

**UNIVERSITY OF NORTH FLORIDA**

**Radiation Safety Program**

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## Introduction

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

UNF shall use, to the extent possible, procedures and engineering controls based upon sound radiation protection principles in maintaining occupational doses and public doses as low as reasonably achievable.

UNF'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. In an effort to minimize exposure risks, the radiation safety practices outlined in this program must be maintained and adhered to by individuals using radioactive materials at UNF

## Radiation Safety Program

This Radiation Safety Program sets forth policies, regulations and procedures approved by UNF's Radiation Safety Review Committee (RSRC). UNF's 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.

- A. ALARA Policy
- B. Administration
- C. Radiation Safety Training
- D. Operating Procedures
- E. Procedures for Receiving, Opening Packages of Radioactive Material
- F. Instructions for Obtaining Swipe Samples
- G. Instructions for the preparation of Radioactive Waste for Disposal
- H. Leak Testing an Inventory of Radioactive Materials

## Radiation Safety Program Controls

UNF's Radiation Safety Program has been established to protect the health and safety of users and the public. UNF's radiation safety staff, which includes the Radiation Safety

Officer (RSO), Deputy Radiation Safety Officer (DRSO) and the RSRC, are empowered to assure that these controls are adhered to.

- A. UNF's Radiation Safety Program will be accessible to all users. Radiation safety procedures will be maintained by the RSO and DRSO. In the event changes are made to this Radiation Safety Program, the RSO and/or DRSO shall discuss compliance with all Authorized Users (AU).
- B. The use of radioactive material at UNF 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 UNF by the State of Florida, Department of Health, Bureau of Radiation Control.
- C. UNF shall, at intervals not to exceed 12 months, review the Radiation Safety Program content and implementation.
- D. The following items are established and maintained to ensure that the Radiation Safety Program mission is accomplished:
  - a. ALARA Program
  - b. Radiation Safety Review Committee
  - c. Radiation Safety Officer; Deputy Radiation Safety Officer
  - d. Authorized Users; Authorized Assistants
  - e. Monitoring and survey of radioactive material labs
  - f. Safe practices for using radioactive materials
  - g. Identifying all areas which contain radiation producing devices
  - h. Training Authorized Users and Authorized Assistants

## **Program Participants**

Program participants shall include all individuals named on the radioactive materials license and the RSO and DRSO.

## **Radioactive Material Laboratories**

Radioactive materials shall be used and stored only in designated areas. A record of the designated areas will be maintained by the RSO or his designee.

## ALARA Policy

UNF is committed to keeping radiation exposure, individually and collectively, as low as reasonably achievable (ALARA).

Part III of Chapter 64E-5, FAC, establishes standards for protection against radiation hazards. In addition to complying with the requirements of Part III, FAC, every reasonable effort should be made to maintain radiation exposures as low as reasonably achievable (ALARA).

The fundamental concept of the ALARA philosophy is that unnecessary exposure to radiation should be avoided, even though current occupational exposure limits provide 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 practices, as well as by a management commitment to policies that encourage good practices.

## Commitment

- A. Management, the RSO, DRSO, the RSRC and all authorized users must participate in the establishment, implementation and operation of a radiation safety program which applies the ALARA philosophy.
- B. It will be a UNF priority that all radioactive material users are made aware of UNF's commitment to the ALARA philosophy and that they be instructed in the safe practices and precautions which will keep radiation exposure as low as possible.
- C. UNF has delegated authority to the RSO, DRSO and the RSRC to ensure adherence to ALARA principles. The University administration will support the RSO, DRSO and the RSRC in instances where this authority must be asserted.
- D. UNF will make all reasonable modifications to procedures, equipment and facilities to reduce exposures. UNF will be prepared to describe the reasons for not implementing modifications that have been recommended.

## Radiation Safety Program Administration

- A. The program administrators (RSO/DRSO/RSRC) will emphasize the ALARA philosophy to all users and will encourage personnel to review the Radiation Safety Program and proposed changes to reduce exposure levels.

- B. The program administrators will investigate, in a timely manner, the cause of any personnel exposure considered to be excessive. The program administrators will take corrective actions to ensure that unnecessary exposures are discontinued. A report of each investigation and the action taken, if any, will be maintained for inspection purposes.

## Administration Responsibilities

This section details the administrative responsibilities implemented by UNF to ensure regulatory requirements governing the use of radioactive materials are met.

## Organization Overview

Responsibility for the management of the University of North Florida is vested in the Board of Trustees and the President. Executive responsibilities and authority for the administration of operations at UNF are delegated to the President. The administration of UNF's Radiation Safety Program shall be distributed among levels of management and academia by delegation from the President. Individuals assigned the responsibility for assuring the effective execution of UNF's Radiation Safety Program shall have the necessary freedom to perform their assigned functions.

## Radiation Safety Officer

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:

- a. Acts as UNF's Liaison officer with the licensing agency on all licensing matters.
- b. Ensures that all terms and conditions of the license and regulations are complied with.
- c. Administers the overall day-to-day radiation safety program.
- d. 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.
- e. Oversees control over procurement, use and disposal of licensed materials

through the DRSO

- f. Develops and maintains current operation and emergency procedures
- g. Establishes and maintains a system that will ensure items not conforming to licensed conditions will be promptly identified and corrected.
- h. Investigates the cause of any incident and determines necessary preventative measures.
- i. Suspends any operation causing excessive radiation hazard as rapidly and safely as possible.
- j. Maintains a list of all Authorized Users (AU) and Authorized Assistants (AA)
- k. Establishes and maintains a radiation safety record keeping program.
- l. Ensures that radioactive materials are properly secured against unauthorized access or removal.
- m. Ensures that the license is amended whenever there are changes in licensed activities; responsible individuals and/or commitments provided in the licensing process.
- n. Ensures that all users read and understand UNF's Radiation Safety Program.

### **Deputy Radiation Safety Officer**

The deputy radiation safety officer is responsible for assisting the RSO in all aspects of the radiation safety program including but not limited to the following:

- a. Acts as UNF's alternate liaison officer with the licensing agency on all licensing matters in the absence or at the direction of the RSO.
- b. Assists RSO in ensuring that all terms and conditions of the license and regulations are complied with
- c. Assists RSO in administering day to day radiation safety program
- d. Maintains control over the procurement; use and disposal of licensed materials
- e. Assists in developing and maintaining current operation and emergency procedures



- f. Assists in maintaining the system that will ensure systems not conforming to licensed conditions will be promptly identified and corrected
- g. Assists in investigating the cause of any accident and determines necessary preventative measures
- h. Assists in maintaining a list of Authorized Users (AU) and Authorized Assistants (AA)
- i. Assists in maintaining radiation safety record keeping program
- j. Ensures that radioactive materials are properly secured against unauthorized access or removal.
- k. Assists in ensuring license is amended whenever there are changes in licensed activities, responsible individuals and/or commitments provided in the licensing process.
- l. Assist in maintaining current copies of pertinent regulations and the Radiation Safety Program
- m. Assist in ensuring that all users read and understand UNF's Radiation Safety Program

### **Radiation Safety Review Committee (RSRC)**

Chaired by Presidential appointment the RSRC meets semi-annually and is responsible for the review and oversight of the overall Radiation Safety Program. Members of the RSRC are appointed by the President, the RSO and DRSO are ex-officio members. The duties and responsibilities of the RSRC shall include, but are not limited to the following:

- a. 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.
- b. Seeks ways to reduce the occupational radiation exposure of licensed users.
- c. Prepares special conditions and requirements which may be necessary to ensure radiation safety.
- d. Prepares and disseminates information on radiological safety for the use and

guidance of students and staff.

- e. Reviews and approves all activities involving the use of radioactive materials.
- f. Reviews all ongoing projects involving the use of licensed materials at timely intervals.

## Authorized User (AU)

The AU is the individual ultimately responsible for planning, initiating and interpreting the results of the particular research or project employing radioactive materials at UNF. The AU may assign individuals to assist in the activities involving radioactive materials. The AU shares the responsibility for the safe use of radioactive materials at UNF. The AU's duties and responsibilities to the radiation safety program include but are not limited to the following:

- a. Ensures that radioactive materials are only used as described in UNF's radioactive material license and that no unauthorized use of radioactive material occurs.
- b. Ensures that individuals under their jurisdiction and assigned duties to involving the use of licensed materials, are authorized to do so.
- c. Ensures that all individuals under their jurisdiction working with, or in the vicinity of, radioactive materials or radiation producing devices are properly trained and monitored.
- d. Administers and enforces radiation safety practices and regulations.
- e. Informs the RSO of all changes in personnel working with radioactive materials or radiation producing devices.
- f. Maintains control over radiation source(s) in their jurisdiction .
- g. Maintains adequate inventory and utilization records.
- h. Ensures that all radioactive waste is properly disposed of within their laboratory.
- i. Ensures the safe and secure storage of all radioactive materials.
- j. Ensures that all required surveys and wipes are conducted.
- k. Performs daily contamination surveys when radioactive materials are in use.

## Authorized Assistant (AA)

These individuals work under the supervision of the AU. 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 Safety Training

UNF's Radiation Safety Program is designed to provide the required radiation safety training to individuals using licensed materials and to ancillary personnel working in or around restricted areas. UNF's Radiation Safety Program meets the radiation safety training requirements for AU's as outlined in 64E-5.1307, FAC.

Individuals authorized to use licensed radioactive materials shall have sufficient training in radiation safety in order to protect public health, safety and the environment.

The extent of the instruction given shall be commensurate with the radiation tasks assigned.

## Authorized Users (AU)

Individuals designated as AU's will be qualified by training and experience to ensure that all segments of UNF's Radiation safety Program are implemented.

## Authorized Assistants (AA)

Individuals designated as AA's will be given sufficient training to perform their duties in a safe fashion. This Includes:

1. Radiation Safety Training Course Outline
  - a. Principles and fundamentals of radiation protection and safety practices related to the use of radioactive materials, including ALARA principles.
  - b. Radioactivity Measurements.
  - c. Use of radiation detection instruments and monitoring techniques.
  - d. Biological effects of radiation exposure.
  - e. Transportation of radioactive materials.

- f. Practical experience with the use of radioactive materials.
  - g. UNF's written Radiation Safety Program.
2. Training materials presented as a part of this course is divided into three segments:
- a. Basic principles and fundamentals (2 Hours): This segment is intended to provide users with basic information relating to the principles and fundamentals of radiation protection.
  - b. UNF's Radiation Safety Program (2 Hours): Covers UNF's radiation safety guidelines to be followed when engaged in handling licensed materials.
  - c. Hands on/Practical (4 Hours): Under the direct supervision of an AU, the AA will be instructed on the proper use of monitoring devices as well as safety practices which must be adhered to when using radioactive materials.
3. Instructions will be given by the AU's, the RSO and/or approved outside vendor.
4. Records of AA training shall be maintained by the AU. The RSO shall review all training records. These records shall be maintained during the employment of the AA or 5 years, whichever is greater. See Appendix A, Radiation Safety Training for AA's.
5. At the completion of the training, an exam will be given to test the AA's understanding of the material covered. The examination will include:
- a. Basic principles and fundamentals.
  - b. Procedures and regulations.
  - c. A practical exam, See Appendix B, Radiation Safety Orientation.
6. Instructions to Employees
- The extent of these instructions shall be commensurate with the potential radiological health hazard present in the workplace.

UNF will provide instruction in the following areas to all individuals who, in the course of employment, are engaged in activities that may involve exposure to radiation:

- a. Storage, transfer and use of radiation sources in UNF facilities.

- b. The hazards associated with exposure to radiation, the precautions or procedures to minimize exposures and the purpose and function of protective devices employed.
- c. The applicable provisions of 64E-5, FAC regarding personal protective measures.
- d. The responsibility to report promptly to the AA, AU, RSO or DRSO, any condition which may constitute, lead to or cause a violation of the Radiation Safety Program, 64E-5, FAC or unnecessary exposure to radiation or radioactive material.
- e. The appropriate response to warnings made in the event any unusual occurrence or malfunction occurs that may involve exposure to radiation.
- f. Radiation exposure reports shall be furnished to employees pursuant to 64E-5-903, FAC.

## **Operating Procedures**

The operating procedures in this Radiation Safety Program have been established to ensure the safety of all University staff, students and the public. In compliance with 64E-5.901(1)(c), FAC, UNF's Radiation Safety Program shall be available in each lab.

## **Use of Radioactive Materials**

- A. The purchase and use of any device or material which produces ionizing radiation must be approved by the RSO or DRSO.
  - a. UNF's Request for Possession and Use of Radiation Sources, Appendix C, details the proposal study goals, isotope, activity, experimental method, safety precautions and an estimate of expected waste, shall be submitted to the Radiation Safety Officer, a document with all of the above information is acceptable in lieu of Appendix C.
  - b. The approved request form will be kept on file and serve as documentation of standard operating procedures. Deviations from approved operating procedures will require further review.

- c. Licensed activities will be performed by the AU or an AA under the supervision of an AU. The required radiation safety training shall be given prior to performing activities involving the use of radioactive materials. The following instructions are included as part of the approved operating procedures
  - i. Storage and use of radiation sources so that exposures are maintained as low as reasonably achievable and no individual is likely to be exposed to radiation in excess of the standards established in part III, 64E-5, FAC.
  - ii. Methods and occasions for conducting radiation surveys.
  - iii. Methods and occasions for locking and securing sources of radiation.
  - iv. Personnel monitoring and the use of personnel monitoring equipment.
  - v. Minimizing exposure in the event of an accident.
  - vi. Notifying personnel in the event of damage, loss, theft or accidents involving sources of radiation.
  - vii. General guidelines for the safe handling and use of unsealed sources.
  - viii. Maintenance of records.
  - ix. Picking up, receiving and opening packages containing radioactive materials.
  
- B. The following general safety practices are to be employed by each individual involved in work with radiation instrumentation, equipment or licensed materials:
  - a. General radiation safety training and hands-on training for the specific licensed activities, prior to assigned use.
  - b. Wear assigned Personal Monitoring Device, PMD (whole body and where appropriate, a ring badge) at all times when working with radioactive materials and radiation producing devices.
  - c. Notify the AU's and the RSO or DRSO of any unsafe practices or device malfunctions that could lead to radiation exposure.
  - d. In case of an emergency, follow the emergency procedures as outlined in this document.
  
- C. Personnel Monitoring

PMD's shall be issued to all AU's, AA's and the RSO. PMD's shall be worn when operating or performing tasks which require the use of radioactive material.

- a. Instructions on the proper use fo the PMD shall be given to each user. The RSO or DRSO shall be responsible for issuing the PMD's and collecting when due.
- b. The following instructions shall be given to authorized users and authorized assistants:
  - i. All personnel shall wear their assigned PMD at all times during licensed activities.
  - ii. Clip your PMD firmly to your clothing between your waist and neck and always wear it when working with radiation sources.
  - iii. Each PMD will be assigned to only one person.
  - iv. PMD's shall be exchanged quarterly.
  - v. In the event of PMD loss, immediately notify the AU and/or RSO, or DRSO.
  - vi. Dosimetry reports shall be maintained on file.
  - vii. UNF shall furnish an annual written radiation exposure report to each individual who has been issued a PMD.

## **Occupational Dose Limits**

UNF shall control the occupational dose of all employees, except for planned special exposures as specified in 64E-5.309, FAC.

- A. An annual to the whole body dose not to exceed 5 rem.
- B. An annual eye dose equivalent of 15 rem shall not be exceeded.
- C. A shallow dose equivalent of 50 rem to the skin or any extremity shall not be exceeded.
- D. Any dose which exceeds 10% of the limit will be investigated by the RSO to ensure ALARA.
- E. All planned exposures must be reviewed by the RSRC.

- F. The RSO shall determine prior occupational dose of all employees assigned duties involving the use of radiation sources in accordance with 64E-5.308 FAC. This may be accomplished by Determining the occupational dose received during the current year and attempting to obtain past records to calculate the lifetime cumulative occupational radiation dose.
- G. The annual occupational dose limits for minors are 10% of the annual occupational dose limits specified for adult employees in 64E-5.302 FAC.
- H. UNF will provide special instructions to employees of childbearing age, regarding the risk to the unborn fetus associated with prenatal radiation exposure.
  - a. UNF shall ensure that occupational dose to an embryo or fetus during the entire pregnancy of a declared pregnant employee does not exceed 0.5 rem.
  - b. Each individual who has declared pregnancy shall wear a radiation monitor at waist level while working with radioactive materials. This monitor shall be used to estimate the fetal deep-dose equivalent. When the declared pregnant employee wears protective clothing, the monitor shall be worn under the protective clothing. The fetal dose is to be kept as low as reasonably achievable, but shall not exceed 10% of the standards specified in 64E-5.304 FAC.
  - c. The RSRC shall review all declared pregnant employee dosimetry reports. The RSRC retains the right to declare that a pregnant employee not be assigned to radiation duties during the pregnancy period.

## Specific Operating Procedures

The procedures set forth in this section, provide safe operation guidelines for individuals assigned to licensed activities. Strict adherence to these procedures is mandatory to ensure ALARA.

### Safe practices for Radioisotope Laboratory Protective Clothing

- A. Lab Coats shall be worn when using radioactive materials to prevent the contamination of street clothing.
- B. Disposable nitrile gloves should always be worn when working with radioactive materials. Personnel with breaks in the skin should use waterproof tape to seal such breaks or should not use radioactive materials.



- C. Care should be exercised to minimize contamination from the hands or lab coat by reflex action.

## The Workplace

- A. Personal belongings, including books (except those required for work), should not be brought into the radioisotope work area.
- B. Eating, drinking, storing or preparing food, smoking or personal grooming are forbidden in the radioisotope work area.
- C. Work surfaces should be covered with disposable absorptive coverings. Change the absorbent covering at regular intervals to prevent contamination.
- D. Drip trays will be used to transfer beakers, test tubes, etc., from one location to another. If at all possible, radioactive materials will be kept in double containers.
- E. The radioisotope lab shall be posted with Caution-Radioactive Material signs.
- F. Keep the work area neat and clean to prevent accidents and facilitate decontamination.
- G. Work should be carried out under the hood when radioactive materials may be lost by volatilization, dispersion, spraying or splattering. Work with closed containers, when possible. Appropriate shielding shall be used in all cases.
- H. Experiments will be conducted under the fume hood in an effort to reduce intake levels. The hood shall be posted Caution Radiation Area.
- I. Secure all radioactive materials from unauthorized removal.
- J. Radioactive materials outside of the storage area shall be under constant surveillance. Alternatively, the laboratory or area must be secured to prevent unauthorized removal of licensed materials.
- K. Containers of radioactive materials shall be labeled with Caution Radioactive Material, the radionuclide identified, quantity, form and date of activity.

## Utilization of Radioactive Materials

- A. Personal monitors shall be worn at all times when working with radioactive materials.

- B. Pipetting liquids of any type by mouth or the performance of any similar operation by mouth suction is not permitted.
- C. Use a safety pipetting aid for dispensing with standard laboratory pipetting techniques. Eppendorf or other precision pipettes can be used for smaller dispensing. Assume all pipettes and glassware, in the radioisotope area, are contaminated unless labeled otherwise. Contaminated Eppendorf tips and disposable pipettes should be placed in marked radioactive waste containers.
- D. Maintain accurate records of radioactive material inventory. Record withdrawals from the stock vial on utilization forms. See Appendix D, Utilization Form.
- E. When mixing, shaking, or centrifuging, containers should be intact and sealed with paraffin or appropriate stoppers to prevent spillage.
- F. All solutions with radioactive materials should be prepared carefully to prevent spills.
- G. All radioactive solutions should be properly covered and labeled with isotope and activity.
- H. Provide proper shielding to reduce exposure (ALARA), but not to hinder the safe execution of the procedure.
- I. Whenever possible, rehearse operations using non-radioactive materials to ensure that the technique will be reasonably free of incidents.
- J. Liquid wastes should not be poured into the drain or contaminated equipment be washed in the sink unless the level of activity entering the sanitary sewer system has been calculated as permissible.
- K. Contaminated articles with activities above background (corks, paper wipes, work surface covers, glassware, plastic ware, etc.,) should be disposed of in designated containers and should never be placed in ordinary trash receptacles.
- L. At the completion of an experiment or series of experiments, the laboratory work surface should be carefully surveyed with a monitoring instrument or by wipe test to detect possible contamination.
- M. All laboratory glassware, plastic ware and equipment should be properly decontaminated after use and before being re-used.
- N. Before leaving the laboratory, each person should check their hands thoroughly with a monitoring instrument. If levels exceed background, contact the AU or RSO before leaving the laboratory.

- O. It is desirable to decontaminate hands and work surfaces completely, but the following surface contamination tolerances may be allowed following decontamination:

ALPHA                      Removable 50 dpm/100 sq cm

BETA/GAMMA              Removable 100 dpm/100 sq cm

- P. The arbitrary nature of any such tolerances should be recognized. Absolutely complete decontamination is not always feasible. ALARA

### **Contamination Control Program**

- A. A survey, with a radiation monitoring instrument or wipe test, shall be completed at the end of each day in all areas where radioactive materials are used.
- B. A weekly survey, with a radiation instrument or wipe test for removable contamination, shall be completed in all areas where radioactive materials or radioactive wastes are stored.
- C. Survey meters used in conjunction with this program shall be capable of measuring dose rates as low as 0.1 millirem per hour.
- D. A wipe survey shall be completed for removable contamination at the end of each day, in all areas where radioactive materials are routinely used if the radioactive materials authorized by the license are not detectable with instruments capable of measuring dose rate as low as 0.1 millirem per hour.
- E. Personal monitoring shall be performed prior to leaving restricted areas.
- F. The RSO shall be notified if contamination exceeds the action levels described below.

### **Decontamination**

#### **Action Levels requiring Decontamination (64E-5.1319(2)(c), FAC)**

If the action levels stated below are exceeded, follow the decontamination procedures in this section and resurvey to determine the effectiveness of decontamination efforts.

- A. 100 dpm/100 sq cm of any alpha-emitting radioactive material.

- B. 1000 dpm/100 sq cm of any beta- or gamma-emitting radioactive material.
- C. 2000 dpm/100 sq cm of any radioactive material with half-life of less than 80 hours.

### Decontamination Procedures

- A. Wash hands for 2-3 minutes with mild soap and warm water. After rinsing, monitor the hands. If the first washing has not reduced contamination to an acceptable level, repeat using a soft brush and heavy later. Monitor and repeat, as necessary.
- B. Laboratory clothing should be routinely monitored when high levels and/or hazardous classes of isotopes are used. Contaminated garments should be washed in the laboratory or be disposed of as radioactive material.
- C. Laboratory items that have been contaminated must be washed. Never allow a radioactive solution to dry on glass surfaces. In the case of unavoidable glassware contamination, treat with warm cleaning solution such as "Nochromix" or with detergent in a sonic bath.
- D. All spills of radioactive materials must be reported to the AU immediately All Major spills must be reported to the RSO or DRSO.

### Radioactive Materials Spills

#### General

- A. All spills of radioactive materials must be cleaned promptly.
- B. Under no circumstances will an untrained person be assigned to assist in or clean up a spill of radioactive material. Only the RSO, AU and/or AA, under the supervision of an AU will be assigned to this task.
- C. All established safe practices will be followed when cleaning radioactive material spills.
- D. Attempts shall be made to prevent the spread of radioactive materials.
- E. The spill shall be isolated and the nature of contamination identified.

#### Minor Spills

Minor Spills: (<100uCi and/or 5 mR/hr): Spills involving little or no radiation hazard will be decontaminated under the supervision of an AU. The following general procedures shall be

followed when cleaning spills of radioactive material:

Notify the AU Immediately: All instructions given by the AU must be followed without deviation.

- A. Inform other individuals who may be affected by the spill. All personnel present at the time of the spill will be monitored for possible contamination. Uncontaminated individuals should vacate the area. Contaminated persons will remain in the area until decontaminated.
- B. Contain the spill if the material is a liquid, place an absorbent material over the spill to prevent its spread. If a solid, attempt to contain its spread by covering with a protective barrier such as a drip tray. If volatile, close doors and windows and turn off room ventilation fans.
- C. Decontaminate the affected area. Follow the approved plan in this section. Laboratory surfaces should be cleaned with an appropriate detergent.
- D. Place all contaminated items in radioactive waste containers.
- E. Using appropriate survey techniques, monitor the progress of decontamination effects. Monitor all personnel and materials before releasing them to uncontaminated areas.

## Major Spills

Major Spills (>100 uCi and/or 5 mR/hr): Situations involving significant radiation hazard to personnel shall be managed under the direct supervision of the RSO and/or his designee. This will be considered a radiological emergency.

- A. Vacate all personnel not involved with the spill immediately.
- B. Notify the RSO and AU by dialing the phone numbers posted in the lab. After hours, call UPD by dialing 620-2800.
- C. Unless injured, persons shall not leave the area in an effort to confine the spread of contamination.
- D. Post the area and prevent unauthorized personnel from entering.
- E. Contain the spill from spreading.
- F. Decontaminate the area according to this section.

- G. Using appropriate survey techniques, monitor the progress of decontamination efforts. Monitor all personnel and materials before releasing them to unaffected areas.
- H. The RSO shall generate a written report which shall include cause, personnel involved and corrective measures taken. The report shall be reviewed by the RSRC. If required, the RSO shall notify the Department of Health, Bureau of Radiation Control.

## Radioactive Contamination Limits

Contamination levels set by UNF are far below the maximum quantity of radioactive contamination allowed under 64E-5 FAC. In keeping with ALARA, UNF will adhere to these low values.

ALPHA                      Removable 50 dpm/100 sq cm

BETA/GAMMA Removable 100 dpm/100 sq cm

## Spill Decontamination Procedures

### Spill Kit

The kit should include the following:

1. radiation survey meter/dosimetry.
2. gauze sponges.
3. large and small bags.
4. radiation warning tags.
5. signs and tape.
6. paper towels.
7. bags or boxes for sharps.
8. disposable gloves and shoe covers.
9. decontaminating detergent.
10. masking tape.

11. tongs or forceps.
12. grease pencil or marker.
13. Swipes.
14. survey forms.

## Decontamination Procedures

- A. DO NOT PANIC
- B. Notify others in the lab.
- C. Cover the spill.
- D. Call for help - AU (for all spills) and RSO (for major spills).
- E. Monitor for personnel contamination.
- F. Have a non-contaminated person post a warning sign on the lab door.
- G. Have a non-contaminated person get and assemble the spill kit, above.
- H. One person shall decontaminate while another person remains clean.
- I. Use glove and shoe covers.
- J. Work from the edges of the spill to the center.
- K. Apply detergent and wipe the area.
- L. Take swipes and count.
- M. Cover the spill area until survey results are known.
- N. Make a record of the spill.
- O. Notify the AU and/or the RSO.
- P. Replenish the spill kit.

- Q. Dispose of wastes properly.

## Laboratory Monitoring

Surveys for radiation and removable radioactive contamination must be performed in all radioisotope labs, after each use of radioactive material. The AU's will make arrangements to conduct radiation surveys, as required.

- A. The AU is responsible for ensuring that suitable radiation detection instruments, personnel monitoring devices and other necessary safety equipment are available in radioisotope labs under their direction.
- B. Calibrated radiation survey meters shall be appropriate for the type and level of radiation being monitored. Survey meters shall be calibrated at intervals not to exceed 12 months.
- C. Based on the survey diagram, a radiation survey is to be made in each area indicated (hood, counter top, sink, storage area, floor, etc.). The survey shall be recorded on the Radiation/Contamination Survey Report (Appendix E).
- D. In labs where gamma or high energy beta/gamma (greater than 200keV) radioisotopes are in use, an initial survey for fixed or gross contamination should be performed. Take steps to prevent contamination of the instrument probe, take care not to touch the surface with the probe. Note that results from a Geiger-Mueller (GM) survey will be expressed in terms of counts per minute (CPM) which yields an estimate of how much radioactivity may be present or in units of mR/hr which yields the radiation exposure rate.
- E. Contamination not fixed to a surface can be transferred to hands, clothing, notebooks, etc., leading to internal exposure or contamination of clean areas. Swipe tests are to be made in designated areas for detecting removable contamination.

## Record Keeping

UNF shall retain a record of each survey required. The records shall be maintained by the AU's. These records shall include:

- A. The date of the survey.
- B. An annotated diagram of each area surveyed.
- C. Background levels.
- D. The measured dose rate, keyed to the diagram, expressed in mrem/hr; or the removable contamination, keyed to the diagram, expressed in dpm/100 sq cm; or cpm if performed with a radiation survey instrument with action level indicated.
- E. The serial number and model of the instrument used to make the survey or analyze the samples, and



- F. The name of the person who performed the survey.

## Security

- A. Radioactive materials will be stored in such a manner as to prevent unauthorized removal. Licensed materials shall be stored in an approved, lockable container that cannot be easily removed from the area. Or shall be behind at least 2 locking doors. Additionally keep lab doors locked when unoccupied.
- B. The storage area shall be posted "Caution Radioactive Material."
- C. The key(s) to the room in which radioactive materials are used and stored shall be controlled by the AU
- D. Under no circumstances will the storage area be opened without the supervision of an AU or AA.
- E. Radioactive materials will be used and stored in such a manner than individual members of the public will not receive a radiation dose in excess of the limits specified in 65E-5.312, FAC.

## Radioactive Materials Receipt

- A. All packages of radioactive materials received by UNF shall be claimed by an AA or AU. See Appendix F, Radiation materials Receipt Form.
- B. Process for receipt of a radioactive package:
  - a. The package shall be inspected by receiving to verify that it was not damaged or tampered with during transport.
  - b. The appropriate AU or AA will be notified by phone and will make arrangements for immediate package pickup, and
  - c. The AU or AA will inspect the package as soon as possible after receipt.
  - d. The results of this inspection will be documented by the AU/AA.

## Posting

UNF shall post current copies of the following documents.

- A. The regulations in 64E-5 Part III and Part IX, FAC in each radioisotope lab and in the office of the RSO.
- B. The license, conditions or documents incorporated into the license by reference and amendments thereto in each radioisotope lab and office of the RSO.
- C. The Radiation Safety Program approved under the license in each radioisotope lab and office of the RSO.
- D. Any notice of violation involving radiological working conditions, proposed administrative penalties or orders and any response from the university will be posted in the impacted lab for 10 days.

- E. The certificate of registration (license), in each radioisotope lab and office of the RSO.
- F. The emergency procedures applicable to activities conducted under the license, in each radioisotope lab and office of the RSO.
- G. Notice to Employees form, posted in each radioisotope lab and office of RSO.

## Emergency Procedures

UNF's emergency procedures will be posted in each radioisotope lab, the University Police Department and the office of the RSO.

- A. Emergency Telephone Numbers:
  - a. University Police Department : 620-2800
  - b. Radiation Safety Office: 620-2019
  - c. Florida Bureau of Radiation Control : 407-297-2095

Any unplanned situation that could affect radiation safety is considered a radiological accident. Any threat to human safety or the public at large should be considered an emergency requiring the highest priority and urgency.

- B. In case of an emergency situation involving licensed materials, the following actions shall be taken:
  - a. Evacuate the surrounding area and uncontaminated personnel.
  - b. Contact the RSO or an AU and the UPD.
  - c. Secure the area. If possible prevent the spill or problem from spreading.
  - d. Arrange for additional assistance as needed.
  - e. Get the names of all individuals who may have been exposed to the source.
  - f. All use of radioactive materials will cease until the situation is corrected.
  - g. Upon correction of the situation, the RSO will submit a detailed account of the situation as required per 64E-5.344, FAC, Notification of Incidents.
- C. Instructions in the Event of a Release of Radioactivity and Contamination of Personnel:
  - a. Minimize the amount of radioactive material entering the body by ingestion, inhalation or through any wounds.
  - b. Prevent the spread of contamination from the area of the accident.
  - c. Remove radioactive contamination on personnel.
  - d. Start area decontamination procedures under the direct supervision of the RSO and/or an AU.
- D. Procedures for Controlling Minor Spills and Contamination:
  - a. Notify the AU immediately. All instructions given by the AU must be followed without deviation. If the AU is not available, contact the RSO.
  - b. Wear protective clothing to prevent contamination of the hands and body.

- c. Inform other individuals which may be affected by the spill.
  - d. All personnel present at the time of the spill will be monitored for possible contamination. Vacate the area of uncontaminated individuals. Contaminated persons will remain in the area until decontaminated.
- E. Contain the spill: If the material is a liquid, place an absorbent material such over the spill to prevent its spread.
  - a. A liquid spill shall not be allowed to dry and become powdery.
  - b. If solid, attempt to contain the spread by covering the area with a protective barrier such as a drip tray.
  - c. Start approved decontamination procedures as soon as possible, under the supervision of an AU.
- F. Procedures for Controlling Major Spills and Contamination:
  - a. Situations involving significant radiation hazards shall be decontaminated under the direct supervision of the RSO or the AU and at a minimum, two members of the RSRC.
    - i. Vacate all personnel not involved with the spill, immediately.
    - ii. Notify the RSO and AU.
    - iii. Affected persons shall not leave the area in an effort to confine the spread of contamination
    - iv. Post the area and prevent unauthorized personnel from entering.
    - v. Contain the spill.
    - vi. Decontaminate the area according to section 19.
    - vii. Using appropriate survey techniques, monitor the progress of the decontamination. Monitor all personnel and materials before releasing them to unaffected areas.
    - viii. The RSO shall generate a written report describing the cause, personnel involved and corrective measures taken. The report shall be reviewed by the RSRC.
- G. If the Body is Suspected of Being Contaminated:
  - a. Scan with survey meter to determine contaminated areas of the body or clothing.
  - b. If cuts, abrasions or open wounds are observed, do not immediately attempt decontamination. Instead, proceed as follows:
    - i. Clean areas with dry sterile gauze and cotton swabs. Wet cleaning might increase absorption,
    - ii. Use swabs in a direction away from wounds, taking care not to spread activity over the body, and
    - iii. Dispose of cleaning gauze and swabs in a solid waste container.
  - c. If the skin appears to be intact, use the following procedures:
    - i. Wet hands and apply mild soap,
    - ii. Work up a good lather, keep the lather wet,

- iii. Work lather into contaminated areas by rubbing gently for three minutes. Apply water frequently,
- iv. Rinse thoroughly with lukewarm water, limiting water to contaminated areas,
- v. If the radiation level is still above background, repeat the above procedure, and
- vi. If the radiation level is still above background, initiate more powerful decontamination procedures after consultation with the AU or RSO.

#### H. In Case of Airborne Contamination

- a. Minimize inhalation of radioactive material by holding the breath or donning a respirator equipped with HEPA filter during initial evacuation.
- b. Evacuate the room of personnel not involved in the cleanup.
- c. If the release is near a hood, initiate/continue ventilation.
- d. If high levels of air contamination is suspected, seal doors with masking tape to prevent the spread of contamination.
- e. Persons who have inhaled or ingested contamination should report to the RSO or an AU, immediately for medical attention.
- f. Persons who have vacated the contaminated area should not leave the immediate vicinity until they have been monitored and necessary precautions, such as removal of shoes or outer clothing, taken to limit the spread of radioactivity.

## Radioactive Material Acquisition

### Authorization

- A. An email shall be sent by the AU to the RSO or DRISO requesting permission to order isotope.
- B. The request must include the Isotope, activity and chemical/physical form.
- C. The RSO or DRISO will reply with an authorization and inventory control number to be used when the isotope arrives on campus.

### Receiving

- A. Receipt Arrangements
  - a. Radioactive material packages will be accepted by the receiving department from the carrier at the time of delivery. Use form in Appendix F, Radioactive Materials Receipt.
  - b. The RSO and/or an AU will inform the Receiving Department that a radioactive material delivery is expected, through the requisition process.
  - c. Arrangements will be made to take immediate possession of the package upon its arrival on campus.
  - d. Receiving shall notify the AU or RSO upon receipt of the package.

## B. Monitoring Packages

- a. The radioactive package shall be monitored within three hours after receipt by the AU.
- b. A radiation survey shall be made at the surface of the package and at a distance of 1 meter.
- c. Packages containing unsealed sources shall be wipe tested and the results recorded on the packing slip.

## C. Receipt Inspection

- a. AU (Purchaser): The AU will make arrangements to receive, monitor, open and inspect the package upon receipt. The following procedures shall be implemented:
- b. Wear PMD and gloves. Place the package on a clean work surface on absorbent paper for liquid or solid isotopes or in a hood on absorbent paper for gaseous isotopes,
- c. Inspect the outside of the package. Verify that the package is undamaged except for superficial defects such as marks or dents,
- d. All packages containing radioactive materials will be monitored for radioactive contamination if there is evidence of degradation of package integrity, (crushed, wet or other damage),
- e. Wipe test package for removable contamination: Monitor the external surfaces of packages labeled with a Radioactive White I, Yellow II or Yellow III label as required by US Department of Transportation in 49 CFR 172.403 and 172.436.400,
- f. Verify that outer shipping packages have a Yellow II or Yellow III label. Survey the package to ensure the level does not exceed 200 mR/hr at the surface and 10 mR/hr at 1 meter from the package, and
- g. If the dose rate is greater than listed above, notify the AU or RSO.
- h. Do not open the package, but place it in an isolated area on absorbent paper.
- i. Determine if any staff have come into contact with the package and survey their hands/exposed body parts.
- j. Decontaminate exposed areas/personnel and contact the carrier and supplier of the package.

## Swipe Samples

This section establishes the standard technique for obtaining swipe samples from areas and/or items and determining the presence of removable radioactive contamination.

### A. Requirements

- a. Personnel taking the samples must wear their assigned PMD.
- b. Prerequisites
  - i. Appropriate swipe paper such as Whatman #1





- d. The model and serial number of the radiation survey instrument used,
- e. The radiation dose rate measured at the surface of each container, and
- f. The name of the individual who performed the disposal.

## Waste Reduction

The AU's will use the following guidelines in minimizing waste:

- A. Prevent unnecessary contamination.
- B. Ensure accurate measurement of materials used.
- C. Clean and reuse lab equipment when possible.
- D. Only dispose of materials that are actually contaminated. Packing materials and boxes which have not been in contact with radioactive material shall be disposed of as regular waste. SEPARATE RADIOACTIVE MATERIAL FROM NON-RADIOACTIVE WASTE.
- E. Review procedures and determine what contaminates clean materials and formulate measures to minimize the amount of contamination, (e.g., between pieces of glassware). PRE-PLAN, and
- F. The RSO, AU and RSRC are committed to achieve volume reduction and to ensure ongoing employee training stresses good housekeeping and safety control procedures.

NOTE: THE IDENTITY (CHEMICAL NAME ONLY) AND QUANTITY OF ALL CHEMICAL CONSTITUENTS MIXED WITH RADIOACTIVE WASTE MUST BE NOTED ON EACH WASTE CONTAINER.

## Waste Preparation

This section will provide details on the preparation of all types of radioactive waste. Subsections below will provide detail for specific types of wastes.

- A. Identifying Labels:
  - a. Labels must be affixed to each radioactive waste container.
  - b. Each label must be completely and legibly filled out.
  - c. Labels will be provided and maintained by the AU.
- B. Notification:
  - a. After the radioactive materials have been properly prepared for disposal, notify the RSO to arrange for pick-up.
- C. Labeling – When required:
  - a. Radioactive material labels will bear the words 'Caution Radioactive Materials'; with yellow background and magenta colored lettering and symbol. The labels shall specify:
    - b. The radioisotope(s) in the container(s).
    - c. Activity of the isotope in uCi or mCi.
    - d. Date.
    - e. Name of the AU.
    - f. Lab location, and
    - g. Identity of any chemical constituents.



## Liquid Scintillation Vials

- A. Radioactive liquid scintillation vials shall be separated, according to radioisotope. Carbon-14 and Tritium may be combined in the same container.
- B. Radioactive liquid scintillation vials shall be placed in the original shipping containers or in cardboard boxes which are double lined with heavy plastic bags or plastic drums. Each box shall not exceed 3.0 cubic feet in size and drums shall be no larger than 55 gallon.
- C. Prevent scintillation fluid from contacting any surface on the exterior of the container. Make sure lids are tight.
- D. Containers must be labeled indicating radioisotope, amount, AU name, date and lab location.

## Liquid Wastes

- A. Liquid waste shall be segregated into appropriate containers provided by the AU.
  - a. Only Tritium and Carbon-14 may be combined into the same container. ALL OTHER ISOTOPES MUST BE SEGREGATED.
- B. Wastes shall be segregated as Radioactive or Radioactive Mixed Waste.
  - a. Radioactive mixed waste is any radioactive waste that also contains a hazardous chemical constituent(s) such as xylene, phenol, and cyanide.
- C. Waste containers shall have an identifying label indicating radioisotope, amount, chemical constituents, AU, date and lab location.

## Dry Wastes

- A. All dry/solid waste shall be segregated into waste receptacles according to radioisotope and physical form.
  - a. Only Tritium and Carbon-14 may be combined into the same container. ALL OTHER ISOTOPES MUST BE SEGREGATED.
  - b. The physical form of the waste shall be separated as trash, glassware/sharps and radioactive mixed waste.
- B. Ensure that there is no freestanding liquid included with the dry/solid waste. This includes liquid scintillation vials, centrifuge tubes, liquid source vials, dripping absorbents, etc.
- C. Trash, paper, plastic, gloves, etc., shall be placed into two heavy duty plastic bags and sealed.
- D. Glassware, sharps, pipettes, syringes, centrifuge tubes, needles, etc., shall be placed into a cardboard box lined with heavy duty plastic bags. The bags must be sealed and the box tape closed. Each box shall not exceed 3 cubic feet in size.
- E. Radioactive Mixed Waste - Trash contaminated by hazardous liquid scintillation fluid or other hazardous constituents shall be placed into a cardboard box double lined with heavy duty plastic bags. The bags must be sealed and the box tape closed. Each box

shall not exceed 3 cubic feet in size.

- F. Waste containers must be labeled with radioisotopes, amount, chemical constituents, AU, date, type of waste and lab location. Avoid overloading bags and boxes.

## Sealed Sources

This section will provide details on the management of regulated sealed sources.

### Leak Testing Requirements

- A. All sealed sources shall be tested for leakage at intervals not to exceed six months.
- B. In the absence of a leak test certificate verifying that a test for leakage has been made within 6 months prior to the transfer, the sealed source shall not be used until tested or transferred and the results received.
- C. Leak tests shall be capable of detecting 0.005 microcuries (185 Bq) of radioactive material.
- D. Test samples are taken from the sealed source or from the surfaces of the device in which the sealed source is mounted or stored.
- E. Leak testing of gauges will be performed by or under the direction of the RSO or a licensed vendor.
- F. Leak test samples shall be taken from the surface of the source or at the nearest accessible point of the sealed source.
- G. The records for leak tests shall be retained for three years by the RSO. The records shall contain the manufacturer's name (source), the model and serial number of the source, the identity of each sealed source radionuclide, the estimated activity of each test sample expressed in microcuries, the date of test, and the signature of the RSO.
- H. Leak tests are analyzed by individuals who are licensed to perform leak test services.
- I. If the test reveals the presence of 0.005 microcuries (185 Bq) or more of removable contamination, the AU shall:
- J. Immediately withdraw the sealed source from use and decontaminate, repair or dispose of it as radioactive waste and
- K. File a report, with the Bureau of Radiation Control, within five days of receiving the leak test results describing the equipment involved, the test results and the action taken.

### Sampling Methodology

- A. Samples shall be taken using an authorized/approved leak test kit from a licensed vendor. The swab should only be used for the sealed source indicated on the leak test kit.
- B. Complete and/or verify the sealed source inventory information for the attached leak test kit. The following information must be included on the leak test/inventory form:
  - a. The model and serial number of each sealed source,

- b. The identity of each sealed source radionuclide and its estimated activity,
  - c. The location of each sealed source, and
  - d. The date of the inventory and leak test.
- C. Leak test samples are taken with the source in its shielded position.
  - D. Record the following information on the leak test form: date of test, source serial number, manufacturer of source and source model number.
  - E. Remove the swab applicator from the envelope.
  - F. With the clean swab, wipe the surface of the radiation device at the nearest accessible point to the sealed source.
  - G. After taking the sample from the sealed source, place the sample back into the leak test envelope.
  - H. Complete the inventory/inspection report, place a copy of the report and the leak test sample in an envelope and address it to a licensed leak test vendor.

## Inventory

A physical inventory and inspection will be conducted semi-annually to account for all sealed sources received and possessed by UNF. Inventory records shall be maintained for three years from the date of the inventory. The inventory records shall contain the following: (See Appendix G, Quarterly Inventory Record).

## Sealed Source

- A. The model and serial number of each source.
- B. The identity of each sealed source radionuclide and its estimated activity.
- C. The location of each sealed source.
- D. The date of the inventory.

## Unsealed Sources

- A. The Isotope.
- B. Quantity originally ordered.
- C. Location.
- D. Date of the inventory.
- E. UNF Inventory control number.