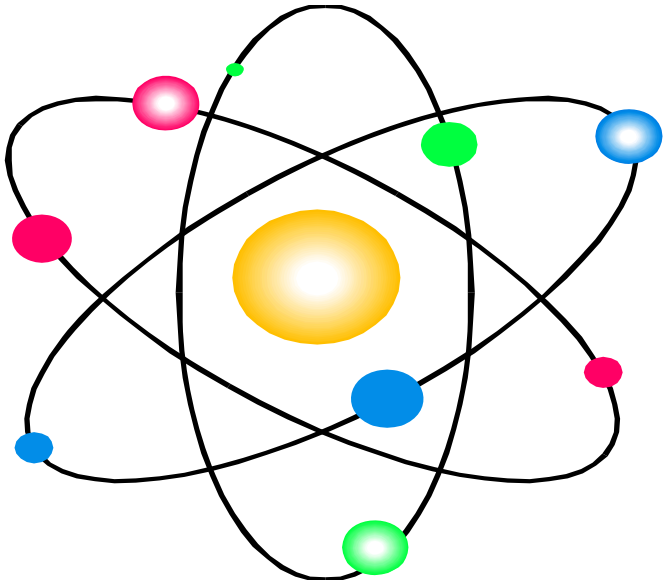
FIU FLORIDA INTERNATIONAL UNIVERSITY
Environmental Health & Safety
11200 SW 8TH Street, CSC 162 ● Miami, FL 33199 ● Tel (305) 348-2621 ● Fax (305) 348-3574 ● http://ehs.fiu.edu

RADIATION SAFETY MANUAL



DEPARTMENT OF ENVIRONMENTAL HEALTH & SAFETY
CSC 162 (305) 348-2621 *ehs@fiu.edu*
www.fiu.edu/~ehs

TABLE OF CONTENTS

FLORIDA INTERNATIONAL UNIVERSITY

A. STATEMENT OF POLICY ON ENVIRONMENTAL HEALTH AND SAFETY

GENERAL STATEMENT:

The University recognizes its responsibility to provide a safe environment for employees and all other members of the University community. Most accidents are avoidable. Accident prevention is fundamental to the interests of personal health and safety, and the protection of property belonging to the University or under its custody. The University also recognizes the need to maintain sensitivity to safety and health issues on the part of all persons at Florida International University, and for specialized training in safety procedures.

POLICY:

It is the policy of the University to take all practical steps to eliminate or reduce exposure of all members of the University community to accidental injury or the conditions that would be injurious to their health.

CONCURRENCE:

The University will adhere to the principals and intent of this policy statement. All practical measures will be taken to ensure the safety of the University community and that of the general public. The policies and procedures adopted by the University Radiation Protection Program will adhere to and be coordinated with the University's overall Environmental Health and Safety policy and Radiation Control Committee advisory decisions.

B. AUTHORITY

All radioactive materials in use in Florida, with the following exceptions, are under the jurisdiction of the Florida Department of Health, Bureau of Radiation Control:

1. Radioactive materials used by or in the possession of Federal Government Agencies.

2. Certain quantities of source material and special nuclear material.

3. Nuclear reactors.

The jurisdiction arises in the agreement entered into by the State of Florida and the United States Atomic Energy Commission effective 1 July 1964, in which the AEC transferred certain regulatory powers to the State under Section 274b of the Atomic Energy Act of 1954, as amended (73. Stat. 679).

In addition to the regulation of by-product material, the State assumed regulation over accelerator-produced radionuclides, naturally occurring radionuclides and required the registration of ionizing radiation producing devices.

Florida International University currently operates under license(s) issued by the Florida Department of Health. These licenses cover the procurement, use and disposal of radioactive material in accordance with the Florida Department of Health, Control of Radiation Hazards regulations as amended and revised on July 3, 1977 and subsequent communications from the State.

The Federal Radiation Control for the Health and Safety Act of 1968 (Public Law 90-602) provides for the regulation and inspection of all types of electronic products capable of emitting ionizing or non-ionizing electromagnetic or particulate radiation or any sonic, infrasonic or ultrasonic wave. X-ray machines, television receivers and projectors, microwave ovens, lasers, ultraviolet lights, x-ray diffraction units, electron microscopes, x-ray microprobes, diathermy units, infrared heaters, ultrasonic cleaners, radar sets and particle accelerators are examples of electronic products included in this control program.

C. INTRODUCTION

The primary purpose of the University Radiation Protection Program is to ensure safety to all personnel using radioactive materials and to make certain that sources of ionizing radiation will be procured, used and disposed of in accordance with the State of Florida, Department of Health, Bureau of Radiation Control Regulations.

The University is required by Regulations to:

1. Establish an appropriate committee to determine relevant policies and procedures.

2. Appoint a radiation safety officer and a committee chairperson.

3. Maintain certain records.

4. Assure that safe procedures are followed.

The Radiation Safety Manual sets forth administrative and safety procedures and policies approved by the University Administration. This Manual provides information intended as an aid to investigators using ionizing radiation. The full cooperation of all individuals directly or indirectly associated with the use of radioactive materials is necessary in order to establish an effective radiation safety program. It is mandatory that all policies, procedures and regulations as set forth in the Manual are strictly followed. Failure to comply shall result in revocation of authorization to use radioactive material or sources of radiation under the University licenses.

This Radiation Safety Manual is based upon the:

FLORIDA DEPARTMENT OF HEALTH
CONTROL OF RADIATION HAZARD REGULATIONS
CHAPTER 64E-5
FLORIDA ADMINISTRATIVE CODE (F.A.C)

Revised July 3, 1997 and the future revisions.

Nothing in this document should be construed as to be in contradiction of the above.

D. RESPONSIBILITIES

Vice President of Research

Alternate: Director of Environmental Health & Safety

Vice President of Research or alternate signs all license applications, renewal requests, amendment request and other correspondences.

UNIVERSITY RADIATION CONTROL COMMITTEE (RCC)

The Florida International University Radiation Control Committee shall consist of representatives from all departments that are involved in teaching and research that use licensed radioactive materials and members of administration involved in supporting their activities whose membership are deemed to be important to the success of the committee (Appendix 1 gives details of the RCC Functions).

Vice President of Research will be the chairperson of the University Radiation Control Committee.

The maximum size of the Radiation Control Committee shall be twenty (20) members. Each department actively using radioactive materials shall be represented by at least one member.

The Committee will convene at least semi-annually and at the request of the Chairperson. A minimum of 50% members must be present to establish quorum.

The responsibilities of the Radiation Control Committee include but are not limited to the following:

- Advise the Radiation Safety Officer on all aspects of health and safety in relation to radiation devices and the use of radionuclides.
- Conduct annual program review in order to assure compliance with established policy and procedures.
- Establish new policies and procedures for compliance with changes requirements of the state and federal regulatory agencies as applicable.
- Recommend administrative practices and procedures as may be considered necessary for safe use of radioactive materials.
- Review proposals and authorized user applications submitted by University community (Appendix 2 gives operating procedures for review of proposals).

DIRECTOR OF ENVIRONMENTAL HEALTH & SAFETY

Acts as liaison between the Radiation Control Committee and the Vice President of Research and is responsible for coordination among the various external and internal stakeholders of the FIU Radiation Protection Program.

RADIATION SAFETY OFFICER (RSO)

Written notice of changes to RSO assignment or other Radiation safety personnel will be made to the State regulatory authority within 30 days.

- Ensure that all radiation related activities comply with the terms and conditions of the license and the applicable regulations specified in Chapter 64E-5 of the F.A.C.
- Provide consultation services to potential authorized users regarding procedures and practices for the safe use of radiation machines or radioactive materials.
- Ensure that radioactive materials are used only by individuals who are authorized by the license and that all individuals wear required personnel monitoring devices
- Maintain all records required by the license and the regulations of chapter 64E-5 F.A.C. These records shall include personnel monitoring records, survey records, training records for users, and receipt, transfer and disposal records of radioactive materials.
- Ensure that radioactive materials are properly secured against unauthorized access or removal.
- Serve as contact with the authorized users for events such as the loss, theft or damage of radioactive materials.
- Ensure that all users read and understand the licensee's emergency operating and radiation safety procedures.
- Conduct inspections of location and facilities using radioactive materials on a periodic basis.
- Provide exposure information to the users including but not limited to an annual exposure report to each user.
- Provide training to individuals who wish to use radioactive materials under the University Licenses.
- Ensure that the sealed sources are leak tested timely and as prescribed by the University Licenses and that a complete inventory of regulated and generally licensed sources is maintained.
- Maintain a list of employees and students who work with radioactive materials or radiation producing devices.
- Serve as ex-officio member of the Radiation Control Committee.

- Act as liaison for any inspections conducted by the regulatory agencies
- Maintain radionuclide inventory to assure compliance with the license limits
- Reports directly to Director, Environmental Health & Safety and communicate with the Vice President, Research through the Director.

Record Keeping:

The RSO is responsible for maintaining the following records:
- Laboratory audit reports
- Sealed Source leak test records
- Instrument calibration records
- Radioactive material inventory
- Inventory of Generally licensed materials
- Records of planned special exposures
- Records of individual monitoring results
- Dose records of authorized users
- Waste pick-up and disposal records.
- Records of all communication with State Bureau of Radiation Control

AUTHORIZED USER

Each authorized user under the University licenses is responsible for the following:

- Comply with all aspects of the University Radiation Safety Program and Manual
- Assuring that each radiation worker receives the required training
- Preparing work procedures that comply with the requirements of this Manual
- Providing the appropriate personnel protective equipment as required to all radiation workers
- Assuring the operability, as far as practicable, of all safety devices and equipment.
- Maintain appropriate records of contaminations surveys and wipes, and radioactive material inventory.
- Assuring that any equipment or device sent for cleaning, or repair or disposed of as surplus is appropriately decontaminated.
- Report any incidents including spills and injuries related to use or storage of radioactive materials to the RSO.

RADIATION WORKER

Each individual who is designated as a user of or who has contact with any radioactive material and/or is an operator of a radiation producing machine is responsible for:

- Keeping his/her exposure to radiation as low as possible, and specifically below the Maximum Permissible Exposure limits, listed under Section I of this Manual.
- Wearing the prescribed monitoring equipment such as dosimetry badges and pocket dosimeters in radiation areas.
- Utilizing all appropriate protective measures such as:
    1. Wearing protective clothing whenever contamination is possible.
    2. Wearing gloves and respiratory protection devices where necessary.
    3. Using pipette-filling devices. Never pipette radioactive liquids by mouth.
    4. Performing radioactive work within confines of an exhaust hood or glove box unless previous examination has indicated working in the open safe.
- Surveying his/her hands, shoes, and body for radioactivity, and removing all loose contamination before leaving radiation areas.
- Eliminating smoking, eating or drinking or use of cosmetics in areas where radioactive materials are present. Eating/drinking/use of cosmetics may be permitted in an office adjacent to such as area when it has been demonstrated that the office is free from contamination. Refrigerators will not be used jointly for foods and radioactive materials.
- Maintaining good personal hygiene.
    1. Keep fingernails short and clean.
    2. Do not work with radioactive materials if there is a break in the skin below the wrist.
    3. Wash hands and arms thoroughly before handling any object that goes to the mouth, nose, or eyes.
- Checking the immediate areas of hoods, benches, etc., where radioactive materials are being used, at least once daily for contamination. Any contamination should be removed immediately. If such removal is not possible, the area shall be clearly marked and the Radiation Safety Officer notified.
- Keeping the area containing radioactive materials neat and clean. The work area should be free of equipment and materials not required for the immediate procedure. Keep or transport materials in appropriate containers, preferably double containers, to prevent breakage or spillage and to insure adequate shielding.
- Keep work surfaces covered with absorbent material to limit and collect spillage in case of accident. If possible, use stainless steel trays or pans as means to limit and collect spillage in case of an accident.
- Labeling and isolating radioactive waste and equipment, such as glassware, used for radioactive materials. Once equipment is used for radioactive substances, it

shall not be used for other work or sent from the area to cleaning facilities, repair shops, or to surplus, until properly decontaminated.

- Reporting accidental release, inhalation, ingestion, or injury involving radioactive materials to the authorized user and the Radiation Safety Officer, and carrying out recommended corrective measures. The individual shall cooperate with RSO for evaluating his/her exposure and investigating the incident.
- Carrying out decontamination procedures when necessary and taking the necessary steps to prevent any additional spread of contamination.
- Post the laminated copy of emergency response protocol approved by the RSO, in highly visible area e.g. backside of door.

E. AUTHORIZED USER APPLICATION

All individuals who wish to use radioactive materials in any type of research must first be authorized under the University license as an authorized user. The application procedure to become an authorized user is as follows:

Submit the following information in the application packet to the Radiation Safety Officer (RSO):

1. Copy of current resume
2. Copy of radiation training records
3. Contact information including telephone, fax, mailing address and email
4. Completed form RC1 (Appendix 3)
5. For grant proposals fill in DSRT proposal review form for Radioactive Materials, Radiation Producing Machines and Lasers Safety Clearance (Appendix 4)
6. Project proposal that includes at minimum the following information:
    - Isotope to be used
    - Form of material – solid, liquid, gas or sealed source.
    - Quantity (activity) to be used
    - Completed form RC2 (Appendix 5)
    - Location where radioactive materials will be used (including detailed floor plan)
    - Detailed procedure specifying exact use of radioactive materials
    - Detailed safety procedures
    - Acknowledgement of receipt and review of the Radiation Safety Manual

The RSO on receipt will review application to assure that all required items are included and are incompliance with the University Radiation Protection Program. RSO will conduct preliminary inspection of the location where radioactive materials will be used. The RSO will then forward the application to the University Radiation Control Committee (RCC) for review with his/her recommendations.

The RCC may request the applicant to attend the meeting to provide any clarifications that may be required.

If the proposal is rejected, the RSO will forward RCC concerns and recommendations to the applicant. The applicant can then address these concerns and resubmit the updated application for review.

If the proposal is approved, the RSO prepares the amendment request for the Bureau of Radiation Control (for items or quantities not covered in the current Broad Scope License) and forwards the packet to the Vice President of Research for approval and submission. The vice President of Research sends formal approval letter to the authorized user.

Note: ***Please note that radioactive materials can be ordered and used only after The Bureau of Radiation Control approves the amendment (whereever applicable) and the Radiation Safety Office receives a copy of the amended License.***

F. NEW PROPOSAL REVIEW

If you are an authorized user under the license and you wish to start a new project. You must submit a proposal for the new project with the following information to the RSO:

- Isotope to be used
- Form of material – solid, liquid, gas or sealed source.
- Quantity (activity) to be used
- Completed form RC2 (Appendix 5)
- Location where radioactive materials will be used (including detailed floor plan)
- Detailed procedure specifying exact use of radioactive materials
- Detailed safety procedures
- Acknowledgement of receipt and review of the Radiation Safety Manual

Note: ***If you are not an authorized user fill in section D- Authorized User application also.***

The RSO on receipt will review application to assure that all required items are included and are incompliance with the University Radiation Protection Program. The RSO will then forward the application to the University Radiation Control Committee (RCC) for review with his/her recommendations.

The RCC may request the applicant to attend the meeting to provide any clarifications that may be required.

If the proposal is rejected, the RSO will forward RCC concerns and recommendations to the applicant. The applicant can then address these concerns and resubmit the updated application for review.

If the proposal is approved, the RSO prepares the amendment request for the Bureau of Radiation Control and forwards the packet to the Vice President of Research for approval and submission.

Note: ***Please note that each authorized user can only order and use radioactive materials for which he/she has been approved. For example if you are authorized to use P-32 in a particular project and later decide to use S-35 in the same project, you must get approval for the use of S-35 before starting use. Similarly if you have approval for P-32 for project A and then start another project B that also involves P-32, you need to get approval for the new project before you can start work.***

G. PROCUREMENT PROCEDURES

The following procedure must be followed when ordering approved radioactive materials under any of the University Licenses.

- All requisitions for radioactive materials must clearly state that item being ordered is radioactive materials. The requisition must give information about the isotope, activity and the form. Example:

  Radioactive Material
  Isotope: P-32
  Form: Liquid
  Activity: 500 microcuries

- The delivery address for all radioactive material must be given as follows:

  For License # 3669-1: Environmental Health & Safety, MAM, CSC 162, Miami, FL 33199.

- All requisitions shall be submitted to the Radiation Safety Officer for approval before being sent to the Purchasing Department.

- In the event that the Radiation Safety Officer is unavailable, the Chairperson of the Radiation Control Committee or the Director of Environmental Health & Safety or his/her designee is authorized to perform this function if an emergency purchase is required.

- All radioactive materials will be received by the Radiation Safety / Environmental Health and Safety office for monitoring and record keeping. The authorized user will be advised of the arrival of the shipment.

- The RSO will deliver the radioactive material along with Radioactive Material Use Record Form to the authorized user. The authorized user will sign receipt of the radioactive material and the form.

- Before sending any material away to be irradiated, tagged, or in any way made radioactive prior permission must be obtained from the University Radiation Safety Officer. Authorization for the maximum activity that can be expected from this process is required. The University Radiation Safety Officer is responsible for obtaining the required permission from the Bureau of Radiation Control when necessary.

H. PERSONNEL RESTRICTIONS

No person who is under 18 years of age may work in radiation areas or handle radioactive materials except by special permission from the Radiation Control Committee.

RADIOACTIVE MATERIAL USERS:

All individuals other than authorized users working with radioactive material will do so under the supervision of an authorized user. The authorized user or alternate* shall be on the same campus as the student, in order for the students to use radioactive materials under their supervision, but not necessarily in their physical presence. In no case will students be allowed to use radioactive materials when the authorized user is unavailable for direct supervision as described above.

All staff and students, both graduate and undergraduate shall attend and successfully complete the Radiation Safety training, which comprises of on-line radiation safety training and hands-on radiation safety training, before starting work with radioactive materials.

**Alternate must also be an authorized user under the University license.*

I. PERSONNEL MONITORING:

Personnel monitoring is required where:

1. An individual is likely to receive in one year from sources external to the body, a dose equivalent in excess of 10% of the limits in Section I.
2. An individual enters a high radiation area (dose equivalent rate in excess of 100 mrem/hr at 30 cm from any source of radiation or from any surface that the radiation penetrates).
3. An adult is likely to receive, in one year, an intake (by inhalation or ingestion) that results in committed effective dose equivalent in excess of 100 mrem.
4. A minor or a declared pregnant woman is likely to receive, in one year, a dose equivalent in excess of 50 mrem.

All individuals must wear dosimetry badges as specified below and/or when deemed necessary by the University Radiation Safety Officer.

Whole Body badges shall be worn when:

1. When the University Radiation Safety Officer determines that personnel monitoring is required or likely exposures exceeds the limits given above.
2. Working with any apparatus (such as x-ray machines, Klystron tubes, electron microscopes, etc.) capable of producing or emitting ionizing radiation.

Extremity badges (Ring Badges):

An extremity badge shall be worn by individuals who may receive a higher extremity dose due to possible exposure as a result of a particular procedure, activity level or the isotope being used in the research activities.

Note: *Individuals requiring dosimetry badges shall not start work prior to receipt of the appropriate badges.*

All monitored personnel shall comply with the following with regard to personnel dosimetry badges:

A. Never use another worker's badge; if a spare badge is used, mark it with the name or initials of the individual using it.

B. Wear badges on torso, at or above the waist and below the shoulder.

C. Store badges with their control badge whenever possible. Always keep badges away from extreme environmental conditions such as intense heat or light that may affect a badge's ability to accurately record radiation exposure.

D. Return badges to the Office of Environmental Health & Safety promptly at the end of each monitoring period (a quarter for whole body badge and a month for extremity badge) to ensure timely processing.

E. Spare/visitor badges assigned to new hires or contract employees can only be worn for the first month of employment; an assigned badge imprinted with the worker's name and /or other form of identification must be requested immediately upon employment.

Personnel Dosimetry Program Management:

The personnel dosimetry program is managed by the RSO through the Environmental Health & Safety office.

Each authorized user is responsible for the dosimetry badges for the individuals working under his/her supervision. The timely return of badges is an essential part of the dosimetry program and non-compliance with this may result in suspension or cancellation of privileges to use radioactive materials under the University license.

Dosimetry badges will be processed on a quarterly basis (whole body badges) or monthly basis (extremity badges) or as deemed necessary by the RSO.

To obtain a new badge the "Badge Request Form" (Appendix 7) must be completed and sent to Office of Environmental Health & Safety.

The Office of Environmental Health & Safety shall maintain permanent records of dosimetry badge readings.

Whenever an individual's dosimetry badge is lost or damaged, immediately report this to the RSO or Environmental Health & Safety in order to obtain a replacement badge. The individual should stop working with radioactive materials till replacement badge is received.

BIOASSAY

a. Biological samples, e.g. urine, feces, blood, tissue biopsies and expired air, may be taken from all personnel who are working with heavy elements, millicurie quantities of tritium or other radionuclides, at intervals specified by the Radiation Safety Officer. Biological samples will be taken from all personnel who have ingested or who are suspected to have ingested radioactive materials.

   Special tests for determining the presence of radioactive materials in the body are desirable for persons handling intermediate or high-level quantities of unconfined radioactive materials. These tests may be ordered at the direction of the University Radiation Safety Officer.

b. Suspected Intake
   If any radioactive material is suspected to have entered any person's body through wound, ingestion or inhalation, the following steps should be taken:

- Immediately contact the RSO
- The RSO will investigate the incident
- If the RSO determines that a bioassay is required an outside consultant will be contracted to conduct the bioassay testing.
- Based on the test results the RSO will determine what further actions should be taken

TRITIUM BIOASSAY

Condition Under Which Bioassay Is Necessary

Routine bioassay is necessary when quantities of tritium processed by an individual at any one time or the total amount processed per month exceed those for the forms of tritium shown in the table below:

Types of Operation	**HTO and Other Tritiated Compounds (Including Nucleotide Precursors)**
Process in open room or bench with possible escape of tritium from process vessel	2 mCi
Processes with possible escape of tritium carried out within a fume hood of adequate design, face velocity and performance reliability.	20 mCi
Processes carried out with glove boxes that are ordinary closed but with possible release of tritium from process vessels and occasional exposure to contaminated box and box leakage	200 mCi

Note: ***The maximum radioactivity handled must not to exceed the authorized use limit***

Participation

All individuals involved in the processing of tritium under conditions specified in the above table should participate in the bioassay program.

Types Of Bioassay That Should Be Performed

1. Baseline (pre-employment or pre-operational)
   A baseline bioassay should be conducted not more than one month prior to the individual beginning work with tritium in amounts that would require participation in the bioassay program.

2. Emergency
   If the initial sample or other data indicates a possible exposure high enough to warrant immediate medical attention, a complete and immediate follow-up should be conducted.

3. Post-Operational and Termination of Usage
   A bioassay should be performed within one month after the last possible exposure to tritium such as when operations are being discontinued, or when the individual is terminating activities with potential exposure.

4. Diagnostic
   Follow-up bioassay should be performed as soon as possible but within one week of any sample exceeding levels given as action points, in order to confirm the initial results and in the case of a single intake, to allow an estimate of the effective half-life of the tritium in the body.

Frequency Of Sampling

A bioassay sample of at least 50 ml of urine should be taken within 72 hours following entry of an individual into an area where operations require bioassay and then every month or more frequently thereafter, as long as the individual is working with tritium. When work with tritium is on an infrequent basis (less frequently than every month), bioassay should be performed within 10 days of the end of the work period during which tritium was handled.

Action Points and Corresponding Actions

Monthly and Other Sampling

1. If urinary excretion rates exceed 5 µCi/L, but are less than 50 µCi/L, the following course of action should be taken:

   a) An investigation of the operations involved, including air and surface contamination monitoring, should be carried out to determine the causes of the exposure and evaluate the potential for further exposures or for the possible involvement of other individuals.

   b) Any reasonable corrective actions that the survey indicates may lower the potential for further exposures should be implemented.

   c) A repeat urine sample should be taken within one week of the previous sample and should be evaluated within a week after collection. Internal dose commitments should be estimated using at least these two urine sample evaluations and other survey data, including the probable times of the intake of tritium.

   d) Any evidence indicating that further work in the area might result in an individual receiving a dose commitment in excess of the limits established in 64E-5.304, should serve as cause to remove the individual from work in this operation until the sources of exposure is discovered and corrected.

e) Reports or notification must be provided as required by 64E-5.344 and 64E-5.345 of Chapter 64E-5 or as required by conditions of the license.

2. If urinary excretion rates exceed 50 µCi/L , the following course of action should be taken:

a) Carry out all steps in item 1

b) If the projected dose commitment exceeds levels for whole body as provided in 64E-5.304 of Chapter 64E-5, provide appropriate notification to DOH.

c) Refer the case to appropriate medical/health physics consultation for recommendations regarding immediate therapeutic procedures that may be carried out to accelerate removal of tritium from the body and reduce the dose to as low as is reasonably achievable.

d) Carry out repeated sampling (24 hr urine collections) at approximately one-week intervals at least until samples show an excretion rate less than 5 µCi/L. If there is a possibility of long term organic compartments of tritium that require evaluation, continue sampling as long as necessary to ensure that appreciable exposures to these other compartments do not go undetected and to provide estimates of total dose commitments.

Any individual working with tritium at Florida International University in any manner, and in any amount, may, if they wish, have a bioassay performed for their own information by contacting the radiation safety office.

IODINE 125 BIOASSAY

Condition Under Which Bioassay Is Necessary

Routine bioassay is necessary when quantities of I-125 processed by an individual at any one time or the total amount processed in a 3-month period exceed those for the forms of I-125 shown in the table below:

Types of Operation	Volatile or Dispersible Activity Handled in Unsealed Form
Process in open room or bench, with possible escape of iodine from process vessels	0.1 mCi
Processes with possible escape of iodine carried out within a fume hood of adequate design, face velocity and performance reliability.	1 mCi
Processes carried out within glove boxes, ordinarily closed, but with possible release of	10 mCi

iodine from process vessels and occasional exposure to contaminated box and box leakage	

Participation

All individuals handling radioactive iodine close to the process so that intake is possible should participate in the bioassay program.

Types Of Bioassay That Should Be Performed

1. Baseline (pre-employment or pre-operational)
   A baseline bioassay should be conducted prior to working with radioiodine in sufficient quantity.

2. Emergency
   Perform bioassay for I-125 as soon as possible after any accident that might cause uptakes to exceed 0.5 μCi of I-125. In such a case investigation of the operation involved, including air and other in-plant surveys, should be carried out to determine the causes of exposures and to evaluate the potential for further exposures. Further, as soon as possible, refer the case to appropriate medical consultation for recommendations regarding therapeutic procedures that may be carried out to accelerate removal of radioactive iodine from the body. This should be done within 2-3 hours after exposure when the time of exposure is known so that any prescribed thyroid-blocking agent would be effective. Carry out repeated measurements at approximately 1-week intervals at least until the thyroid burden is less than 0.12 μCi.

3. Post-Operational and Termination of Usage
   A bioassay should be performed within 2 weeks of the last possible exposure to I-125 when operations are being discontinued, or when the individual is terminating activities with potential exposure.

4. Diagnostic
   Follow-up bioassay should be performed as soon as possible but within 2 weeks of any measurements exceeding action level (0.12 μCi), in order to confirm the initial results and in the case of a single intake, to allow an estimate of the effective half-life of radioiodine in the thyroid.

Frequency Of Sampling

A bioassay sample or measurement should be obtained within 72 hours following entry of an individual into an area where operations require bioassay (but waiting for at least 6 hours for distribution of the iodine to the thyroid) and then every 2 weeks or more frequently thereafter, as long as the individual is working with iodine in conditions that require bioassay. When work with iodine is on an infrequent basis

(less frequently than every 2 weeks), bioassay should be performed within 10 days of the end of the work period during which radioactive iodine was handled.

Action Points and Corresponding Actions

Biweekly and More Frequent Measurements

1. Whenever the thyroid burden at the time of measurement exceeds 0.12 μCi of I-125, the following actions should be taken:

   a) An investigation of the operations involved, including air and other in-plant surveys, should be carried out to determine the causes of exposures and to evaluate the potential for further exposures.

   b) If investigation reveal the concentrations could be high worker exposures should be restricted until the source is discovered and corrected.

   c) A repeat bioassay should be taken within 2 weeks of the previous measurements and should be evaluated within 24 hours after measurement in order to confirm the presence of internal iodine and to obtain an estimate of its effective half-life for use in estimating dose commitment.

   d) Reports or notification must be provided as required by 64E-5.344 and 64E-5.345 of Chapter 64E-5 or as required by conditions of the license.

   2. If thyroid burden any time exceeds 0.5 μCi of I-125, the following actions should be taken:

   a) Carry out all steps in item 1.
   b) As soon as possible, refer the case to appropriate medical consultation for recommendations regarding therapeutic procedures that may be carried out to accelerate removal of radioactive iodine from the body. This should be done within 2-3 hours after exposure when the time of exposure is known so that any prescribed thyroid-blocking agent would be effective.
   c) Carry out repeated measurements at approximately 1-week intervals at least until the thyroid burden is less than 0.12 μCi.

J. MAXIMUM PERMISSIBLE EXPOSURE

Since any radiation exposure is undesirable, it is important that **ALL EXPOSURES BE AS LOW AS REASONABLY ACHIEVABLE** (ALARA). The total exposure (effective dose equivalent) is sum of external exposure (deep dose equivalent) and internal exposure (committed effective dose equivalent). It is very important that the doses received by individuals shall not exceed the applicable limits for the whole body and for any organ.

The table below gives the maximum permissible exposure limits specified by the Florida Department of Health (DOH) and Florida International University (FIU):

Table: Dose limits

Type of worker	**Body part**	**Annual Exposure Limit (mrem)**		**FIU Quarterly Exposure Limit (mrem)**
		DOH	**FIU**	
Occupational worker	Whole body	5,000	1,000	500
Occupational worker	Eye lens	15,000	3,000	2,000
Occupational worker	Extremity/skin/ any organ other that eye lens	50,000	10,000	5,000
Declared pregnant woman Occupational worker	Whole body	500 mrem during the entire pregnancy period, not to exceed 50 mrem in any month		
Minor / Student	Whole body	500	100	
Member of public	Whole body	100	100	

“Declared pregnant woman” means a woman who has voluntarily informed in writing of her pregnancy and the anticipated date of conception. See appendix 8 for pregnancy declaration and Appendix 9 for pregnancy withdrawal.

INTERNAL EXPOSURE

DOH (F.A.C. 64E-5) gives Annual Limits for Intakes (ALI) of radionuclides and the corresponding Derived Air Concentration (DAC) values for Occupational workers. ALI and DAC values for FIU will be 20% of the DOH values so that the committed effective dose equivalent limit of 1000 mrem/year will not be exceeded (Appendix 10). Action levels for airborne radioactivity concentration should be set at 50% of the FIU DAC values.

Contact University Radiation Safety Officer for ALI and DAC values for a mixture of radionuclides (64E-5.307), for compliance with requirements for summation of

external and internal doses (64E-5.305), determination of external dose from airborne material (64E-5.306) and for determination of internal exposure (64E-5.307).

NOTE: *FIU Maximum Permissible Dose limits (MPE's) are significantly lower than those required by state law. Work with radioactive materials can easily be performed with these exposure levels as long as proper safety procedures are applied. This MPE level is an important facet of the University As Low As Reasonably Achievable (ALARA) program.*

Planned Special Exposures

In addition to FIU dose limits an adult worker may be given planned special exposures, not exceeding 5 times the FIU annual dose limits. Written justification for such an exposure must be provided by the investigator to RSO and approval obtained from the Director Environmental Health and Safety prior to exposing any individual.

REPORTING OVEREXPOSURES:

In the event of a suspected overexposure the Radiation Safety Officer must be notified at once. In certain instances the State requires immediate notification of personnel exposures (64E-5.344 and 345). The investigator responsible for the area in which a radiation exposure is received by the individual, which is equal to or exceeds the maximum permissible exposures, shall provide the RSO a detailed report in writing explaining the incident that resulted in said exposure and describing the steps taken to prevent future exposures.

J. RADIOISOTOPE FACILITIES

Radioactive materials shall only be used or stored in locations specifically designated and authorized under the University licenses.

The rooms and/or areas authorized are on record with the Radiation Safety Office. Changes in authorized locations require approval from the Radiation Control Committee and an amendment to the license.

Authorized users are strictly forbidden to transfer radioactive material from one facility to another without approval from the Radiation Safety Office.

When radioactive materials are no longer being used at a location, the location needs to be decommissioned. Contact the RSO in order to get the required closeout survey completed and for removal of the room from the list of authorized locations.

All work with radioactive materials, as far as possible, should be performed in a fume hood or a glove box. All work with alpha emitting radionuclides and volatile radioactive should be carried out in a fume hood or a glove box. Contact the RSO for any clarification.

K. RADIATION CAUTION SIGNS

Each authorized user is responsible for obtaining and posting of proper warning signs in all areas in which ionizing radiation is used. The authorized user shall consult with the Radiation Safety Officer before placing any signs in operating facilities.

The philosophy of signage is to insure that no person can unknowingly enter an area where radioactive material are stored or utilized. Therefore, appropriate signs should be prominently displayed:

a) At all entrance doors to a room or laboratory where radioactivity is used or stored.
b) On all storage lockers *(i.e.* refrigerator, cabinet, etc.) that contain radioactive materials.
c) On the designated radioactive materials handling sink(s).
d) On the designated radioactive waste containers.
e) On any other structure or area, which meets the philosophical basis, cited above. Consult the Radiation Safety Office for further clarifications.

Post: “CAUTION, RADIATION AREA” or “CAUTION, RADIOATIVE MATERIALS”, as applicable.

Additionally, other signs which prohibit smoking, eating and drinking in the designated areas are required.

There should be signs which designate a portion of a room as being a "radioactive lab" if that is the laboratory organization.

NOTICES, INSTRUCTIONS AND REPORTS TO WORKERS; INSPECTIONS

Posting of Notices to Workers (64E-5.901)
Current copies of following documents shall be posted:

- Place where regulations, license, conditions and documents and procedures can be examined.
- Any notice of violations issued by the State.
- The certificate of registration; and
- The emergency procedures.

All individuals who in course of employment are likely to receive an occupation exposure in excess of 100 mrem in a year shall receive proper training and instructions about possible sources of exposure and methods to maintain exposure ALARA (64E-5.902).

A written report on exposure received by all radiation workers, for which personnel monitoring is required, shall be prepared and furnished to each radiation worker. The

report will have the following statement: “This report is furnished to you under the provisions of the Florida Department of Health Regulation entitles Chapter 64E-5, Control of Radiation Hazards. You should preserve this report for future reference.”

Written report to the employee shall be furnished annually and upon termination of employment. Records of furnishing reports shall be maintained for 3 years (64E-5.903).

L. LABORATORY MONITORING

Radiation monitoring in the laboratory is performed to demonstrate that the radiation levels, contamination and airborne radioactivity levels (where applicable) are within the specified limits.

Surveys comprising of radiation levels and contamination measurements will be performed in all laboratories that use radioactive materials. Airborne radioactivity will be measured where the potential of radioactive materials becoming airborne exists or as determined by the RSO.

The authorized user is responsible to act as radiation safety officer of his/her laboratory, to enforce these regulations and to assure that all the personnel working in his/her laboratory are properly informed as to the hazards and safe use of radioactive material.

Authorized users shall maintain a floor plan of each lab where radioactive materials are being used or stored and mark areas where radioactive material is used or stored and the locations of the wipe tests or survey meter readings (Appendix 11).

SURVEY INSTRUMENTS:

Authorized users are required to have an appropriate and calibrated survey instruments available for each authorized location. These survey instruments must be appropriate to the type and level of ionizing radiation used and should be available to all individuals authorized to use radioactive materials at the location.

For nuclides that cannot be properly detected by a survey meter, appropriate sensitive instrumentation must be available.

All survey meters shall be calibrated at least annually. A tag showing the name of the person/company which performed the calibration, date of calibration and the next calibration due date should be affixed to the survey instruments including detectors.

Monitoring requirements

All authorized users are required to comply with the following monitoring and record keeping requirements:

DAILY SURVEYS

Daily surveys are required when radioactive materials are actively being used in the lab. An area survey must be performed at the end of each day when radioactive materials are used or received and the readings recorded in the lab journal.

The survey report shall include:

- The date of the survey
- An annotated diagram of each area surveyed
- Background levels
- Measured dose rates (expressed in millirem per hour), and the removable contamination (expressed in dpm per 100 cm^2) or total contamination (in cpm or dpm per 100 cm^2), if performed with a survey meter. The measured values shall be keyed to the diagram
- The action levels for radiation levels, contamination and air activity (e.g., 500 dpm per 100 cm^2 for beta-gamma contamination)
- The serial number, model number and manufacturer of the instrument
- Name and initials of the person who performed the survey.

The form SW1 (Appendix 12) provides a basic format that may be used to assure that all required items are recorded.

Note: In cases where the isotope is not readily detectable using survey meters (e.g. Tritium) daily wipes should be taken and counted in a liquid scintillation counter. Record keeping requirements are the same as those given above for daily surveys.

WEEKLY SURVEYS:

Weekly surveys are required for each authorized location when radioactive materials are not being actively used but are kept in storage. Record keeping requirements are the same as those given above for daily surveys.

WEEKLY WIPES:

All designated lab areas are required to be wipe-tested on a weekly basis. Collect wipes from a designated area and calculate dpm/100 cm^2 using the survey meter counting efficiency and the wipe area. These wipes can be counted using a survey meter or counter (for detectable materials) or scintillation counter. Record keeping requirements are the same as those given above for daily surveys.

Note: *All survey meters and scintillation devices must be calibrate. Any survey or reading measured using a non-calibrated device cannot be used to fulfill the requirements of the regulations.*

Detailed survey and wipe procedures are given in Appendix 13.

ACTION LEVELS

The action levels set based on the University ALARA program are as follows:

- In ***Normal Radioactive Area***
  For removable contamination:
  20 disintegrations per minute (dpm) alpha/100 cm^2

100 dpm beta-gamma/100 cm^2

For exposure rate:
20 micro R/h

- In ***Hot Lab***
  100 dpm alpha/100 cm^2
  500 dpm beta-gamma/100 cm^2

  For exposure rate:
  1 mR/h

Normal radioactive areas are defined as those areas within the captioned laboratories not ordinarily expected to be used for studies utilizing radioactive materials other than sealed sources or calibration standards.

Hot Labs are defined as those designated with appropriate signs as radioactive handling areas.

If contamination levels are higher than the action levels given above, the authorized user is responsible to undertake decontamination for the area. Decontamination should be done using the spill clean-up procedures provided in the Section P. A survey or wipe test must be done after completion of decontamination procedures to assure that the readings have been reduced to acceptable levels. Proper records of clean-up must be maintained and the RSO must be notified.

The University Radiation Safety Officer, at his/her own discretion or upon the request of an investigator, may monitor a laboratory or an experimental setup periodically. The inspection shall consist of wipe-test and/or other forms of surface monitoring and a review of the user's records of compliance with regulations as outlined in this Radiation Control Plan. The authorized user shall be notified of the impending inspection and his/her presence will be required.

M. RADIOACTIVE WASTE DISPOSAL

Disposal of radioactive wastes depends on a number of factors, e.g., type of radiation, energy, half-life, etc. Therefore to assure that all the different aspects are considered, all disposal procedures shall to be developed in consultation with the Radiation Safety Officer.

Radioactive waste will be segregated based on the following criteria:

- Isotope
- State - dry or liquid
- Half-life – Short or long

Separate containers will be used for radioactive waste that fall into the short-lived category (having a half-life of less than 120 days), and long half-life waste (having half lives equal to or greater than 120 days). Disposal of short half-life waste will be in accordance with FAC 64E-5.328 (1) (a) and 331 (1) (c).

Note: ***All radiation labels should be attached only on the external surface of the containers, so that these can be easily removed or obliterated when the material is classified as non-radioactive.***

DRY WASTE:

Special waste containers for radioactive waste disposal are to be available in all laboratories in which radionuclides are used. All radioactive material users should contact the Radiation Safety Officer regarding the type of dry waste containers recommended.

Dry wastes such as paper towels, disposable pipettes, absorbent bench paper etc. will be packed in transparent plastic bags. The amount of dry waste must be minimized. Always monitor waste and insure that only contaminated waste is stored as radioactive waste.

Care should be exerted by laboratory managers to prevent any unauthorized use of specially marked bags and/or containers. Bags labeled radioactive material should not be used to store or pack any other material, or used for regular garbage. It is particularly inappropriate to place radioactive waste in bio-hazard bags unless the waste is both radioactive and a biohazard.

LIQUID WASTE:

Small quantities of liquid wastes, which are soluble or dispersible in water may be discharged into the sewage system according to Florida Department of Health Regulations. Consult the University Radiation Safety Officer for allowable quantities of various radionuclides that can be disposed of in this manner. Records must be maintained for these disposals.

CAUTION: *Incineration and burial of radioactive wastes are not permitted under Florida department of health regulations.*

SHORT HALF-LIFE WASTE

Short half-life (<120 days) wastes will be stored for at least 10 half-lives, and then surveyed, with survey meter used in the most sensitive range, to insure that the dose rate of the package does not exceed background radiation levels before final disposal. The plastic bag or any other container used for disposal to a county or city landfill, or any other location should not contain any radioactive labels or marking. Do not use hazardous waste bags unless the waste has biological hazards other than radioactivity.

The short half-life waste must be labeled with the tags provided by the RSO. The following is the minimum information to be included on the tag.

1. Authorized user's name
2. Radionuclide
3. Approximate amount of Radionuclide
4. Form (e.g., Solid or liquid)
5. Date of storage
6. Surface dose rate
7. Date of final disposal as non-radioactive waste

Short half-life radioactive waste that has hazardous components will be disposed as hazardous wastes according to RCRA regulations after holding it for decay for a minimum of 10 half-lives or when the surface dose rate is equal to or less than background.

Short half-life radioactive waste that has biohazardous components will be disposed as biohazardous waste after holding it for decay for a minimum of 10 half-lives or when the surface dose rate is equal to or less than background.

LONG HALF-LIFE WASTE

All the long half-life waste is to be stored in the radioactive storage room (e.g. in OE 150) in the section designated for such waste.

The RSO will monitor the quantity of waste and when he/she determines that the quantity of waste is such that a shipment has to be made, an outside contractor will be hired to remove the waste.

The State Bureau of Radiation Control (64E-5.1508) will be notified at least forty eight (48) hours in advance of shipping low-level radioactive waste to a commercial treatment, storage or disposal facility. The notification will be made by either calling (407) 297-2095, or writing to the Office of Radiation Control, Radioactive Materials Program, Department of Health, Post Office Box 15490, Orlando, Florida 32858.

Mixed Waste

Waste that is hazardous and radioactive is called mixed waste. It is very expensive to dispose of such a waste. Contact RSO before procuring such materials and before disposing such a waste.

SIGNS AND LABELS FOR RADIOACTIVE WASTE CONTAINERS:

Dry and Liquid Waste

Containers for such radioactive waste must be conspicuously posted with an appropriate radioactive waste caution sign. In addition, dry and liquid waste containers when filled and ready for waste accumulation shall bear the following information:

a. Investigators name,
b. Radionuclide(s) in the container,
c. Quantity of activity in container in microcuries
d. Surface dose rate
e. Date of start of accumulation.
f. Name and initials of the surveyor and date.

RADIOACTIVE WASTE DISPOSAL

All waste radioactive material will then be transferred to the Radioactive Waste Storage Room located in OE 150. This room shall remain locked at all times and will be off-limits to custodial personnel. The Radiation Safety Officer is the only person authorized to enter the waste storage room.

To request pick-up complete the “Radioactive Waste Pick-up Request” form, appendix 14, and send it to the Radiation Safety Officer. The RSO will then contact the applicant to arrange for a pick-up time.

All documentation after pick-up from the authorized location will be completed and maintained by the RSO.

Short Half-life Waste

All such waste (water soluble only) will be either disposed through the sanitary sewer or will be removed to the waste storage room.

All records of radioactive waste released in the sanitary sewer will be maintained by the authorized user and will be available for inspection by the RSO.

The RSO shall keep inventory records of items placed in the storage room. Upon completion of 10 half-lives, the RSO will survey the packages, deface the labels and

dispose the waste package. Proper records for each waste package will be maintained by the RSO.

N. SHIELDING FOR RADIOACTIVE MATERIALS

As a general rule, when radioactive material is stored in a laboratory facility it must be shielded in such a manner that the exposure rate at the surface of the shield does not exceed 2.5 milliroentgens per hour.

Normally, gamma-emitting radionuclides will be shielded in lead containers or behind lead bricks. High-energy beta-emitting radionuclides should utilize plastic or glass containers or shields as a primary barrier. Lead may be used on the outside of the plastic or glass container as a secondary barrier.

The storage area for radionuclides should preferably be in an isolated area of the laboratory so that personnel in the laboratory or in the adjoining rooms or hallway will not be exposed.

Each storage facility will be inspected by the Radiation Safety Officer to determine compliance with regulations. If the materials require refrigerated storage, the dedicated refrigerator must be appropriately identified, labeled with the radiation symbol, and food storage prohibitions enforced. Such refrigerated storage must be within an approved laboratory or containment and secured by the RSO or authorized user.

O. EMERGENCY PROCEDURES

Radioactive materials are normally handled using all recommended precautions and preventive measures. No matter how carefully you work, accidents sometimes happen. With adequate training and preparation, you will have the skills to safely handle an emergency.

Decontamination procedures are the responsibility of the worker and the authorized user, and shall be carried out under the direction of the Radiation Safety Officer or person(s) designated by him/her, and with the cognizance of the other University officials who may be responsible for the facility or laboratory.

It is important to note that serious injury and life-or-death situations always take priority over radiological concerns. There are no radiation sources at the University that produce contamination and radiation exposure risks large enough to prevent first aid from being given.

In all cases of physical injury, even minor injuries, medical attention and hospitalization take precedence over contamination concerns. Contact Public Safety at x5911 or 75911 to request medical assistance

Plan ahead and equip your lab with spill response supplies such as paper towels, cleaning agent, extra waste bags and gloves. The five key steps to follow are:

Stop ... working - get your thoughts together and don't panic
Presume ... everything is contaminated until proven otherwise
Inform ... the RSO and others in the area about the spill
Localize ... the spilled material to contain the spill
Label ... or cordon off the area to limit access

CLEAN-UP PROCEDURES

Small localized spills with no spread of contamination may be cleaned by lab personnel responsible for the spill. The clean-up of larger spills with spread of radioactivity needs to be supervised by RSO. All spills must be reported to allow RSO the opportunity to independently monitor the area.

Minor spill

A minor spill is defined as a spill involving;

- Less than 100 microcuries, and
- Less than a liter, and
- No personnel contamination, and
- No airborne contamination.

Action to take:

1. Warn fellow workers of the spill hazard and keep others out of the area.
2. Contain the spill and soak up with absorbent material.
3. Be careful not to track contamination out of the spill area. Remove shoe at the edge of the contaminated area. Use disposable gloves to prevent contamination of hands and to prevent cross contamination.
4. Conduct a wipe test to ensure that the spill has been cleaned up. Check all objects.
5. Send a written report to the RSO including the wipe test results.

Major spill

A major spill is defined as a spill involving:

- More than 100 microcuries, or
- Any amount of activity which results in personnel contamination, or
- More than a liter, or
- Possibility of airborne contamination

Action to take:

1. **CONTAIN** the spill by absorbing as much as possible with absorbent material such as paper towels.
2. **NOTIFY** all persons to leave the area of the spill.
3. **CONTACT** the Radiation Safety Office.
4. **LEAVE** contaminated shoes and clothing in the room where the spill occurred.
5. **SECURE** the area by locking the door and posting a sign to **"KEEP OUT"**, or post a guard outside the area where the spill occurred.
6. **DECONTAMINATE** any contamination to personnel; follow decontamination procedures.
7. **CONTACT** the supervisor of the room where the spill occurred.

P. DECONTAMINATION

There are 2 key points to understand about contamination:

1. It is the responsibility of the person causing it to clean it up, and
2. When it is discovered it must be cleaned up at once.

Decontamination of anything utilized in the exclusion zone, interior to the laboratory or authorized area, and the contamination reduction areas (personnel and/or equipment) is an integral part of the system to contain and minimize the potential for the movement of contamination from on-site to off-site areas. Personnel decontamination is highly site-specific and will be determined with consideration for the following factors:

a. Types of on-site contaminants
b. Levels of contamination
c. Personal protection levels utilized, garments and respiration filtration apparatus
d. Work activities performed
e. Reason for leaving the site

Decontamination procedures will be performed on all equipment leaving the exclusion zone to prevent the off-site migration of contaminants. The equipment used on-site will be decontaminated at the end of the project or between individual work operations, as specified in the site operations plan, or by direction of the RSO or authorized supervisory user. Additional efforts to limit the potential for environmental exposure will include the rinsing of the contaminated surfaces with decontamination solutions selected by the RSO, the collection and disposal of the wastewater as hazardous waste (or in compliance with the specifications in the site operations plan), and the supervision of these activities by the RSO.

Following are basic decontamination procedures for things that are most likely to be contaminated as a result of a spill.

CLOTHING

Contaminated clothing should be monitored and separated into two categories:

1. Clothing exhibiting no detectable activity can be laundered according to ordinary laundry procedures.
2. If the contamination is localized cut that portion of the cloth and dispose it as radioactive waste. Otherwise dispose the clothing as radioactive waste or wash with mild detergents. Dry the cloth and survey. If the activity is not reduced to a suitable level, the clothing should be handled as radioactive waste. The wash and rinse liquids may require handling as radioactive waste. Contact RSO.

SKIN

1. Wash approximately 2 minutes with mild pure soap in tepid water with a good lather, covering the affected area thoroughly. A soft brush may be used. Particular attention should be given to the nails and cuticles when the hands are contaminated. Avoid rough scrubbing. Repeat 2 or 3 times if necessary.
2. For low level activity contamination, spot clean contaminated skin areas using a 5% water solution of the solid mixture of 30% regular detergent, 65% Calgon, and 5% Carboxymethyl Cellulose. Avoid prolonged scrubbing of the contaminated area. Use the brush lightly to prevent scratching or eroding the skin. Rinse with tepid water.

   Note: *Ethylene di-amine tetra acetic acid (EDTA) is good complexing agent and its dilute solution (~5%) in water can be used for decontamination.*
3. If contamination is with a radioactive grease compound, mechanic's waterless hand cleaning cream is more effective and less irritating.
4. If contamination persists contact RSO.

DECONTAMINATION OF SURFACES AND BUILDING MATERIALS

Area will be declared as restricted entry, by RSO, requiring rubber and respiratory protection. The area will be cordoned off and marked accordingly.

There are three common types of contamination:

1. The radionuclide is in a small volume of liquid and dries after it reaches the surface.

2. The radionuclide is in a larger volume of liquid and is wiped off before it dries. The remainder then dries before it is cleaned.

3. The radionuclide is airborne and has become attached to dust or other particulates in the air before depositing on the surface.

Initial decontamination should be done by wiping the area with a piece of cloth damp with a chelating solution. All decontamination procedures must be carried out while wearing disposable gloves, protective footwear, and other appropriate protective measures such as respirators (see appendix 8 for details on use of respirators) if airborne contamination is a possibility. An appropriate survey should be made after each sweep to determine the level.

The wiping cloth, gloves, washing and rinsing solutions, etc must be treated as radioactive waste until monitoring determines otherwise.

The area must be kept isolated until appropriate surveys demonstrate activities no higher than background. The University Radiation Safety Officer must certify the area to be free of contamination.

Q. SECURITY, THEFT, LOSS AND ACCESS CONTROL

The potential for harm from willful misuse or accidental loss of radioactive materials is a serious concern that each authorized users must address. Regulatory agencies pay particular attention to this issue during inspections. In the event of a theft or loss, the investigator's security measures and record keeping may come under intense regulatory and public scrutiny. Therefore, investigators should implement and maintain all reasonable precautions to control and secure their sources, even small ones such as check sources. Following are some guidelines that may be helpful:

- Sources of radiation shall be secured against unauthorized removal from the place of storage. Check integrity of physical barriers and security controls (e.g. locks, source safes, etc.).
- Lock laboratory doors when the laboratory is unattended.
- Keep stock materials in a designated storage location, preferably locked.
- Access control procedures must be implemented when using large quantities of radioactive materials.
- Establish a checkout procedure whereby persons authorized to use them sign out stock materials, record the use on inventory forms or other written documents, and sign the remaining stock back in immediately at the conclusion of the experiment.
- Implement "line-of-site" rules for larger quantities or sources: if you are working where you can't see your stock material, put it away.

RESPONSE PROCEDURES IN CASE OF LOST OR STOLEN MATERIALS

- Contact the Public Safety Department to report theft
- Contact the RSO regarding any lost or stolen materials and provide a written statement regarding theft or loss
- The RSO will conduct inquiry into the matter and will inform Bureau of Radiation Control if deemed necessary.

ACCESS CONTROL

- Access to radiological laboratories will be restricted only to authorized personnel.

- Only authorized personnel will have keyed access to the radiological laboratory.

- The laboratory will be kept closed all time and locked when no one is present during working or after office hours.

- If a portion of a radiological laboratory is used for radioactive and another for non-radioactive work, the radiological portion of the lab shall be conspicuously marked and access to this section shall be permitted only to the trained and authorized radiation workers

.

R. SEALED SOURCES

PROCUREMENT

The Radiation Safety Officer must be consulted regarding the procurement, trade-in, replenishment, transfer, relocation or disposal of any instrument or device containing radioactive materials as a sealed source.

Individuals who wish to procure any equipment that contains a sealed source or a standalone sealed source must complete the “Application for Procurement of Sealed Source” (Appendix 15) and submit it to the RSO for approval.

LEAK TESTS

All sealed sources will be leak tested by an outside consultant at intervals not to exceed six months, unless more frequent intervals are prescribed. The RSO will assure that these tests are conducted and reports are kept on file.

The Environmental Health & Safety office will maintain data on sealed sources and records of leak tests.

INVENTORY

The RSO will conduct a semi-annual inventory of all registered sealed sources to assure that the records on file are accurate.

GENERAL LICENSE SOURCES

Individuals who purchase any source including a check source are required to register this source with the Radiation Safety Office. Purchase of such a source requires prior approval from the Radiation Safety Office and the user is required to register the source once it has been received. Annual inventory of generalized licensed sources is required, and must be performed and recorded.

S. TRANSFER OF RADIONUCLIDES, SEALED SOURCES AND RADIATION PRODUCING DEVICES

ON CAMPUS TRANSFERS:

Since approval for use of ionizing radiation sources are given only for the original working area, radioactive materials and other sources of ionizing and non-ionizing radiation shall not be transferred without approval of the University Radiation Safety Officer.

OFF CAMPUS TRANSFERS:

If the proper legal agreement exists between two institutions and the receiving institution has a license permitting receipt of a particular radionuclide, a transfer may be made with the approval of the Radiation Safety Officers of both institutions. A radiation producing device may be transferred after notification of and approval by the Radiation Safety Officers of both institutions. The University Radiation Safety Officer is responsible for obtaining the necessary approval from the Department of Health.

T. DEVICES PRODUCING IONIZING RADIATION:

The University Radiation Safety Officer must be consulted regarding the procurement, modification, transfer, relocation or disposal of any device capable of producing potentially hazardous ionizing radiation.

REGISTRATION OF DEVICES CAPABLE OF PRODUCING IONIZING RADIATION

All machines and devices capable of producing potentially harmful ionizing radiation must be registered with the Radiation Safety Officer. The following types of machines and apparatus are among those that must be registered:

i. Medical and dental x-ray machines, including fluoroscopes
ii. X-ray diffraction units
iii. Electron microscopes
iv. Particle microscopes
v. Static eliminators functioning by emitting ionizing radiation
vi. Any other equipment that may produce potentially hazardous ionizing radiation.

Individuals who wish to purchase these types of devices must complete the “Application for Procurement of Radiation Machines” (Appendix 16) and submit the completed application to the Radiation Safety Officer for review and approval.

The Radiation Safety Officer is responsible for registering this equipment with the Department of Health, Bureau of Radiation Control, as required.

U. RADIATION SAFETY TRAINING

Statement of Intent:

The requirements of the training program, outlined below, are minimum qualification standards and it is intended that all users should meet and exceed the requirements of this section.

1. All radiation workers are required to qualify for use by:
    - Satisfying the restrictions as identified in Section G of this manual.
    - Signing and understanding the briefing sheet for the activity they will be performing.
    - Such briefing will be read to the personnel by the authorized user and signatures will be required as an acknowledgment of the safety principles to be observed and the responsibility of the individual regarding the ALARA program.
    - All workers will be familiarized with the location and content of notices posted in conformance with F.A.C. 64E-5.323. All individuals engaged in licensed or registered activities will be instructed in the requirements and obligations of FAC 64E-5.903.
    - The authorized user will, forward the originals of these documents to the RSO who will maintain the records for five years. The user shall retain copies on hand for the personnel currently authorized for entry.

2. All named authorized users will be required to satisfy the State regarding their qualification for that status.

3. Authorized users and the RSO shall be required to maintain their currency and familiarity with the devices and materials they are handling. The RSO will determine the level and extent of training required for these activities, notwithstanding State regulatory direction.

4. Authorized user training per FAC 64E-5.1309 will be the standard for acceptance of new users who do not otherwise possess training or experience acceptable to the RSO and the State regulatory authority. Such training is not offered by FIU, and must be taken with approved organizations to the satisfaction of the RSO.

5. Hazardous Materials training for both radioactive and non-radioactive hazards will be required for users who may be exposed to such hazards in the course of their work, or as directed by the RSO. Such training may be obtained from commercial or Government programs and will be to the standards of 49 CFR 172 or those acceptable to the RSO.

V. RESPIRATORY PROTECTION PROGRAM

Occupational exposure to diseases caused by breathing air contaminated with harmful dusts, fogs, fumes, mists, gases, smokes, sprays, or vapors (called contaminants) can be controlled by adhering to work procedures established by various department and the Respiratory Protection Standard (The Standard).

The respiratory protection program (Appendix 17) describes how the responsibilities for the various aspects of compliance are distributed among various units within the University community and your role as an employee who may be potentially exposed to airborne contaminants.

The program outlines has been developed in accordance with 29 CFR 1910.134, and has been customized to FIU operations.

W. APPENDICIES