending on the activity of the isotope. Lucite and Plexiglass are the best shielding for high energy betas. Lead shielding should be used for gamma emitters; however, it should never be the primary shielding for high energy beta emitters. Beta particle interaction with lead can cause a type of x-ray radiation called bremsstrahlung. To use lead shielding in conjunction with Lucite or Plexiglass shielding, make sure the lead lines the outside of the plastic shielding and not the inside.

Whenever possible, conduct all protocols on break resistant impervious trays or containers lined with disposable absorbent coverings. Volatile radioactive materials require special ventilation and filtration and should only be conducted in approved labeled hoods. Contact the RSO before running a protocol with a potentially volatile component.

All used radioactive material is considered radioactive waste, and special precautions must be taken with potentially contaminated or radioactive items. Have a radioactive storage waste plan before conducting radioactive material procedures. Further information on radioactive waste storage and disposal is available in the [Florida Tech Radioactive Materials Use and Safety Manual](#) sections 6.15-6.18 and 12.0.

Always wear PPE (safety glasses, disposable gloves, and lab coats) when conducting protocols and experiments involving radioactive materials. Do not wear PPE such as lab coats or disposable outside of a posted lab: always remove PPE in the lab to prevent spreading contamination and throw contaminated items into radioactive waste containers. Post-protocol surveys should be conducted before leaving a lab. Information on how to conduct a post-protocol survey is in the [Florida Tech Radioactive Materials Use and Safety Manual](#) section 6.9. Always wash hands after running protocols with radioactive materials.

After hours work and solitary work with radioactive materials is strongly discouraged.

## Survey and Laboratory Monitoring

Authorized radioactive materials labs must have a method to survey labs for possible contamination. The type of survey conducted depends on the isotopic emission. High energy beta and gamma emissions can be surveyed with portable probes and meters such as Geiger Mueller meters with a pancake probe. Scintillation counting and wipe tests must be performed on alpha or low energy beta emitters as these emissions cannot be detected by GM meter probes. Always wear PPE (safety glasses, disposable gloves, and lab coats) when conducting surveys.

When conducting a wipe test, use a filter paper to wipe 100 cm<sup>2</sup> of the surface. Place the filter in a vial with scintillation cocktail (biosafe brands only) and run with an appropriate counting program on the scintillation counter. Contamination levels must not be equal to the action levels. Contact the RSO if action levels are exceeded.

<b>Radioactive Material (RAM)</b>	<b>DPM (per 100 cm<sup>2</sup>)</b>
Alpha Emitting	100
Beta or Gamma Emitting	1000
Transuranic	50
Uranium	2000
Half-life less than 80 hours	2000

Table 2 – Survey Action Levels



Geiger meter surveys should be conducted such that the probe is directly above the surface being surveyed. To prevent contamination of the probe, cover it with a glove or fine plastic film. Check hands and feet for contamination with the probe after every protocol. Survey levels must not exceed 0.2 mR/hr. Contact the RSO if action levels are exceeded.

Surveys should be conducted at the end of the day whenever radioactive materials are used, weekly in labs where materials are used, and monthly where materials are stored. Also, authorized users of high energy beta and gamma emitters should do a self-survey of hands and feet with a Geiger meter to check for contamination after each use. Maintain copies of all surveys conducted, including maps of where surveys were taken, scintillation counts, Geiger readings, the date of the survey, and the initials of the person conducting the survey. Keep a copy for your records and scan and send a copy to the RSO for their records. Survey records must be maintained for three years. Further information on survey requirements is in the [Florida Tech Radioactive Materials Use and Safety Manual](#) section 9.0.

Geiger meters must be calibrated annually to be used in posted labs for routine surveys. The RSO returns GM meters to Ludlum annually. The RSO will provide a calibrated loaner to use during calibration.

## Decontamination Procedures

Survey results above action levels require decontamination. Whether it is a minor spill or a major spill, the RSO should be contacted immediately to assist in the clean-up (contact information is posted on every lab). If contamination is found, prevent others from entering the area, but do not leave the area and keep anyone around the contamination from leaving unless an emergency requires immediate evacuation. Staying put minimizes the spread of contamination. Further information on spill response and decontamination are found in the [Florida Tech Radioactive Materials Use and Safety Manual](#) sections 13.0 and 14.0.

There are two types of contamination: fixed and removable. Fixed contamination cannot be removed, and the item must either be shielded for decay or disposed of as waste. Removable contamination is determined by a smear test and can be decontaminated.

**Minor spills** are those with contamination levels below 1000 dpm/100 cm<sup>2</sup>, less than 2 mR/hr at 5 cm, or less than a volume of 2 liters. Survey personnel first to determine if they or their clothing are contaminated: contaminated clothing should be collected in plastic bags for decay or disposal. Limit contamination with absorbent materials and coverings and remove any contaminated items into bags for waste disposal. The RSO will assist in cleaning up the spill if requested. Consult the [Florida Tech Radioactive Materials Use and Safety Manual](#) sections 13.3 and 14.0 for specific response guidelines for minor spills and decontamination.

**Major spills** are those with contamination levels above 1000 dpm/100 cm<sup>2</sup>, greater than 2 mR/hr at 5 cm, greater than a volume of 2 liters, or whenever an individual is contaminated with radioactive materials. The RSO should be contacted immediately for help in responding to

major spills. Anyone not involved in the spill (and not at risk of contamination by the spill) should be notified to leave the lab at once. Survey personnel (in the area of the spill) first to determine if skin or clothing is contaminated. Decontaminate personnel as soon as possible. Bag all contaminated clothing and leave behind. Collect rinse water (if possible) to minimize spread of contamination. Use absorbent material to contain the spill whenever possible. Switch off fans and ventilation if possible and vacate the area. The area should be cordoned off with signage and should not be reentered until assessed by the RSO. The RSO will assist in cleaning up the spill. Do not attempt clean-up without the RSO. Consult the [Florida Tech Radioactive Materials Use and Safety Manual](#) section 13.4 for specific response guidelines for major spills.

Whenever a person's skin is contaminated with radioactive materials, they must immediately wash with soap and water for at least five minutes (collect this rinse whenever possible as radioactive waste to minimize release into sewer). Contact the RSO anytime an individual may have inhaled, ingested, or come into physical contact with radioactive materials.

## Radioactive Waste Procedures

All radioactive waste is to be collected in plastic-lined primary containers (for solid waste), polyethylene bottles (liquid waste), vial boxes (for scintillation waste), or by steel shipping drums (also for solid waste).

Radioactive waste containers should be separated by isotope whenever possible: at the very least they should be separated into short half-life (less than 90 days) or long half-life containers. Mixing isotopes and short half-life with long half-life isotopes is very costly. Waste should also be separated by form which includes solid waste (contaminated solid materials, gels, paper, animal carcasses, plant tissue, etc.), liquid waste (including rinse-water and water miscible radio-chemicals) and scintillation waste (which includes cocktail and the vial).

The following radioactive material may be disposed of regardless of radioactivity per [64E-5.331 \(F.A.C.\)](#):

- 1) 0.05 microcurie (1.850 kBq) or less of tritium 3 or carbon 14 per gram of medium used for liquid scintillation counting, and
- 2) 0.05 microcurie (1.850 kBq) or less of hydrogen 3 or carbon 14 per gram of animal tissue averaged over the weight of the entire animal tissue averaged over the weight of the entire animal; provided, however, tissue may not be disposed of under this section in the manner that would permit its use either as food for humans or as animal feed.

**Note: Biohazardous waste such as animal tissue is still hazardous waste: submit hazardous waste requests to EHS for all Biohazardous waste.**

Detailed records for all radioactive waste must be recorded and sent to the RSO before requesting the waste to be picked up: disposal records must be kept for the lifetime of the license with the RSO in the office of EHS.

All radioactive waste is picked up by the RSO. All waste containers must be properly labeled with either a tag or sticker with the radiation trefoil and the caution wording "Radioactive Waste." The label must also include the isotope, date, estimated activity on date, and the PI's name. Contact the RSO if you need assistance with labeling.

It is strongly discouraged to mix hazardous waste with radioactive waste as this increases the cost of disposal. If it impossible to avoid mixed wastes, also include a hazardous waste label with the chemical contents listed.

Radioactive wastes are disposed by decay, sewer disposal, or sent to a commercial site by the RSO. Short lived wastes can be stored until decayed to acceptable levels (at least 10 half-lives). They will be surveyed before disposal to verify it is decayed out and then disposed of by the RSO as conventional waste. Radiation labels/signage should be removed or destroyed before disposal. Sewer disposed radioactive material must be readily soluble or dispersible in water and meet the requirements of [64E-5.330, State of Florida Bureau of Radiation Control ALIs, DACs, and Effluent Concentrations, Table III](#) and the [City of Melbourne Prohibited Discharge Standards and Local Limits](#). Radioactive waste that cannot be decayed out or disposed of as commercial or sanitary sewer waste will be packaged for shipment to a commercial disposal site. Further information on radioactive waste procedures can be found in the [Florida Tech Radioactive Materials Use and Safety Manual](#) sections 6.15-6.18 and 12.0.

## Sealed Sources

Sealed sources are used at Florida Tech for instrumental calibration, laboratory experiments, and/or gas chromatography detectors (ECD). Because they are encapsulated, the risk of internal exposure is minimized; general safety cautions should still be followed, and the capsule of a sealed source should never be intentionally broken.

Sealed sources should be in a locked box or safe when not in use, and their use should be logged in a book or clipboard that is easily accessible and adjacent to the lock box/safe. All authorized users must record their use of the sealed sources in this log (including name, date used, isotope, activity, and serial number of the source if available).

All sealed sources will be inventoried biannually by the RSO. Leak tests must be conducted every six months unless the sealed source contains an isotope with a half-life less than 30 days, contains only a gas, is 100  $\mu\text{Ci}$  or less of a beta or gamma emitting material, is 10  $\mu\text{Ci}$  or less of an alpha-emitting material, or the source is listed as storage only.

Out of service sources will be maintained in storage at the Radiation Safety Storage location. Sources may not be put back into service without approval of the RSO and the subsequent amendment of the license to allow such use.

Further information regarding sealed source use at Florida Tech can be found in the [Florida Tech Radioactive Materials Use and Safety Manual](#) section 10.0.

## Radiation Producing Equipment

Radiation producing equipment at Florida Tech include X-ray diffractors (XRDs) and electron microscopes. All radiation producing equipment must be registered with the Florida Department of Health. Contact the RSO prior to purchasing radiation producing devices. All registrations are required to be renewed annually with the Florida Department of Health: they are due in October. New registrations and renewals are completed by the RSO. If equipment is damaged, not functioning currently, or to be discarded, contact the RSO. Further information regarding radiation producing equipment at Florida Tech can be found in the [Florida Tech Radioactive Materials Use and Safety Manual](#) section 15.0.

## Emergency Procedures

Whenever there is direct threat to life or a potential for serious injury, always call 911 before contacting the RSO. Whenever emergency services are contacted, they should be informed of the radioactive materials they may possibly encounter during their response. Further information on emergency procedures can be found in the [Florida Tech Radioactive Materials Use and Safety Manual](#) section 13.0.

All radioactive labs must be posted with the [Emergency Notice](#) with 24-hour emergency contact information (which includes how to contact the RSO and Security). Contact the RSO whenever there are spills or possible external or internal exposures. It is strongly discouraged to conduct radioactive material protocols alone or after hours, during holidays, or over the weekends. Whenever there is a plan to conduct after hours protocols, always let the RSO know well in advance.

Contact the RSO if there are missing radioactive materials due to loss or theft: the RSO must report missing radioactive materials immediately to the Florida Department of Health Bureau of Radiation Control once notified.

If you suspect a radioactive material or radiation producing device to be damaged, contact the RSO immediately and do not use the material or device until inspected by the RSO.

## Record Keeping

Surveys, use logs, and waste logs must be kept for three years by both the PI and the RSO (all PIs must send copies of their records to the RSO as soon as completed). Records of exposure, purchases, training, and disposals must be kept by the PI for the duration of their radioactive materials use at Florida Tech and by the RSO for the duration of the license.

## Audits and Inventory

The RSO will conduct audits annually to evaluate the records and procedures of a PI and to conduct annual refresher training. Inventories of radioactive materials will be taken during these audits as well. The audit is to ensure compliance with regulations and to address any concerns the PI and authorized user may have. A PI or authorized user may contact the RSO for assistance outside of the provision of the audits.

# Appendix 1 - Radioactive Material User Approval Request

Ref. Number \_\_\_\_\_

## IONIZING RADIATION USER APPROVAL REQUEST

Name \_\_\_\_\_ Department \_\_\_\_\_

Bldg/Location \_\_\_\_\_ Tel. # \_\_\_\_\_

### TRAINING (Use Supplemental Sheets if Necessary)

	Formal	Informal	Location	Duration
1. Principles and practices of radiation protection	Yes No	Yes No		
2. Radioactivity measurements, standardization and monitoring techniques and instruments.	Yes No	Yes No		
3. Biological effects of radiation	Yes No	Yes No		

### EXPERIENCE (Use Supplemental Sheets if Necessary)

Type of X-Ray/accelerator and/or Nuclide	Maximum Energy and/or Curies	Purpose in Use	Location	Duration

I certify that I have read and understand the following:

- |                                                          |        |
|----------------------------------------------------------|--------|
| 1. Florida Tech Radioisotope Use Manual                  | Yes No |
| 2. Florida DOH – Control of Radiation Hazard Regulations | Yes No |
| 3. Local Procedures and Methods of Control               | Yes No |

Name of User \_\_\_\_\_

Date \_\_\_\_\_

Signature of User \_\_\_\_\_

Date \_\_\_\_\_

Approved \_\_\_\_\_

(Radiation Safety Officer)

## Appendix 2 - Radioactive Material Use Authorization

<b>RADIOACTIVE MATERIAL USE AUTHORIZATION</b> (Prepare in original and one copy)			
Department	<input type="checkbox"/> New Request  <input type="checkbox"/> Modification	Date Prepared	Reference Number
1. Title or Brief Description of Project:			
2. Procedure Including Special Techniques and Safety Precautions (Information to be submitted on additional sheets in duplicate)			3. Completion Date
4. Radioactivity Requirements			
A. Element and Isotope		B. Physical Forms	
C. Total Quantity Required		D. Estimated Activity Per Experiment	
5. Location of Use			
<input type="checkbox"/> Main Campus (FIT) <input type="checkbox"/> Temporary Site (Specify)		Building	Room Number
6. Users (Submit Supplement Form for Each Individual)		7. Signature of Request Originator	Date
Principle Investigator		Title or Position	Extension
8. Signature of Department Head	Date	10. Radiation Safety Committee <input type="checkbox"/> Disapproved	
Title or Position	Extension	<input type="checkbox"/> Approved, subject to conditions noted in Item 12	
9. Signature – Radiation Safety Officer	Date	Chairman – Radiation Safety Committee	Date
Title or Position	Extension	11. Expiration Date	
12. An approved "Radioactive Material Use Authorization" shall be subject to all applicable rules, regulations and the orders of the Florida Tech Radiation Safety Committee now or hereafter in effect and any conditions specified below			
a. <u>Standard Conditions</u> (1) The Principal Investigator shall insure compliance with Florida Tech Radiation Safety Manual and statements and procedures contained within the request. (2) The Principal Investigator shall provide health and safety procedures covering radiological protection, control and security of radioactive material, to each individual using or having responsibility for use of such material.			
b. <u>Special Conditions</u> (To be completed by Radiation Safety Committee)			

