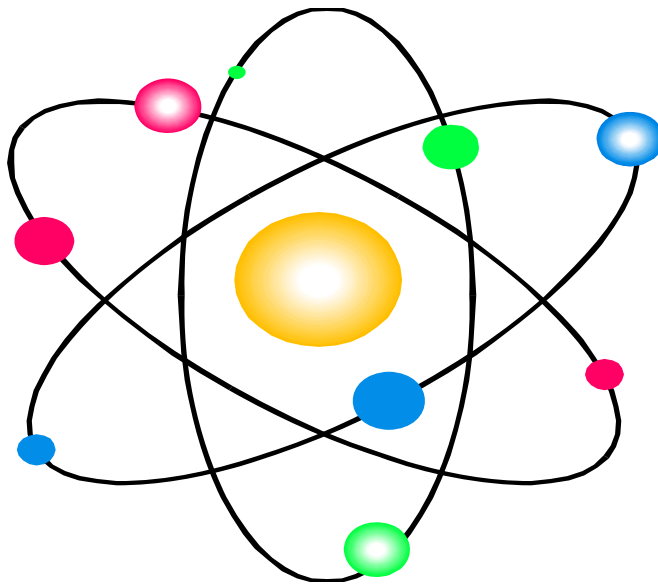




FIU

FLORIDA INTERNATIONAL UNIVERSITY
Miami's public research university

RADIATION SAFETY MANUAL



DEPARTMENT OF ENVIRONMENTAL HEALTH & SAFETY & RISK MANAGEMENT SERVICES

CSC 162

(305) 348-2621

ehs@fiu.edu www.fiu.edu/~ehs

An ounce of prevention is worth far more than a pound of cure

TABLE OF CONTENTS

I. POLICY STATEMENT.....	1
II. AUTHORITY.....	2
III. INTRODUCTION	3
IV. RESPONSIBILITIES	4
V. PROCUREMENT PROCEDURES	6
VI. RADIATION SAFETY INSTRUMENTATION AND EQUIPMENT	12
VII. PERSONNEL RESTRICTIONS	14
VIII. LABORATORY SURVEYING AND MONITORING	15
IX. RADIOACTIVE WASTE DISPOSAL.....	16
X. SHIELDING OF STORED RADIOACTIVE MATERIALS	20
XI. MAXIMUM PERMISSIBLE EXPOSURE	21
XII. EMERGENCY PROCEDURES; SPILL CONTROL.....	23
XIII. BIOASSAY.....	28
XIV. TRANSFER OF RADIONUCLIDES, SEALED SOURCES AND RADIATION PRODUCING DEVICES	33
XV. RADIATION CAUTION SIGNS	34
XVI. RADIOISOTOPE FACILITIES	35
XVII. SEALED SOURCE LEAK TESTS	36
XVIII. REGISTRATION OF DEVICES CAPABLE OF PRODUCING IONIZING RADIATION	37
XIX. INDIVIDUAL RESPONSIBILITY FOR RADIATION PROTECTION	38
XX. RADIATION TRAINING PROGRAM	40
XXI. SECURITY, THEFT, AND LOSS	42
XXII. ADMINISTRATION OF RADIOACTIVE MATERIALS IN ANIMALS OR PLANTS	43
XXIII. POINT SYSTEM FOR NON-COMPLIANCES	44
XXIV. APPENDICIES	
Appendix 1 –Organization Chart for Management of Radiation Program.....	47
Appendix 2 –University Radiation Control Committee (RCC) Functions	48

APPENDIX 3 – Survey Requirements in Radiological Laboratory	53
Appendix 4 – Waste Shipment.....	54
Appendix 5 – Procedures for a Pregnant Woman to Declare Pregnancy.....	57
Appendix 6. Radiological Emergency Plan	58
Appendix 7. Administration of Radioactive Materials in Animals	70
Appendix 8. Administration of Radioactive Materials in Plants	72
Appendix 9. Procedure for Exchange of Contaminated Air Filter	73
Appendix 10. Points for Non-compliances and Recurrence of Non-compliances (Violations).....	76

I. STATEMENT OF POLICY ON FLORIDA INTERNATIONAL UNIVERSITY 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.

II. 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 a Broad Scope License issued by the Florida Department of Health. This license covers 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.

III. 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

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

IV. RESPONSIBILITIES

Vice President for Research

Responsible corporate officer. Signs all registration and license forms.

University Radiation Control Committee

Advises University Radiation Safety Officer (RSO) on all aspects of health and safety in relation to radiation devices and the use of radionuclides. Reviews records for compliance with established policy and procedures. Establishes new policies and procedures for compliance with any new directives from the Radiological and Occupational Health Section, Florida State Statutes. For the purposes of this document, the terms Radiation Safety Officer and Radiation Control Officer are interchangeable.

Recommends such administrative practices and procedures as may be considered necessary. Reviews special requests and appeals. Reviews all actions taken by the Subcommittees. The Committee will have at least two physical meeting and two web meeting or telephonic conferences in a year.

Director of Environmental Health and Safety

Acts as liaison between the Radiation Control Committee and the vice President of Administrative Affairs and responsible for coordination of disposal of wastes with agencies external to Florida International University.

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

University Radiation Safety Officer, RSO

1. Supervises conduct of safety and control mechanisms related to the registration and inspection of radiation devices and the licensing and regulation of radioactive materials.
2. Formulates the University Control Plan with advice from the Committee.
3. Responsible to the Vice President for Administrative Affairs for safety surveys, records, reports, violations and compliance with specific license conditions and other requirements of the State Division of Health.
4. Approves all procedures that might conceivably involve radiation exposure and all changes in such procedures.
5. Consults with any potential user of radiation devices or radioactive materials and advises them as to the necessary radiation safety procedures.
6. Approves the order of all radioactive materials to be used at the University.
7. Prescribes routine radiation surveys and personnel monitoring as deemed necessary.
8. May suspend any operation which may be suspected of causing excessive radiation exposures or hazards.
9. Notifies personnel of excessive exposure to radiation.
10. Conducts inspections to verify compliance with radiation safety requirements.

Update

Appendix 1 shows an organizational chart. Vice President Research, a Senior Management official, is chairperson of the Radiation Control Committee (RCC). He/she may designate authority to Director EH&S for routine management of the Program. The RSO reports to the Director EH&S and communicates with VP Research through the Director EH&S. The RSO manages day-to-day activities of the program. The RSO submits proposals, reports to RCC for approval, comments or vote, as necessary. The RCC establishes operating policies, practices and procedures for compliance with the regulations. The RCC also reviews proposals, reports, procedures, emergency response plan. Conducts periodic program audit, and communicates with the RSO.

The RCC will review the permits issued annually or earlier depending on the non-compliances observed during quarterly inspections and the points for the non-compliances accumulated (see section XXIII and Appendix 10, point system). The program for renewal of permits will include a review of the authorized user's safety and compliance history, types and quantity of materials requested, facilities and equipment, and training and supervision of radiation workers in the user's laboratory.

Appendix 2 gives functions of the Radiation Control Committee.

V. PROCUREMENT PROCEDURES

For activities under the University license, when an investigator wishes to obtain radioactive materials for the first time, or obtain radionuclides in amounts or of a type outside the bounds of his/her authorized use he/she must follow the procedures set forth below. For subsequent orders of authorized radionuclides, the investigator need only follow the procedures set forth in Item 2.

Authorized User Application

All individuals who wish use of 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 showing training and experience with radiation/radioactive materials
2. Copy of radiation training records
3. Contact information including telephone, fax, mailing address and email
4. Completed form RC1 (download from the EH&S website www.fiu.edu/~ehs under radiation/laser safety)
5. 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 (download from the EH&S website www.fiu.edu/~ehs under radiation/laser safety)
 - 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 in compliance 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 Vice President of Research/ or his/her designee (e.g., Director Environmental Health & Safety) authorizes the applicant through a written communication.

Note: *Please note that radioactive materials can be ordered and used only after the written authorization is received.*

New Proposal/New Work Location Review

If you are an authorized user under the license and you wish to start a new project and/or work at a different location 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 use
- Completed form RC2
- 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 in compliance 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 Vice President of Research/ or his/her designee (e.g., Director Environmental Health & Safety) authorizes the applicant through a written communication.

Note: *Please note that radioactive materials can be ordered and used only after the written authorization is received. 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.*

Approval Procedure for Rooms where Radioactive Gases/volatile Materials are Used

All rooms where radioactive gases are to be used or stored must first be approved by the FIU Radiation Control Committee (RCC) for the stated purpose. The procedure for approval is as follows:

The principal investigator (PI) completes and submits an application package to the RSO.

The application package must contain the following items:

- Copy of resume
- Copy of records for training in use of radioactive materials
- Completed [RC-1 form](#) (can be download from FIU EH&S web site). Give information about the training and experience with radioactive material and statement of agreement by the applicant to comply with regulations
- Proposal for use of radioactive materials (gases) containing:
 1. What radioactive gases will be used?
 2. How much activity will be used?
 3. Where will these gases be used? (Please provide floor plan)
 4. Details of procedures for use
 5. Details of safety procedures
 6. Details of Security and access control
 7. Details of enclosure (fume hood/glove boxes), exhaust, filtration, etc.
- Radiation Safety Officer (RSO) inspects the room and evaluates the consequence of release of the gas into the room based on the type of the radioactive gas (inert or absorbed into system, external or internal exposure, type and energy of the radiation from the gas or its progeny), radioactivity, exhaust system/filtration, and potential for exposure of personnel in the room and in the adjacent areas.
- The RSO recommends engineering and administrative measures required, even reduction in the quantity of radioactivity, to ensure that the exposures from the use or storage of gas to the radiation workers or members of the public (individuals who are not radiation workers) are ALARA.

- After the identified safety concerns have been addressed the RSO forwards the PI's request to RCC for review for approval/approval with comments/recommendations.
- The RCC approves the request or recommends changes/ improvement.
- The requester is informed accordingly.
- RSO informs the PI to use the room for the stated purpose after all requirements have been met.

Ordering Radioactive Materials

The following procedure must be followed when ordering approved radioactive materials under the University License.

- All requisitions for radioactive materials must clearly show that item being ordered contain radioactive materials including the isotope, the activity and the form. Example:

Radioactive Materials
Isotope: P32
Form: Liquid
Activity: 500 microcuries

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

Environmental Health & Safety, University Park, CSC 162, 11200 SW 8th Street, Miami, FL 33199.

The Radiation Safety Officer may authorize delivery of short half-life (half-life < 3 days) directly to the authorize use lab. Contact the RSO for approval

- All requisitions shall be submitted to the Radiation Safety Officer for approval before being sent to the Purchasing Department. An e-mail/fax request for approval may be made to the RSO.
- The RSO will verify the quantity of requested nuclide is authorized for the investigator and does not exceed the inventory quota under the University License.
- The RSO will accord approval by mail/e-mail/fax.
- In the event that the Radiation Safety Officer is unavailable, the Chairperson of the Radiation Control Committee or the Director of Environmental Health &

Safety & Risk Management Services 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.
- Before sending any material away to be irradiated, tagged, or in any way made radioactive prior permission must be secured by 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.

c. All radioactive materials, for use by the licensed users, will be received by the Office of Environmental Health and Safety for logging and monitoring. Any package of such materials which appears damaged will be left untouched. The University Radiation Safety Officer will be immediately notified upon detection of damage. The investigator will be advised of the arrival of the shipment.

d. Copies of the requisition, Purchase order and receiving report will be retained by the Environmental Health and Safety Office.

Procedure after Initial Approval:

- a. No RC-1 Forms or other documentation are required for repeat orders
- b. Submit all requisitions to the University Radiation Safety Officer for the radioactive materials requested.
- c. Each investigator must maintain an accurate log of receipt, use and disposal of all radioactive material in his possession for at least three years.

Persons requesting initial usage, unusual usage, or large quantities of radioactive materials may be requested to meet with the University Radiation Control Committee for discussion of the problem involved and inspection of the facilities to be used.

Sealed Sources not on the General License:

The University Radiation Safety Officer must be contacted regarding the procurement, trade-in, replenishment, transfer, relocation or disposal of any instrument or device containing radioactive materials as a sealed source. An inventory should be filed for each such sealed source. Sealed sources must be leak tested as outlined in Section XVII.

All users holding or responsible for controlled radioactive materials, listed in the license or amendments to it, shall report the quantities and activity levels of materials in their possession to the RSO on a semi-annual basis. Such reporting will be performed by the user, on the semi-annual basis or at the request of the RSO. The

report must identify the type of material held, the form in which it is being used, and the activity levels currently indicated or assayed.

Devices Producing Ionizing Radiation:

The University Radiation Safety Officer must be contacted regarding the procurement, modification, transfer, relocation or disposal of any device capable of producing potentially hazardous ionizing radiation. All such devices must be registered with the State Department of Health by the University Radiation Safety Office. This equipment will be inspected periodically by the University Radiation Safety Officer. See Section XVIII.

VI. RADIATION SAFETY INSTRUMENTATION AND EQUIPMENT

The responsible investigator must ascertain that suitable survey instruments, personnel monitoring devices, and other equipment necessary to assure radiation safety are available for his/her facilities and that the equipment is in working condition.

1. Survey Instruments:

Calibrated survey instruments which are appropriate to the type and level of ionizing radiation used must be available to the investigator. For nuclides that cannot be properly detected by a survey meter, appropriate sensitive instrumentation must be available. Survey meters shall be calibrated annually.

2 Personnel Monitoring:

The personnel dosimetry program is managed by the RSO through The Office of Environmental Health & Safety & Risk Management Services (EH&S). EH&S shall maintain permanent records of dosimetry badge readings.

Personnel monitoring devices must be worn by personnel as specified below and/or in such instances as deemed necessary by the RSO.

a. Dosimetry badges shall be worn when:

1. An individual enters or works in a radiation area where he may receive a dose in any calendar quarter in excess of 25% of the maximum permissible exposure levels specified in section XI.

2. Working with any apparatus (such as x-ray machines, Klystron tubes, electron microscopes, etc.) capable of producing or emitting ionizing radiation and as deemed necessary by the RSO.

b. Additional Personnel Dosimeters (Ring Badges):

An additional dosimetry badge shall be worn in hazardous operations if area or other types of monitors are not adequate in the judgment of the University Radiation Control Officer and/or the University Radiation Control Committee.

All dosimetry badges are to be obtained from the Office of Environmental Health & Safety & Risk Management Services. To obtain a new badge the "Badge Request Form" must be completed and sent to Office of Environmental Health & Safety & Risk Management Services. The form can be downloaded from the EH&S website www.fiu.edu/~ehs under radiation/laser safety.

Dosimetry badges will be processed as frequently as recommended by the supplier.

Handling and processing of dosimetry badges shall be the responsibility of the Environmental Health & Safety & Risk Management. In the event that an overexposure is indicated, or suspected, it is the responsibility of the investigator to notify the University Radiation Safety Officer immediately.

Permanent records of dosimetry badge readings will be maintained by the Office of Environmental Health & Safety & Risk Management Services on all personnel wearing dosimetry badges.

Whenever an individual's dosimetry badge is lost or damaged it should be reported to the Office of Environmental Health & Safety & Risk Management Services immediately so that a new badge can be issued.

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

- A. Never use another worker's TLD.
- B. Wear badges on torso, at or above the waist and below the shoulder, and wear dosimeter(s) beside the badge.
- C. Store badges with the control badges whenever possible. Always keep badges from extreme environmental conditions such as intense heat or light which may affect a badge's ability to accurately record radiation exposure.
- D. Return badges to the Office of Environmental Health & Safety & Risk Management Services promptly at the end of each quarter to ensure rapid processing.
- E. Spare/visitor badges assigned to new hires or contract employees can only be worn for the month of employment; an assigned imprinted with the worker's name and /or other form of identification will be ordered immediately up employment and provided for use in the second monthly monitoring period.

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

Update:

Whole body TLD badges will be exchanged quarterly. Extremity TLD badges will be exchanged monthly. We will change our procedures accordingly.

VII. 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.

Radiation Material Users:

A. Students

All students working with radioactive material will do so under the supervision of an authorized user. The user must be in the same building as the student and available to allow 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, must attend a Radiation Safety Seminar upon assignment to a project laboratory where radioactive materials are used. Attendance at such a seminar must be verified and a record of attendance shall be filed with the University Radiation Safety Officer. Each new user shall be provided with a copy of the University Radiation Protection Program. Such Seminars will be conducted by the RSO, RSO or contracted, approved organizations as appropriate to the project, equipment and materials being handled. The individual attending the seminar shall take an exam at the end and results will be kept on file for two years.

VIII. LABORATORY SURVEYING AND MONITORING

The authorized user has the responsibility to act as Radiation Safety Officer of his/her laboratory, to enforce these regulations and to insure that the personnel of the laboratory are properly informed as to the hazards and uses of radioactive material.

Each investigator is responsible for making, or causing to be made, routine area surveys to assure the absence of contamination in his laboratory. Permanent records of these surveys will be maintained. A floor plan of each lab where radioactive materials have been or are being used will be drawn and areas marked where wipe tests or survey meter readings have been made. These records must be retained and made available for inspection.

The University Radiation Control Officer, at his/her own discretion or upon the request of an investigator, may monitor a laboratory or an experimental setup periodically. The inspection will 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 will be notified of the impending inspection and his/her presence will be required.

The University Radiation Safety Officer will require that action be taken to decontaminate laboratory areas outside of hoods, dry boxes and other enclosed areas not susceptible to transfer of activity if the revealed contamination from wipe-tests exceeds the following limits:

- In **normal radioactive areas**
20 DPM ALPHA/100 cm²
100 DPM BETA-GAMMA/100 cm²

- In **hot labs**
20 DPM ALPHA/100 cm²
500 DPM BETA-GAMMA/100 cm²

Normal radioactive areas are defined as those areas within the captioned laboratories not ordinarily expected to be used for studies utilizing radioactive materials.

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

All users will survey their laboratories at the end of each day when radioactive materials are received or used, and the results recorded on the same day, even if negative. These records will be maintained for DOH inspections.

Appendix 3 gives details of the survey requirements. If contamination levels are higher than the action levels given above, the authorized user is responsible to undertake decontamination for the area.

IX. RADIOACTIVE WASTE DISPOSAL

Disposal of radioactive wastes depend on a number of factors, e.g., type of radiation, energy, half-life, etc. In view of this, disposal procedures are to be arranged with the University Radiation Safety Officer.

Radioactive waste will be segregated according to type (dry or liquid) and half-life. Separate containers will be used for radioactive waste that fall into the short-lived category having a half life of 90 days or less; and long half-life waste, having half lives greater than 90 days. Disposal of short half life waste will be in accordance with FAC 64E-5.328.

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 University Radiation Safety Officer regarding the type of dry waste containers recommended.

Dry wastes such as paper towels, disposable pipets, absorbent bench paper etc. will be packed in plastic bags. The amount of dry waste must be kept minimized. Always monitor waste and insure that only contaminated waste is stored as radioactive waste. Red bags labeled as radioactive material should not be used to store or pack any other material, or used for regular garbage.

Care should be exerted by laboratory managers to prevent any unauthorized use of specially marked bags and/or containers. 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 Division of Health Regulations. Consult the University Radiation Control 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; EXCEPT ONLY C-14 AND H-3 DESCRIBED IN SECTION 64E-5.329, F.A.C., MAY BE INCINERATED PROVIDED THE CONCENTRATION IS BELOW 0.05 MICROCURIES PER GRAM.

SHORT HALF-LIFE WASTE

Short half-life wastes (90 days or less) will be stored for at least 10 half-lives, and then surveyed to insure 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 lived 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. Date of storage
5. Date of final disposal as non-radioactive waste
6. 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 and when the surface dose rate is indistinguishable from the 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 and when the surface dose rate is indistinguishable from the background.

Caution signs and labels for radioactive waste containers:

Dry and Liquid Waste

Containers for such radioactive waste must be conspicuously posted with an appropriate radiation 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. Approximate quantity of activity in container in microcuries or millicuries,
- d. Date of start of accumulation.

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. Authorized radioactive material users and the Radiation Control Officers are the only persons authorized entry to the waste storage room.

Short Half-life Waste

All such waste will be either disposed through the sanitary sewer or will be removed to the waste storage room.

All Records of radioactive waste released will be maintained by the Authorized user and will be available for inspection by the DOH office.

It is the responsibility of the authorized user to insure that the short-lived waste he/she generates is removed from the radioactive waste storage area when the 10 half-lives have transpired.

Long Half-life Waste

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

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

The State Office of Radiation Control 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 the office of Radiation Control, Radioactive Materials Program, Department of Health and Rehabilitative Services, Post Office Box 15490, Orlando, Florida 32858.

If a waste is to be incinerated, the notification shall include the location and owner of the incinerator and a copy of the contract between FIU and the incineration company.

Specialized wastes, obtained from US Department of Energy will be returned to the originating site or disposed of in accordance with the appropriate sections of this document, and by direction of the RSO.

UPDATE- Radioactive Waste Shipment

For shipment of long-lived waste FIU will engage services of companies like Bionomics, Duratek, Permafix, etc.

For packing and transportation comply with requirement of sections 64E-5.1501 and 64E-5.1501, F.A.C. and 49 CFR 171.15.

Employees involved in work that affects hazardous material transportation safety will receive hazmat training before performing such functions.

The following papers accompany the waste (see Appendix 4):

Shipping paper
Container and Waste Description
Emergency Response Information

X. SHIELDING OF STORED 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. Strong 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 a hood or in a remote 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 University 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.

XI. MAXIMUM PERMISSIBLE EXPOSURE

The maximum permissible exposures (MPE) are specified by Florida Division of Health Regulations as set forth in the Rules and Regulations for Control of Radiation Hazards.

Since any radiation exposure is undesirable it is important that all exposures be **As Low As Reasonably Achievable**. The maximum permissible exposures for Florida International University are set forth below:

Occupational Dose Limits for Adults:

- A. The Annual limit, which is the more limiting of:
 - i. The total effective dose equivalent equal to 1 rem; or
 - ii. The sum of deep the dose equivalent and the committed dose equivalent to any individual organ or tissue other than the lens of the eye equal to 12 rem.

- B. The annual limit to the lens of the eye, to the skin, and to the extremities are:
 - i. The lens dose equivalent of 3 rem, and
 - ii. A shallow dose equivalent of 12 rem to the skin or to any extremity.

The total effective dose equivalent is sum of the deep dose equivalent and the committed effective dose equivalent.

Deep Dose Equivalent, which applies to external whole body whole body exposure, means the dose equivalent at a tissue depth of 1 centimeter.

Committed Dose Equivalent means dose equivalent to organs or tissues of reference that will be received from an intake of radioactive material by an individual during the 50-year period following the intake.

Committed Effective Dose Equivalent is the sum of products of weighting factors applicable to each of the body organs or tissues that are irradiated and the committed dose equivalent to each of these organs or tissues

It is noted that these MPE's are significantly lower than those required by state law. These exposure levels are easily achievable as long as the level of use remains at present levels. This MPE level is an important facet of the University A.L.A.R.A. (As Low As Reasonably Achievable) program.

Occupational Dose Limits for Minors:

The annual occupational dose limits for minors are 10 percent of the annual occupational dose limits specified above for adult workers.

Dose Limits for Individual Members of the Public:

The total effective dose equivalent to individual members of the public from the licensed or registered operations shall not exceed 0.1 rem per year.

Pregnant Workers

Declared pregnant workers will be required to observe the limits imposed by FAC 64E-5.311.

“Declared pregnant woman” means a woman who has voluntarily informed in writing of her pregnancy and the anticipated date of conception.

The exposure limits set by regulations for a declared pregnant woman (Appendix 5) are:

- 500 mrem during the entire pregnancy
- 50 mrem during any one month

Maximum Permissible Exposures to Concentrations of Radioactive Material in Restricted Areas:

No staff member or student shall possess or use radionuclides in such a manner as to result in an individual being present in an area where the concentration of the radioactive material approaches the concentration in air allowed by the Florida Division of Health. The RSO should be contacted on any problems where the radionuclides to be used are not listed by the Florida Division of Health.

Reporting Overexposures:

In the event of a suspected overexposure of any personnel the Radiation Safety Officer must be notified at once. In certain instances the State requires immediate notification of personnel exposures. The investigator responsible for the area in which a radiation exposure is received by a person which is equal to or exceeds the maximum permissible exposures must follow the procedure outlined below:

- a. Provide the Radiation Safety Officer written details of the exposure.
- b. Describe the procedures which will be followed to prevent recurrence of such an exposure.

XII. EMERGENCY PROCEDURES; SPILL CONTROL

In the event of an accident (spill, atmosphere contamination, overexposure, etc.), the University Radiation Safety Officer, ext. 70489/72621) shall be notified immediately without such action causing excessive spreading of contamination. In the event the radiation Safety officer cannot be reached, utilize the emergency call list given in this section and posted in the radiological labs. The University Public Safety X 76626 can be contacted for after office hour numbers. Decontamination procedures necessary shall be the responsibility of the experimenter and/or his supervisor, and shall be carried out under the direction of the RSO 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.

The following protective action guides are to serve as a basic philosophy for evacuation and implementation of the state radiological emergency plan resulting from a major radiological accident (based on EPA, office of radiation programs recommendations of September, 1974, and state of Florida Radiological Emergency Plan, May, 1975)

1. General Public:

The limits of 64E-5.312 (1) (a) and (c) will apply. Survey in accordance with 64E-5.314 will be accomplished as required by RSO.

TEDE less than 0.1 rem projected dose in a year from licensed operation.

Deep Dose Equivalent in unrestricted areas not to exceed 0.002 rem in any one hour.

(1) Protective action may not be warranted where higher than normal risks could be anticipated from protective action.

2. Emergency Workers:

Values as specified in 64E-5.309.

3. Lifesaving Activities:

Values as specified in 64E-5.309.

Radioactive materials are normally handled using all recommended precautions and preventive measures. However, the possibility of unplanned spill or contamination exists. If this serious problem is encountered, decontamination activities must be carried out as soon possible, and every effort should be made to prevent the spread contamination.

First- Isolate the area and notify the Radiation Safety Officer. **(305) 348-0489**

Second- Determine the extent and type of contamination.

There can be two levels of contamination, high when activity is greater than 100 microcurie per liter volume or low when activity is less than 100 microcurie per liter volume.

Follow Radiological Emergency Plan (Appendix 6) for various types of emergencies. Ensure contamination on clothing, body parts, equipments or building materials is within the limits.

A. 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. Clothing exhibiting low-level or high-level contamination should be soaked in Versene or similar chelating agent, thoroughly rinsed, monitored with the survey meter and dried. If the activity is not reduced to a suitable level so that it gives a contact dose rate of 10 micro R/h, above background, the clothing should be handled as radioactive waste. The wash and rinse liquids may require handling as radioactive waste.
3. See Supplementary procedures for clean-up of radioactive spills and decontamination posters.

B. 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.

C. 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 with a 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 face masks 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 Radiation Safety Officer must certify the area to contamination free.

SUPPLEMENTARY PROCEDURES FOR CLEAN-UP OF RADIOACTIVE SPILLS

Radioactive materials are normally handled using all recommended precautions and preventive measures. However, the possibility of an unplanned spill or contamination, as per 64E-513, exists. If this serious problem is encountered, decontamination activities must be carried out as soon as possible, and every effort should be made to prevent the spread of contamination.

First determine the extent and type of contamination, low or high. Low level contamination spill is defined as any spill involving less than 100 microcurie per liter volume and high level contamination is defined as any spill involving greater than 100 microcurie per liter volume.

Once the level of contamination is determined, follow by immediately removing the spilled surface activity. The following procedure is believed to be more effective and less time consuming, which is of great importance.

A. 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. Clothing exhibiting contamination should be soaked in Versene, monitored with the survey meter and dried. If the activity is not reduced to a suitable level, the clothing should be discarded.

B. 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. 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.

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, wash the skin with dilute HCl and follow by washing with soap. Then rinse well with cold water.

5. For persistent contamination, a mixture of 8% Carboxy methyl cellulose, 3% detergent, 1% Versene, and 88% water may be homogenized into a cream and rubbed into the skin from 3 to 5 minutes. Then rinse thoroughly with warm water. This is generally used only as an extreme method because Versene often increases the rate of absorption of the radio element.

C. Decontamination of Surfaces and Building Materials:

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 wearing personal protective equipment and vacuuming or wiping with a damp wipe. If unsuccessful, try scrubbing with soap and water.

Decontamination

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 URSO 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 URSO, the collection and disposal of the waste water as hazardous waste (or in compliance with the specifications in the site operations plan), and the supervision of these activities by the URSO.

Decontamination Solutions

Solution A: Solution containing 5% Sodium Carbonate (Na_2CO_3) and 5% Trisodium Phosphate (Na_3PO_4)

Solution B: Solution containing 10% Calcium Hypochlorite (CaCl_2O_2)

Solution C: Solution containing 5% Trisodium Phosphate (Na_3PO_4)
A good general purpose rinse.

Solution D: A dilute solution of Hydrochloric acid (HCl) (Maintain pH of 3)

Solution E: A dilute solution of phosphate free analytical quality detergent

The following Emergency response protocol will be laminated and posted as authorized by the RSO.

SPECIAL RESPONSE PROTOCOL

See Appendix 6 RADIOLOGICAL EMERGENCY PLAN

General Guidelines

In all cases of physical injury, even minor injuries, medical attention and hospitalization take precedence over contamination concerns. Contact Public Safety at x75911 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

Emergency Contacts

Radiation Safety Officer: (305) 348-0489 or (305) 348-2621

Alternate Radiation Safety Officer: (305) 348-7835 or (305) 348-2621

Public Safety: (305) 348-2626 or (305) 348-5911

XIII. 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 Ingestion

If you suspect that any radioactive material may have been ingested by any personnel, 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	1 mCi
Processes with possible escape of tritium carried out within a fume hood of adequate design, face velocity and performance reliability.	10 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	100 mCi

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 $\mu\text{Ci/L}$, but are less than 50 $\mu\text{Ci/L}$, 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 $50 \mu\text{Ci/L}$, 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 $5 \mu\text{Ci/L}$. 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 will be performed when quantities of Iodine 125 processed by an individual at any one time or the total amount processed over any 3-month period exceed 10% of those for the forms of iodine shown in the table below (U.S Nuclear Commission Regulatory Guide 8.20):

Types of Operation	Iodine 125 activity handled in unsealed form making bioassay necessary	
	Volatile or dispersible	Bound to nonvolatile agent
Process in open room or bench with possible escape of Iodine 125 from process vessel	1 mCi	10 mCi
Processes with possible escape of Iodine 125 carried out within a fume hood of adequate design, face velocity and performance reliability.	10 mCi	100 mCi
Processes carried out within glove boxes that are ordinary closed but with possible release of Iodine 125 from process vessels and occasional exposure to contaminated box and box leakage	100 mCi	1000 mCi

All workers handling these activities of iodine 125 or close to the process so that intake is possible should participate in bioassay program.

Types of Bioassay

Baseline. Prior to beginning work with I-125.

Routine. A bioassay sample should be obtained within 72 hours following entry of an individual into an area where bioassay is performed (but waiting at least 6 hours for distribution of major part of iodine to the thyroid) and every 2 weeks or more frequently thereafter. When work with iodine is less frequently than every 2 weeks bioassay should be performed between 6 hours and 10 days of the work period during which I-125 was handled. Bioassay frequency should be changed to quarterly after 3 months, provided no I-125 thyroid burden above 0.12 microcuries has been detected.

Procedure:

- The bioassay procedure consists of thyroid scan using a scintillation probe- a NaI detector with a thin window attached to a rate meter or a scaler.

- Any instrument that is used to monitor an individual's thyroid, as part of an I-125 bioassay program, must be calibrated annually. In addition, the counting efficiency should be determined using a thyroid phantom and I-125 standard.
- Whenever the thyroid I-125 burden at the time of measurement exceeds 0.12 microcuries the following action should be taken:
 - Investigation of the operations involved, including air and other in-plant surveys to determine the cause of potential exposures.
 - A repeat bioassay should be performed within 2 weeks of previous measurement to confirm the presence of internal iodine and to obtain an estimate of its effective half-life for use in estimating dose commitment.
 - If the thyroid burden exceeds 0.5 microcuries take necessary steps such as medical consultation for removal of iodine and/or blocking of thyroid, weekly measurement until the thyroid burden is less than 0.12 microcuries.

Quarterly Measurements

If measurements and surveys indicate that a worker will receive further exposures, reinstitute bi-weekly or more frequent surveys.

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

1. 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.

2. 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 Bureau of Radiation Control.

XV. RADIATION CAUTION SIGNS

Each investigator is responsible for obtaining and posting of proper warning signs in all areas in which ionizing radiation are used. The investigator shall consult with the University Radiation Control 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 any entrance door to a room or laboratory where radioactivity is used or stored.
- b) On any storage locker (*i.e.* refrigerator, cabinet, etc.) which contains radioactive materials.
- c) On the designated radioactive materials handling sink(s).
- d) On the designated disposal containers.
- e) On any other structure or area which meets the philosophical basis cited above. Consult the Radiation Safety Office for further clarifications.

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 "hot lab" if that is the laboratory organization.

Signs must be posted as required. Appropriate signs will be available from the University Radiation Control Officer.

XVI. RADIOISOTOPE FACILITIES

Because of the concern for radiation safety, sources of ionizing radiation are not to be used in any facility or area outside of those specifically designated by the Radiation Control Safety Plan and Licensing materials.

The rooms and/or areas specified are on file with the license application. Any changes to these specifications will require approval from the Radiation Control Committee or an amendment to the license. The authorized users are expressly not authorized to transfer 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.

Before any facility, which was used for radioactive work, is released for unrestricted use thorough survey of the facility will be conducted. Survey will first be conducted by the principal investigator who will submit the report to the Radiation Safety Officer. The Radiation Safety Officer/Radiation consultant will then conduct survey to confirm that the facility can be released. Regulatory Guide 1.86(NRC 1974), Termination of Operating Licenses for Nuclear Reactors gives criteria for acceptable surface contamination levels.

Procedure for using Radioactive Materials at Temporary Sites

1. The authorized user shall submit proposal to RSO for use of radioactive materials at a temporary site.
2. He/she shall be authorized user for the radioactive material he/she plans to use.
3. The proposal shall describe details of the temporary site, its location, method for containment of the radioactive material/spills, controls for the safety, access control to the site and security of the radioactive material.
4. The RSO shall visit the site and ensure that the proposed safety and security measures are adequate and achievable.
5. The RSO will forward the proposal to RCC with his/her recommendations for approval/vote/comments.
6. The RSO will inform the user to resubmit the proposal with changes, if the RCC recommends so.
7. After the proposal is approved by RCC the RSO will ask the user to complete safety and security measures.
8. The RSO will approve the site for radioactive work after the user has complied with the safety and security requirements.
9. For radioactive work at any site belonging to an institution other than FIU, FIU shall reach an agreement with that institution for use of the site, its safety and security.

XVII. SEALED SOURCE LEAK TESTS

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 sources or a standalone sealed source must complete the "Application for Procurement of Sealed Source" and submit it to the RSO for approval.

LEAK TESTS

All sealed sources will be leak tested (by the user/by an outside consultant) at intervals not to exceed six months, unless more frequent intervals are prescribed. The URSO 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 that purchase any source including check sources are required to and report register the sources with the Radiation Safety Office. Purchase of these sources does not require prior approval but the user is required to register the source once it has been received. Annual inventory of these sources shall also be performed and records maintained.

XVIII. REGISTRATION OF DEVICES CAPABLE OF PRODUCING IONIZING RADIATION

All machines and devices capable of producing potentially harmful ionizing radiation must be registered with the University Radiation Safety Officer. The following types of machines and apparatus are among those which 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 which may produce potentially hazardous ionizing radiation.

1. Description of the equipment, to include type, make, model, PKV, PMA, and date of installation (For particle accelerators or other "special apparatus" provide the pertinent information when the equipment is not described by these specifications).

2. Location of installation, to include building and room number when possible.

3. Department and/or person responsible for operation of the machine.

4. Qualifications of persons in charge.

5. Summary of calibration information on the machine.

- a. For non-medical x-ray and other apparatus:
- b. Pertinent information on the radiation output of the apparatus should be given if possible.

7. Copy of summary of protection surveys performed on the device and description of any personnel monitoring regularly performed.

8. The Radiation Safety Officer will register all radiation producing devices with the Department of Health, Bureau of Radiation Control, Radiation Machine Section, P.O. Box 210, Jacksonville, FL 32231. Phone: (904) 359-6363; Fax: (904) 359-6362.

XIX. INDIVIDUAL RESPONSIBILITY FOR RADIATION PROTECTION

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:

- a. Keeping his exposure to radiation as low as possible, and specifically below the Maximum Permissible Exposures, listed under Part XI of this Radiation Control Plan.
- b. Wearing the prescribed monitoring equipment such as dosimetry badges and pocket dosimeters in radiation areas.
- c. 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 the safety or working in the open.
- d. Surveying his hands, shoes, and body for radioactivity, and removing all loose contamination before leaving radiation areas.
- e. Eliminating smoking or eating in areas where radioactive materials are present. Smoking or eating may be permitted in an office adjacent to such as area when it has been demonstrated that the office is free of contamination. Refrigerators will not be used jointly for foods and radioactive materials.
- f. 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 which goes to the mouth, nose, or eyes.
- g. 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 University Radiation Safety Officer notified.
- h. 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. Wherever practical

keep work surfaces covered with absorbent material, preferably stainless steel trays or pans, to limit and collect spillage in case of accident.

i. 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 demonstrated to be free of contamination.

j. Reporting accidental release, inhalation, ingestion, or injury involving radioactive materials to his supervisor and the University Radiation Safety Officer, and carrying out their recommended corrective measures. The individual shall cooperate in any and all attempts to evaluate his exposure.

k. Carrying out decontamination procedures when necessary and taking the necessary steps to prevent any additional spread of contamination.

XX. RADIATION TRAINING PROGRAM

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 personnel entering radiation hazard areas are required to qualify for entry by:
 - Satisfying the restrictions as identified in Section VI of this manual.
 - Signing and understanding the briefing sheet for the activity they are to 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 of and content of notices posted in conformance with FAC 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. Named 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-5.1307 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 47CFR 172 or those acceptable to the RSO.
6. FIU conducts training programs of the following different types:
 - On-line radiation safety training, which can be taken from any computer with internet connection. This will serve the purpose of refresher training

- for the current authorized users (FAC 64E-5.1309) and radiation workers. Refresher training is required every 3 years.
- As a part of the initial training for all radiation workers hands on classroom training is required, in addition to on-line training. The class room radiation training seminars are delivered, as required, usually two per year.

The topics covered in these trainings are:

- Principles and fundamentals of radiation protection and safety practices- radiation and contamination, posting and labeling, Dose limits, control of exposures-ALARA
 - Radioactivity measurement
 - Use of radiation detection instruments and monitoring techniques, and radiation surveys
 - Biological effects of radiation
 - Transportation of radioactive materials
 - Radioactive material ordering, inventory, forms and procedures, waste management, and emergency response
- Radiation Awareness Training. This is given to individuals who do not work with radioactive materials but may have to enter radiological labs for performing certain duties.

After any training an examination is conducted. Minimum passing marks are 80%.

Training certificates are issued to successful candidates and records are maintained. Records are also maintained for online training.

XXI. SECURITY, THEFT, AND LOSS

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.

XXII. ADMINISTRATION OF RADIOACTIVE MATERIALS IN ANIMALS OR PLANTS

Appendix 7 gives general guidelines for the preparation of specific procedures for administration of radioactive materials in animals. The researcher incorporates the required information in the preparation of their protocols for administration of radioactive materials.

Appendix 8 gives a typical procedure for administration of radioactive materials in plants.

XXIII. POINT SYSTEM FOR NON-COMPLIANCES

Justification

To ensure that the University complies with the State regulations on the use of radioactive materials the authorized users are required to comply with the University's radiation protection program. Timely implementation of various facets of the program is very important. The State Bureau of Radiation Control requires details of the disciplinary actions that may or will be taken when users of radioactive materials do not follow the procedures provided by the University.

The FIU radiation safety office developed progressive action plan which has been approved by the Radiation Control Committee and consented by the University Compliance Officer from the Office of Counsel General. According to this plan the authorized users accumulate points for non-compliances with the Radiation Program. Appendix 10 gives points that an authorized user will accumulate for various non-compliances.

The FIU Radiation Control Committee recommended that that the RSO should send the approved point system package to the Committee members. The Committee members will discuss the importance of the point system with the authorized users in their departments, and educate them. They will give them a copy, and obtain acknowledgment of the receipt and forward to the RSO.

Consequence of the Points Accumulated:

- When an authorized user accumulates 5 points he/she will be notified of the points accumulated with a copy to the department chair. The authorized should post notice of violations in a visible location. Not posting notice of violation will be considered as violation.
- The authorized user will be given an opportunity to remove points by undergoing additional training.
- A maximum of 5 points accrued can be removed over a 3 year period from additional training. The remaining points stay on for 3 years. To remove any point written appeal must be submitted to the Vice President for Research (see section reinstating an authorized user).
- If an authorized user accumulates 10 points or more over an academic year (July 1 to June 30) and/or 20 points over 3 consecutive academic years his/her privilege to work with radioactive materials will be withdrawn within a week, via a memorandum with a copy to Department Chair, Director EH&S, and Chairperson, Radiation Control Committee.

Reinstating an Authorized User

An authorized user whose privileges to work with radioactive materials were withdrawn should:

- Acknowledge the receipt of notice from the Committee/ RSO on behalf of the Committee within 10 days of receipt.

- Post copy of the notice at a visible location in his/her laboratory.
- Suspend work with radioactive materials within the time specified in the notice.
- May request Director Environmental Health & Safety for extending the date of suspension of work with radioactive materials to enable him/her to complete the work in progress.
- Submit written Appeal to the Vice President for Research with copy to the Director EH&S and the RSO stating the corrective measures he/she plans to implement to prevent recurrence of non-compliances and request for removing the points.
- The Vice President for Research in consultation with Director EH&S, decides whether to remove the points, if so how many for which years and responds to the authorized user with copy to the Director EH&S and the RSO.

Custody of Radioactive Materials

If privileges to work with radioactive materials of an authorized user are withdrawn and an appeal to reinstate is rejected by the Vice President, the RSO does the following:

- Informs the authorized user, the department chair and the department Representative to the Committee of the decision.
- The department chair and Representative and the RSO will discuss appointment of an alternate authorized user in the department who will take custody of the radioactive materials. The Representative and the RSO work together to assure expedited training or authorization for the alternate user, if required.
- The alternate user takes control of all radioactive materials and complies with approved procedures.

The date for implementation of the point system is July 01, 2005.

ACKNOWLEDGMENT STATEMENT

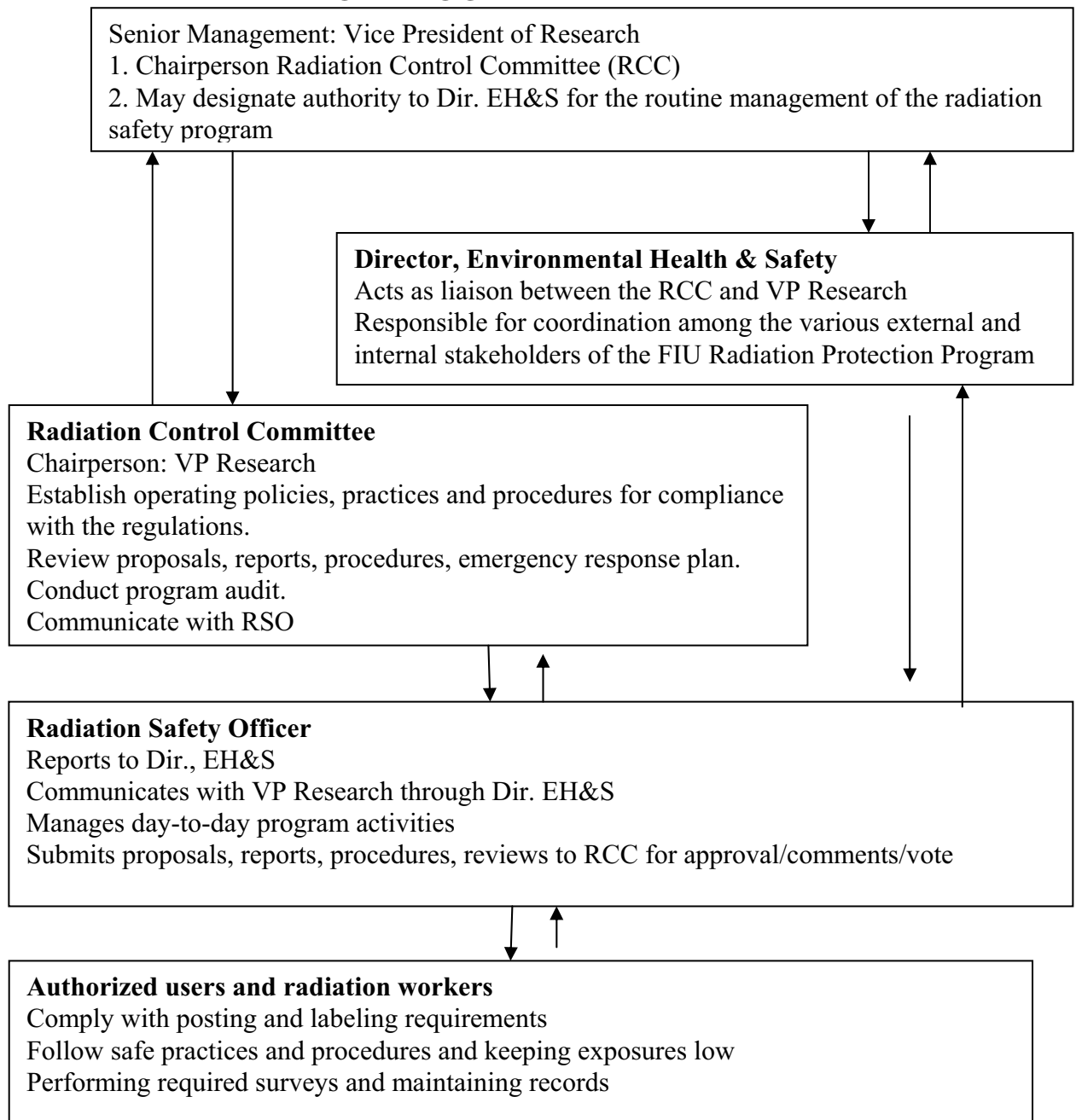
I hereby certify that I am an authorized user of radioactive materials on FIU radioactive material license # 3669-1. _____ the Radiation Control Committee member from our department _____ has explained to me the importance of the point system. I have received, read, and understood the significance of the point system. Failure to comply with the radiation program rules and regulations may result in my accumulating enough points and may result in withdrawal of my privileges to work with radioactive materials.

Name: _____ Signature _____ Date _____

Cc: University Radiation Safety Officer

APPENDICES

APPENDIX 1. ORGANIZATION CHART FOR MANAGEMENT OF RADIATION PROGRAM



APPENDIX 2. UNIVERSITY RADIATION CONTROL COMMITTEE (RCC) FUNCTIONS

Policy

The Radiation Control Committee (RCC), a Standing Committee at Florida International University ("University") is the governing body for all aspects of radiation protection within the University, including all affiliated research, clinical, instructional and service units utilizing radiation sources in facilities owned or controlled by the University. The RCC shall ensure that all possession, use and disposition of radiation sources, including sealed sources in instruments and generally licensed radioactive materials, by University personnel at Florida International University comply with pertinent federal and state regulations and with the specific conditions of licenses issued to the University. The RCC shall ensure that all concomitant radiation exposures are maintained **As Low As Reasonably Achievable (ALARA)**.

Responsibilities and Authority

The RCC develops and promulgates policies, rules and procedures for the safe use of radiation sources. The RCC has the authority to grant, deny, or withdraw permission for the use of radioactive materials or any other radiation sources within the University. It is the intent of the University that no use of radiation proceeds without the knowledge and approval of the Committee.

The University Radiation Safety Officer (RSO) carries out the directives of the RCC. The RSO operates out of the Department of Environmental Health and Safety, which has broad responsibilities for all safety and occupational health programs on the Florida International University campuses.

The RCC reports to the University Vice President, Research, who is Chairperson of the RCC. The Vice President, Research may delegate administrative authority to Director, Environmental Health & Safety Department for matters related to the routine management of the Radiation Safety Program.

In its oversight role of the University Radiation Safety Program, the RCC is responsible for the following:

- Developing University policies, procedures, safety manuals, and criteria for training (and refresher training) and testing of each category of workers involved with the use of radioactive materials, including ancillary staff, to ensure that the radiation safety program is properly implemented according to accepted health physics practices. Ancillary staff refers to any support staff that provide service to areas where radioactive materials are used or stored, and includes housekeeping, maintenance, security, and receiving personnel.
- Reviews emergency response plans, including agreements, if any, with offsite emergency response agencies,
- Reviewing all proposals for radionuclide use and conditions of use, plans for all new buildings and modifications of existing structures where radioactive

- material or radiation producing devices are to be used, as proposed by the Radiation Safety Officer.
- Voting to approve, disapprove, or amend proposals.
- Ensuring that only qualified individuals are permitted to use radiation sources, or to supervise such use by others.
- Reviewing semi-annual reports from the RSO summarizing radiation surveys, lab inspections, occupational radiation dose for all personnel working with radioactive materials and other sources of ionizing radiation, any significant incidents, including spills, contamination, misadministration, etc.
- Conducting an annual audit of the radiation safety program that includes a review of documentation and performance required to comply with license conditions, Federal/State of Florida regulations, and Radiation Control Committee recommendations, and ALARA program.
- Enforcing compliance with the program, including imposition of sanctions for noncompliance.
- Reviewing proposals for vendor services as may be required by license regulations, or commercial requirements.
- Making recommendations on risk management issues related to radiation safety.
- Delegating to the Radiation Safety Officer the authority to act for the RCC between meetings. His/her actions will be reported to the RCC for review at appropriate intervals.
- Recommending and implementing procedures for radioactive waste disposal.
- Providing advice to research groups, departments and investigators.

Radiation Safety Officer (RSO)

- 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 Florida Administrative Code (F.A.C.).
- Review and approve purchase of radioactive materials.
- 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

- 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.
- Approve all procedures that might involve radiation exposures and all changes in such procedures.
- 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 (and their contact information) who work with radioactive materials or radiation producing devices.
 - Manage disposal of radioactive wastes.
 - Review all proposals for authorization of new users of radioactive materials, new radioactive laboratories or radioactive materials and submit with recommendations to the RCC for approval.
- Act as liaison for any inspections conducted by the regulatory agencies.
- Maintain radionuclide inventory to assure compliance with the license limits.
- 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, radioactive material inventory (receipt, use, transfer and disposal) records, waste pick-up and disposal records, planned special exposures records, laboratory audit reports, generally licensed materials inventory records, sealed Source leak test records, instrument calibration records, and records of all communication with the State Bureau of Radiation Control.
- Serve as ex-officio member of the Radiation Control Committee.
- Submit Semi-annual summarizing radiation surveys, lab inspections, occupational radiation dose for all personnel working with radioactive materials and other sources of ionizing radiation, any significant incidents, including spills, contamination, misadministration, etc.
- Perform annual ALARA review and submit to RCC for review.

- Arrange for RCC meetings, obtain approval of the RCC for changes in radiation program, use of radioactive materials, and prepare minutes of the RCC minutes and distribute among members.
- In absence of the Chairperson, RCC and Director Environmental Health and Safety acts on their behalf for all matters related to the Radiation Safety Program.
- Report directly to Director, Environmental Health & Safety and communicate with the Vice President, Research through the Director.
- Prepares periodic reports for RCC review and to update the chair.

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

Termination or Changes in Radiation Projects

The Radiation Safety Officer or Director of Environmental Health Safety have full authority to close or order evacuation from a laboratory or other facility where release, contamination, or other incident involving radioactive material is deemed to present a real hazard to persons who occupy that space. Such actions shall be taken upon prior consultation with the Vice president, Research.

Appeals

Any individual may submit a written appeal regarding action or decision of the RCC through the Vice President, Research. A copy of any appeal must be sent to the Director of Environmental Health & Safety Department simultaneously.

Membership

Each department actively using radioactive materials shall be represented by at least one member. Qualified members shall include principal investigators and/or experienced professionals, proficient in the use and handling of radioactive materials, who are knowledgeable about regulatory compliance and University policy

related to radioactive material use. Representatives of other groups or functions that affect the effective management of the radiation safety program, e.g. Purchasing, Public Safety and Work Management may also be appointed as ex-officio members.

The current members are from:

- Biological Sciences
- Biomedical Engineering
- Chemistry
- Earth Sciences
- Environmental Engineering
- Environmental Health & Safety & Risk Management Services
- Environmental Studies
- Hemispheric Center for Environmental Technology
- Physics. and
- Southeast Environmental Research Center.

Appointment to the committee shall be as follows:

Regular Appointments

Nominations for appointment to Radiation Control Committee shall be directed to the Vice President for Research via the Radiation Safety Officer. The RCC will evaluate the nominations and will vote to approve/disapprove the members. The majority vote will prevail.

Unless a member is repeated violator of licensing requirements or leaves the University he/she shall continue to be a member of the RCC.

The Vice President for Research (or Director, EH&S) will chair the Radiation Control Committee.

Ex-officio members shall be appointed at the discretion of the Vice President for Research or Director EH&S. The Chief of the Police or one of his/her senior administrators, Director, Purchasing Department or one of her/his senior administrators and Director, Facilities Management or one of her/his senior administrators will serve as ex-officio of the RCC. They will be invited to attend one of the biannual meetings. The ex-officio members will have no voting rights.

Meetings, Agenda, and Quorum

The Committee meets semi-annually, or more frequently, at the discretion of the Chair. A quorum consists of fifty per cent of the membership, and must include the Chair (or his/her representative), and the RSO. In order to plan for temporary absences, each Committee member may designate an alternate. The designee may represent the absent Committee member in all aspects of Committee participation, and shall have the responsibility and authority to act on behalf of that member. The designated alternate member should be an active authorized user on one of the University licenses or an inactive user in good standing. All appointed members present are entitled to vote. Between meetings, interim decisions may be made by

established subcommittees or by a majority of all voting members via mailed ballot or e-mail. Such decisions shall be ratified by confirmation from the Chairperson, RCC. The Chair may veto the decision of the committee, if it is determined in consultation with RSO/Director, EH&S that the decision reached by members is not in the interest of the Radiation Program or of the University.

The RCC conducts the following activities at its meetings:

- Reviews records and reports from the RSO, ALARA program, results of regulator inspections/audits by RSO and State Bureau of Radiation Control,
- Reviews and approves or disapproves authorizations as proposed by the Radiation Safety Office.
- Conducts reviews of compliance with regulations and University procedures, and authorizes enforcement, if deemed necessary.
- Recommends changes in policies and procedures, as appropriate.

Prior to each meeting the RSO will prepare an agenda for the meeting and distribute among the members. The RSO shall maintain minutes of the meetings. The minutes will include the date of the meeting, the members present and absent to demonstrate that quorum was present, a summary of the discussions, recommendations and the results of votes. The RSO will also document the RCC's review of new users, uses, and program changes. Minutes will be distributed to members of the Committee. Additional copies may be distributed to others within the University as determined by the chairperson or Director EH&S.

Subcommittees

The RCC may establish subcommittees to perform specific functions. Each subcommittee shall submit a written report of its activities and actions to the RCC in a timely manner. Any authority granted to a subcommittee is subject to approval for action by the full Committee. Each subcommittee report accepted by the RCC becomes part of the record filed in the University Archives.

Code of Conduct

All members of the Radiation Control Committee shall be expected to conduct themselves in a manner supportive of the policies, operations and initiatives of the committee, and in a manner that does not improperly interfere with the fulfillment of responsibilities of the RCC.

APPENDIX 3. SURVEY REQUIREMENTS IN RADIOLOGICAL LABORATORY

Item	Regulatory Requirement
Area Radiation Survey (Type and Frequency)	<ol style="list-style-type: none"> 1. Survey with a radiation survey instrument at the end of each day of use or receipt of all areas where radioactive materials are used or received. 2. Weekly survey with a radiation survey instrument of all areas where radioactive materials or radioactive wastes are stored. 3. Weekly wipe survey for removable contamination during weeks of use of all areas where radioactive materials or wastes are routinely used or stored. 4. Wipe survey for removable contamination at the end of each day of use of all areas where radioactive materials are routinely used if the radioactive materials are not detectable with survey instruments. For example, collecting wipes and counting for tritium in a liquid scintillation counter. <p>In labs/areas where radioactive materials/wastes are stored a weekly survey, at a minimum, is required, even if the lab is kept locked, and there is only one authorized users/radiation worker whose absence from work place is documented. An alternate AU for each lab is recommended who performs surveys during the absence of the AU.</p>
Personal Monitoring	Monitoring for individuals for contamination prior to leaving the restricted area
Radiation Survey Report	<p>The survey report shall be prepared and shall include:</p> <ul style="list-style-type: none"> • 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 cpm or dpm per 100 cm²). The measured values shall be keyed to the diagram. • The action levels (500 dpm per 100 cm²) for contamination. • The serial number, model number and manufacturer of the instrument. • The initials of the person who performed the survey. <p>Records of personal and area surveys shall be retained for 3 years.</p>
Air Flow Rate through Fume Hood	80 to 120 linear feet per minute; measured semi-annually.

APPENDIX 4. WASTE SHIPMENT

1. Shipping paper

The shipping paper shows:

Organization managing transportation and Emergency contact

Name and address/phone # of the consignee (Agency to whom the material is shipped)

Name, number of the carrier, vehicle number, route

The materials being shipped: radioactive

Hazard Classification 7 (radioactive)

Not otherwise specified or surface contaminated objects

Identification number (Applicable to waste, e.g., UN 2982, UN 2912, UN 2913)

Name of the radionuclide

Physical form: solid or liquid

Chemical form: oxide

Details of the contents of each package are to be on separate sheet

Radionuclides, Radioactivity in both SI and conventional units, volume weight

Radioactive labels: White-1 < 0.5 mR/h on contact

Radioactive label: Yellow- II ≤ 50 mR/h on contact, dose rate at 1 meter
(Transport index) ≤ 1 .

Type of shipment: Exclusive use shipment (yes/No)

(All shipments may not be exclusive use)

Total number of pieces and weight

24-hour Emergency phone #

Remark: Applicable DOT Emergency Response Guides #

Name, address, signature of shipper and date of shipment

(Applicable name and address will be entered in the shipping paper)

Name, signature of carrier and date of shipment

2. Containers and Waste Description

This form gives details of each package-

Container identification (Box and #, or Drum and #, or Aq and #)

Container description

Volume

Weight

Surface radiation level

Surface contamination

Physical description

Chemical description

Individual radionuclides and activity, total container activity

Waste classification Class A, B, or C, Stable/unstable

Total: number of packages, volume, weight, activity, special nuclear materials (and activity), H-3, C-14, Tc-99, I-129, Source materials and their activity

3. Emergency Response Information (Sample) in Shipping Paper

1. **PROPER SHIPPING NAME AND HAZARD**

Radioactive materials, n.o.s., 7, Hazard Class UN 2982 (Emergency Response Guidebook Guide # 163).

Radioactive materials, Low Specific Activity, n.o.s., 7, Hazard Class UN 2912, LSA-II (Emergency Response Guidebook Guide # 162).

Radioactive materials, Surface contaminated object., 7, Hazard Class UN 2913, SCO-II (Emergency Response Guidebook Guide # 162).

2. **IMMEDIATE HAZARD TO LIFE**

None. Low radiation exposure, low radioactivity. Radiation presents minimal risk to lives of persons during transportation.

3. **RISK OF FIRE OR EXPLOSION:**

None. Radioactivity dose not change flammability or other properties of the materials. Some of the materials may burn, but none of them ignites readily.

4. **IMMEDIATE PRECAUTIONS:**

Keep unnecessary people away; isolate hazard area and deny entry. Uninjured persons or equipment with suspected contamination should be detained or isolated; deny clean up unless instructions are received from Radiation Authority. Notify CHEMTREC of accident conditions shown below.

5. **EMERGENCY FIRE MEASURES:**

Positive pressure self-contained breathing (SCBA) and structural firefighters' protective clothing provide adequate protection. Maintain surveillance until Radiation Authorities arrive.

6. **HANDLING FIRE MEASURES:**

Do not touch damaged packages or spilled material. Small liquid Spills: Cover with sand earth or non-combustible absorbent material. Do not attempt clean-up operations. Maintain area until Radiation Authorities arrive.

7. **FIRST AID:**

The public emergency number 911 should be used as ordinarily prescribed. Ambulance and hospital personnel should be informed about possible low-level radioactive contamination or other radiological conditions. Use first aid treatment according to the nature of the injury.

Priority for rescue, life-saving, first aid, and control of fire are higher than the priority for measuring radiation fields.

8. EMERGENCY NUMBERS:

Florida International University, Environmental Health & Safety, Radiation Safety Office

1200 SW 8th Street CSC-162 Miami

Phone: (305) 348-0489 (regular business hours 8:00 am to 5:00 pm)

24 HOUR (786) 229-1737 (cell)

CHEMTREC 24 HOUR: (800) 424-9300

The testing methods and results of each of Type A packages will be maintained on files at the FIU permanent facility.

APPENDIX 5. PROCEDURES FOR A PREGNANT WOMAN TO DECLARE PREGNANCY

1. The pregnant woman worker completes the “pregnancy declaration by a pregnant woman worker” form (download from the EH&S website www.fiu.edu/~ehs under radiation/laser safety) and submits to her supervisor. After the notification is signed by the stated officials it is recorded by both supervisor and RSO.
2. The RSO brings to the attention of the supervisor the dose limits of the embryo or fetus under section 64E-5.311 (500 mrem during the entire pregnancy from occupational exposure and 50 mrem in any month). The dose to the embryo or fetus is taken as sum of the deep dose equivalent to the declared pregnant woman and the dose to embryo or fetus from radionuclides in the embryo or fetus and radionuclides in the declared pregnant woman.
3. Each declared pregnant worker shall wear a radiation dose monitor at the waist level to estimate the fetal deep dose equivalent.
4. Each declared pregnant worker whose duties require protective clothing shall also wear a radiation dose monitor outside the protective clothing to estimate dose to the worker, and the standard occupational limits will apply.
5. The declaration remains in effect until the declared pregnant woman withdraws the declaration in writing, that is completes and submits “WITHDRAWING A PREGNANCY DECLARATION” form (download from the EH&S website www.fiu.edu/~ehs under radiation/laser safety) or is no longer pregnant.

APPENDIX 6. RADIOLOGICAL EMERGENCY PLAN

Introduction

Florida Administrative Code (64E-5.219 Emergency Planning) requires each application to possess radioactive materials in unsealed form, on foils or plated sources, or sealed in glass in excess of the quantities in 64E-5.220, must contain either: (a) An evaluation showing that the maximum dose to a person off-site due to a release of radioactive materials would not exceed 1 rem (10 mSv) effective dose equivalent or 5 rem (50 mSv) to the thyroid; or (b) An emergency plan for responding to a release of radioactive material. Florida International University (FIU) does not possess nor intends to possess radioactive materials in quantities exceeding in 64E-5.220. FIU has established maximum exposure limits of its occupation workers to 20% of the State limits, the actual exposures being significantly lower. FIU has embarked up on a Radiological Emergency Plan in order to adequately protect its employees, students and public, and to keep their internal and external radiological exposures as low as reasonably achievable.

Purpose

The purpose of this Radiation Emergency Plan is to identify the potential conditions that may result in release of radioactive materials, and to plan for actions that must be initiated to protect FIU community and the public from exposures to radiation.

Types of Radiological Emergencies:

Radiation emergency can be on-site affecting personnel and property of the facility where emergency conditions may exist or off-site affecting public outside the campus. Since FIU is licensed to possess only extremely small quantity of source and special nuclear materials, a nuclear criticality accident cannot occur in FIU. Further, because FIU is authorized to possess limited quantity of radioactive materials, release of significant quantities of radioactive materials affecting public is not envisioned. Given below are conditions that may result in radiological emergency:

1. Spills of radioactive materials during transfer of solutions from containers, malfunction of equipment, loss of integrity of a containment, such as glove box or fume hood.
2. Incidents Involving Radioactive Dusts, Mists, Fumes, Organic Vapors, and Gases.
3. Radioactive Material Escape to Public Domain.
4. Accident during Transportation of Radioactive Materials or Wastes.
5. Fires, Explosions, or Major Emergencies in Radiological Laboratories
6. Fatal or critical accidents or injuries occurring on University premises accompanied by personal radiological contamination of employees, students or visitors.
7. Natural disasters, including storms, floods, hurricanes, or tornadoes affecting radiological laboratories, and hence impeaching barrier and containment integrity.

Responsibilities of the Head of the Department

- Establish written procedures to handle emergencies ranging from a minor spill to a major accident that may require intervention by University emergency response personnel. These procedures should include provisions for immediate response, after-hours notification, handling of each type of emergency, equipment, and the appropriate roles of users of radioactive materials and the staff. Except for minor spills or releases of radioactivity that can be controlled and cleaned up by the user, individual users should have a clear understanding of their limitations in an emergency, with step-by-step instructions and clear direction of whom to contact.
- Provide radiation safety training to workers and training to respond in radiation emergencies.
- Ensure only authorized persons enter the radioactive use laboratories.
- Designate lead persons, such as principal investigators, departmental safety persons who maintain liaison with department of Environmental Health & Safety.
- Conspicuously post name and telephone number of persons to be contacted in emergency, including those of radiation safety officer (RSO) or an alternate person(s) in areas of use, so that it is readily available to workers in case of emergencies.
- Provide copies of emergency procedures to all users. Post a current copy in each laboratory or other area where radioactive material is used.
- Make emergency response kit available.
- Place emergency spill kits strategically placed in well-marked locations for use by all authorized users and the radiation safety staff.
- Designate persons responsible for inspecting all equipment periodically for proper operation and replenish, as necessary.
- Provide the spill kit and appropriate survey instruments, including batteries (for survey meters).

Responsibilities of the Principal Investigator

- Ensure that you and persons working with you are trained to respond in radiation emergencies.
- Make sure you and persons working with you know where emergency response kit is.
- Ensure name and telephone number of persons to be contacted in emergency, including those of radiation safety officer (RSO) or an alternate person(s) are conspicuously posted at the entrance to the laboratory, so that it is readily available to workers in case of emergencies.
- Ensure radioactive laboratories are kept locked.
- Ensure security of all radioactive materials, including those in instruments.
- Maintain inventory of all radioactive materials.

Responsibilities of the Public Safety Department (UP: 305 348 5911; BBC: 305 919 5911)

- Make assessments of the nature and extent of emergency situation or threats of the emergency to the University and alert the Director of Emergency Management, and the departments with the capability to respond.
- Coordinate with the various service agencies- EH&S, Fire Department Facilities Operations, Health Care & Wellness Center, EMC etc.
- Collect and transmit relevant information throughout the various phases of an emergency to emergency-response agencies.
- Control access on University premises, preservation of law and order and campus security.
- Perform building lock-down procedures as scheduled.
- Provide intelligence information on campus conditions to the Director of Emergency Management.

Types of Emergencies and Response

1. Spills of radioactive materials during transfer of solutions from containers, malfunction of equipment, loss of integrity of a containment, such as glove box or fume hood.

The decision to implement a major spill procedure instead of a minor spill procedure depends on many incident specific variables, such as the number of individuals affected; other hazards present; the likelihood of spread of contamination; and types of surfaces contaminated as well as the radiotoxicity of the spilled material.

1.1 Minor Spills of Liquids (< 100 microcurie of short-half (<90 days) radionuclides, volume < 1 liter) and Solids (< 1 microcurie)

- Instructions to Workers
 - Notify persons in the immediate area that a spill has occurred.
 - Ask someone to promptly report the incident to the Radiation Safety Officer (RSO).
 - Do not allow anyone to leave contaminated area without first being monitored to be sure he/she is not contaminated.
 - Wash hands first if they are contaminated as a result of the accident.
 - Put on disposable gloves to prevent contamination of the hands.
 - Prevent the spread of contamination by covering the spill with absorbent paper. (Paper should be dampened if solids are spilled.)
 - Carefully fold the absorbent paper with the clean side out and place in a plastic bag for transfer to a radioactive waste container. Put contaminated gloves and any other contaminated disposable material in the bag.
 - Clean the spill from the periphery and work inward.
 - Be careful not to track contamination out of the spill area
 - Survey the area with an appropriate low-range radiation detector survey meter or other appropriate technique. Check the area around the spill for contamination.

- Mark off contaminated area with chalk, marker, rope, etc., and restrict traffic to that area.
- After cleaning the spill start decontamination. Start at the periphery of the contaminated area and work inward, reducing systematically the contaminated area.
- Use survey meter or wipe tests to monitor effectiveness of decontamination procedure.
- Check hands, clothing, and shoes for contamination. Check persons in the lab for contamination.
- Allow no one to return to work in the area unless approved by the RSO.
- Follow the instructions of the RSO and/or the RSO's staff (e.g., investigation of root cause, decontamination techniques, surveys, provision of bioassay samples, requested documentation).
- Responsibility of RSO
 - Follow up on the decontamination activities and document the results.
 - Survey and clear the area if the contamination is within the limits, otherwise advise further decontamination.
 - As appropriate, determine cause and corrective actions needed. Document the incident along with contacts of the persons involved. Consider bioassays, if there is a potential for internal contamination.

1.2 Major Spills of Liquids and Solids

- Instructions to Workers
 - Notify persons in the immediate area that a spill has occurred.
 - Ask someone to promptly report the incident to the Radiation Safety Officer (RSO).
 - Do not allow anyone to leave contaminated area without first being monitored to be sure he/she is not contaminated.
 - Wash hands first if they are contaminated as a result of the accident.
 - Put on disposable gloves to prevent contamination of the hands.
 - Cover your nose and mouth with kerchief or dust mask, to prevent inhalation exposures if the material can potentially become airborne.
 - Prevent the spread of contamination by covering the spill with absorbent paper (paper should be dampened, if solids are spilled), but do not attempt to clean it up. To prevent the spread of contamination, limit the movement of all personnel who may be contaminated.
 - Shield the source only if it can be done without further contamination or significant increase in radiation exposure.
 - Request facility management/facility operations to turn off fans, ventilators or air conditioners that supply air to other areas. Direct exhaust ventilation should be left on.
 - If appropriate, survey all persons not involved in the spill and vacate the room.

- Close the room and lock or otherwise secure the area to prevent entry. Post the room with a sign to warn anyone trying to enter that a spill of radioactive material has occurred.
 - Allow no one to return to work in the area unless approved by the RSO.
 - Decontaminate contaminated personnel by removing contaminated clothing and flushing contaminated skin with lukewarm water and then washing with a mild soap.
 - Check Personal Monitoring devices (TLDs) are free from contamination. Seal in plastic contaminated TLDs in plastic bag.
 - Follow instructions of the RSO and/or the RSO's staff for spill clean up and area decontamination, surveys, bioassay samples, etc.
 - Cooperate with the RSO and/or the RSO's staff for investigation of root cause, and needed documentation and data.
- Responsibility of RSO
 - Provide guidance for decontamination. If decontamination of personnel was not fully successful, consider inducing perspiration by covering the area with plastic. Then wash the affected area again to remove any contamination that was released by the perspiration.
 - Provide guidance regarding spill control and decontamination so that normal activities can resume in the area as soon as possible.
 - Take charge of contaminated TLDs. Note down their IDs. These will record high doses. Decontaminate TLDs if possible. Send these for urgent processing.
 - Document the information about contamination and location, and results of personal, equipment and area decontamination, and radiation surveys.
 - Collect nasal swabs and count to check for potential inhalation exposures.
 - Determine cause and needed corrective actions; consider need for bioassays, if licensed material is suspected ingested, inhaled, or absorbed through or injected under the skin.
 - Notify the Director EH&S and Radiation Control Committee.
 - Notify the State Bureau of Radiation Control, if necessary.

2. Incidents Involving Radioactive Dusts, Mists, Fumes, Organic Vapors, and Gases

- Instructions to Workers
 - Notify all personnel to vacate the room immediately. Vacate the room. Seal the area, if possible.
 - Request facility management/facility operations to turn off fans, ventilators or air conditioners that supply air to other areas. Direct exhaust ventilation should be left on.
 - Notify the RSO immediately.
 - Survey all persons who could have possibly been contaminated.
 - Decontaminate as directed by the RSO.
 - Isolate the adjacent corridor against traffic and spectators.

- Promptly report suspected inhalations and ingestions of licensed material to the RSO.
- Decontaminate the area only when advised and/or supervised by the RSO.
- Allow no one to return to work in the area unless approved by the RSO.
- Cooperate with the RSO and/or the RSO's staff (e.g., investigation of root cause, provision of requested bioassay samples).
- Follow the instructions of the RSO and/or the RSO's staff (e.g., decontamination techniques, surveys, provision and collection of bioassay samples, requested documentation).
- Responsibility of RSO
 - Familiarize with the incident, and assess the likely consequence, such as contamination of personnel, equipment and areas.
 - Perform air sample surveys in the area. These are needed to determine the magnitude of the airborne releases and potential inhalation by workers. These are also needed before permitting resumption of work with licensed materials.
 - Supervise decontamination activities.
 - Collect nasal swabs and count to check for potential inhalation exposures.
 - Document the information about the incident. Determine cause.
 - Determine corrective actions needed. Consider need for bioassays/whole body count if licensed material is suspected ingested, inhaled, or absorbed through or injected under the skin. Document incident.
 - Notify the Director EH&S and Radiation Control Committee.
 - Notify the State Bureau of Radiation Control, if necessary.

3. Radioactive Material Escape to Public Domain

All persons (including FIU personnel) who are not occupationally employed to work with radioactive materials or equipment producing radiation are considered members of the public. Such persons are regulated by radiation dose limits applicable to the members of the public. All areas outside the radiological laboratories are considered public domain.

Radioactive material may find its way to the public domain under following conditions:

3.1 Major breach of the integrity of the container of radioactive materials and that of containment structure or of process piping and spreading of spill to areas outside the radiological laboratory.

3.2 Falling of radioactive waste container or radioisotope from vehicle while being transported from one building to another.

3.3 Theft of a radioactive material from a facility or from an instrument and intentionally left in a strategic place exposing personnel to radiation.

3.1 Major breach of the integrity of the container of radioactive materials and that of containment structure or of process piping and spreading of spill to areas outside the radiological laboratory

- Instructions to Workers
 - Notify persons in the immediate area that a spill has occurred.
 - Ask someone to promptly report the incident to the Radiation Safety Officer (RSO).
 - Do not allow anyone to leave contaminated area without first being monitored to be sure he/she is not contaminated.
 - Wash hands first if they are contaminated as a result of the accident.
 - Put on disposable gloves to prevent contamination of the hands.
 - Cordon off the area and label cordon “Radioactive Material Stay Away”.
 - Use dust mask/respirator, if the spill is major or has dry powder.
 - Prevent the spread of contamination by covering the spill with absorbent paper.
 - Carefully fold the absorbent paper with the clean side out and place in a plastic bag for transfer to a radioactive waste container. Put contaminated gloves and any other contaminated disposable material in the bag.
 - Scoop the contaminated soil and collect in a bag.
 - After cleaning the spill start decontamination. Start at the periphery of the contaminated area and work inward, reducing systematically the contaminated area. Remove more soil, if needed.
 - Use survey meter or wipe tests to monitor effectiveness of decontamination procedure.
 - Check hands, clothing, and shoes for contamination.
 - Follow the instructions of the RSO and/or the RSO’s staff (e.g., investigation of root cause, decontamination techniques, surveys, provision of bioassay samples, requested documentation).
- Responsibility of RSO
 - Follow up on the decontamination activities and document the results. Ensure that the area is free from contamination.
 - Survey and clear the area if the area is free from contamination, otherwise advise further decontamination.
 - As appropriate, determine cause and corrective actions needed.
 - Consider bioassays, if there is a potential for internal contamination.

3.2 Falling of radioactive waste container or radioisotope from vehicle while being transported from one building to another

According to radiation safety procedures for transportation of radioactive materials, all radioactive materials will be carried out in the University vehicle and that these materials will be secured in the vehicle so that they do not move or fall off from the vehicle. Further, they will be placed in a secondary container. If the radioactive material container happens to fall from the vehicle, and breaks so that its contents are spilled out, follow the instructions in section 3.1. The RSO assumes duties of both worker and the RSO.

3.3 Theft of a radioactive material from a facility or from an instrument and intentionally left in a strategic place exposing personnel to radiation

The best way to prevent loss of materials is by 1) keeping the radiological laboratories locked all times, 2) issuing laboratories keys only to the authorized users, 3) maintaining access control record (name, time in, time out, purpose) of the persons, 4) installing sensitive radiation monitoring instruments at the laboratory exit, keeping 'on' and hooking the radiation alarm to the department's office, and 5) installing surveillance cameras. Because the quantities of radioactive materials in use or likely to be used in near foreseeable future are small steps 4) and 5) are not warranted. Stealing of radioactive material may be prevented if steps 1 to 3 are followed. It is also important to perform periodic surveys and leak tests.

4. Accident during Transportation of Radioactive Materials or Wastes

Radioactive materials purchased by various authorized users are first received in the Radiation Safety Office. The University Radiation Safety Officer (RSO) delivers these materials to the authorized users in the University vehicle. The RSO also picks up radioactive wastes from different facilities and brings to the University Radioactive Waste Storage Facility (OE-150). During the transportation an accident may take place resulting in integrity breach of the container of radioactive material or of the waste resulting in spill of the radioactive waste material, contamination of the university vehicle, university or public road and contamination of vehicles/personnel involved in the accident, if precautions are not taken. The accident may also cause body injury to the RSO or other persons. The quantity of radioactive materials transported in FIU is very small. Radioisotopes are delivered in their original packing after placing them in secondary containment with vermiculites to absorb any standing liquid. The quantity of waste generated and shipped is negligible and will be contained in the vermiculite if spill occurs in an accident. In case of physical injury, medical attention and hospitalization shall take precedence over decontamination concerns. The RSO shall provide guidance to prevent spread of contamination without sacrificing medical needed attention.

5. Fires, Explosions, or Major Emergencies in Radiological Laboratories

5.1 Minor Fires

- Instructions to Workers
 - Notify all persons present to vacate the area and have one individual immediately call the Public Safety department 75911 and RSO (x 70489).
 - Immediately attempt to put out the fire by approved methods (e.g., fire extinguisher) if other fire hazards or radiation hazards are not present. If you attempt to fight a minor fire, do not do so alone, get help and never allow the fire to block your path of exit from the area or the building. Never compromise your safety in order to control a fire.
 - To use a Fire Extinguisher
 - **Pull the pin**

- **Aim** the extinguisher nozzle at the base of the flames
 - **Squeeze** the handle while holding the fire extinguisher upright
 - **Sweep** the extinguisher nozzle from side to side, covering the fuel with the extinguishing agent.
- Once the fire is out, isolate the area to prevent the spread of possible contamination.
 - Survey all persons involved in combating the fire for possible contamination.
 - Decontaminate personnel by removing contaminated clothing and flushing contaminated skin with lukewarm water, then washing with a mild soap.
 - In consultation with the RSO, determine a plan of decontamination and the types of protective devices and survey equipment that will be necessary to decontaminate the area.
 - Allow no one to return to work in the area unless approved by the RSO.
 - Follow the instructions of the RSO and/or the RSO's staff (e.g., investigation of root cause decontamination techniques, surveys, provision of bioassay samples, requested documentation).
- **Responsibility of RSO**
 - Supervise decontamination activities.
 - If decontamination of personnel was not fully successful, consider inducing perspiration by covering the area with plastic. Then wash the affected area again to remove any contamination that was released by the perspiration.
 - Consult with fire safety officials to assure that there are no other possibilities of another fire starting.
 - Determine cause and needed corrective actions; consider need for bioassays if licensed material is suspected ingested, inhaled, or absorbed through or injected under the skin.
 - Document incident.
 - Notify the Director EH&S and Radiation Control Committee.
 - Notify the State Bureau of Radiation Control, if necessary.

5.2 Major Fires, Explosions, or Major Emergencies

- **Instructions to Workers**
 - Notify all persons in the area to leave immediately.
 - Notify the Public Safety department 75911.
 - Notify the RSO and other facility safety personnel and EH&S safety personnel (x2621, x76971), if hazardous materials are handled in the area.
 - Provide information about the radioactive materials to public safety personnel, where the radioactive materials are currently being stored or being used, and the best possible entrance route to the radiation area, as well as any precautions to avoid exposure or risk of creating radioactive contamination by use of high pressure water, etc. Also provide information whether the materials involved in the fire could be radioactive and/or hazardous, and the precaution to be taken.

-
- Cooperate with the RSO and/or the RSO's staff (e.g., investigation of root cause, provision of requested bioassay samples).
 - Allow no one to return to work in the area unless approved by the RSO.
 - Follow the instructions of the RSO and/or the RSO's staff (e.g., decontamination techniques, surveys, provision of bioassay samples, requested documentation).
 - Responsibility of RSO
 - Coordinate activities with facility's safety personnel and with public safety personnel.
 - Consult with the firefighting personnel and set up a controlled area where the firefighters can be surveyed for contamination of their protective clothing and equipment after the fire is extinguished.
 - Once the fire is extinguished, advise that no body should enter potentially contaminated areas or areas where radioactive and/hazardous materials may be present until a thorough evaluation and survey are performed by RSO and Haz Mat Unit to determine the extent of the damage to the materials and areas.
 - Perform thorough contamination surveys of the firefighters and their equipment, and supervise decontamination, if there is contamination on persons or equipment.
 - Collect air samples and count for radioactivity.
 - Collect nasal swabs of persons and count the samples to check for potential inhalation exposures.
 - Consider bioassays if licensed material is suspected ingested, inhaled, or absorbed through or injected under the skin. Document incident.
 - Collect names and phone numbers of all persons who are involved in the incident or helped in fire incident.
 - Document incident.
 - Notify the Director EH&S and Radiation Control Committee.
 - Notify the State Bureau of Radiation Control, if necessary.

6. Fatal or critical accidents or injuries occurring on University premises accompanied by personal radiological contamination of employees, students or visitors.

- Instructions to Workers
 - Contact Public Safety at x75911 (305-348-5911) to request medical assistance. In all cases of physical injury medical attention and hospitalization take precedence over contamination concerns.
 - Evacuate personnel and if possible segregate them. Determine medical status of involved personnel.
 - Remove all personnel dosimeters and/or TLD badges from exposed personnel. Read dosimeters and record the reading. Send dosimeters and TLDs badges immediately to safe area.
 - Notify Emergency Director who will then activate emergency plan.
 - Notify Radiation Safety Officer.
- Responsibilities RSO

- Evaluate situation and personnel (or provide assistance, as applicable) in regard to:
- Personnel medical status
 - Current environs status
 - Extent of contamination
 - Nature and level of radiation exposure (external, internal)
- Close off radiation area.
 - Request facility management/facility operations to turn off fans, ventilators or air conditioners that supply air to other areas. Direct exhaust ventilation should be left on.
 - Save all samples of clothing, blood, urine, stool, vomitus. Label with name, date, time.
 - Send TLDs for emergency processing.
 - If medical condition permits, perform preliminary decontamination before releasing patients to hospitals.
 - Use portable battery operated tape recorders for collecting and storing information and for obtaining complete history of the accident, if possible. It is often difficult to record all of the events, opinions and statements in an emergency situation. The taped records can be typed later, thus providing a more complete history of the accident.
 - Use a video camera, if available. It will be an excellent method of showing what happened. If a video camera is not available, suitable still photographs will be useful.
 - Collect names and phone numbers of all persons who are involved in the incident or helped in fire incident.
 - Notify the Director EH&S and Radiation Control Committee.
 - Notify the State Bureau of Radiation Control, if necessary.

Natural disasters, including storms, floods, hurricanes, or tornadoes, affecting radiological laboratories, and hence impeaching barrier and containment integrity

Storms, foods, hurricane and tornados can cause extensive damage to property. Damage to the structure (ceiling, walls, etc.), accompanied by damage to containment (fume hood, glove box) and radioactive material container may expose the radioactive material. This may lead to spillage of the material into the fume hood or glove box. The spill may spread to lab floor and other areas. It may also be mixed with rain water, if the lab is flooded.

- Instructions to Workers
 - Secure the radioactive material prior to occurrence of an event. Provide soft packing surrounded by shield around so that when a heavy structure falls on the source vial or the source container, the container is not breached.
 - If the spill does occur, notify persons in the area, if any one is around. It is important to retrieve the material in as short time as possible and comply with instructions regarding natural disaster emergency.

- Notify the public safety.
- Report the incident to the Radiation Safety Officer (RSO) and Director of Emergency Management (DEM) promptly. Follow the instructions of the DEM.
- Request facility management to shut off fans, ventilators, or air conditioners that circulate air to other areas. Direct exhaust ventilation should be left on
- Put on disposable gloves to prevent contamination of the hands.
- Survey the area with an appropriate low-range radiation detector survey meter or other appropriate technique. Also check the area around the spill for contamination.
- Try to retrieve the source with mechanical tools, such as long tongs, small pumps without exposing hands to radiation.
- Follow the spill procedures, if the situation permits.
- Prevent the spread of contamination by covering the spill with absorbent paper.
- Carefully fold the absorbent paper with the clean side out and place in a plastic bag for transfer to a radioactive waste container. Put contaminated gloves and any other contaminated disposable material in the bag.
- Clean the spill from the periphery and work inward.
- Check the persons for contamination.
- Decontaminate the area, only if the situation permits
- Use survey meter or wipe tests to monitor effectiveness of decontamination procedure.
- Check hands, clothing, and shoes for contamination.
- Allow no one to return to work in the area unless approved by the RSO.
- Responsibilities of RSO
 - Follow up on the decontamination activities and document the results.
 - Document the incident along with contacts of the persons involved.
 - If the situation permits: survey and clear the area if the contamination is within the limits, otherwise advise further decontamination.
 - As appropriate, determine cause and corrective actions needed. Consider bioassays, if there is a potential for internal contamination.

APPENDIX 7. ADMINISTRATION OF RADIOACTIVE MATERIALS IN ANIMALS

Procedures for the Use of Radioactive Materials in Animals

General: Any area to be used for radioactive materials used must first be approved by the University Radiation Control Committee.

1. To use radioactive materials in animals, authorized users must submit to the Radiation Safety Officer the precautions and procedures to be used in handling and care of animals for approval by the Radiation Control Committee. Approval is coordinated with the Institutional Animal Care and Use Committee (IACUC). The following information must be included:

- A description of the area in which the animal is to be housed during the procedure.
- Procedures for injecting radioactive material into animals: Describe procedures for restraining animals during injection and the method for containing any radioactive material lost during injection. For small animals, a tray lined with absorbent material should be used. For large animals, some other method may be required.
- Cage: What type of cage will be used? Disposable polystyrene cage is recommended to avoid spread of contamination.
- Describe the number of animals that will be studied at any one time. The radionuclide and the maximum activity to be injected into each animal, the maximum activity used in any single day, and the maximum activity in the lab at one time. After each experiment the room must be carefully surveyed for radioactive contamination.
- Labeling of cages: The label must include the type of radionuclide, quantity of material injected per animal, date of injection, and the name of the Authorized User. Cage labeling is especially important for animals that are not euthanized within a few minutes after injection.
- Monitoring and decontamination of cages: Describe how the monitoring/decontamination of the animals, cages, and lab will be performed. If animal cages are to be returned to the Animal Care Facility after use, describe procedures for decontaminating and monitoring cages. Records of radiation levels and wipe tests must be maintained by the Authorized User. Disposable cages are recommended. These can be packed, and disposed. There will be no need for decontamination.
- Segregation of the animals injected with radioactive materials from other animals: Are long-term retention studies being conducted? If so, detailed labeling of cages and animals is especially important.
- Disposal of animal excreta: Describe the methods to be used for disposal.
- Surgical Instrument Decontamination: Describe how surgical instruments and other non-disposable devices or materials used during the experiment will be decontaminated. They must be surveyed for residual contamination

- prior to storage. They must be clearly labeled with the isotope, date, estimated activity, and Authorized User.
2. Instructions of animal handlers: Describe the indoctrination that will be provided by the Authorized User of handlers that may come into contact with animals injected with radioactive materials. This should include dose levels, time limitation and special handling requirements that you specify for your animals and/or their excreta. In general, once injected with radioactive material, animals should be housed in the experimental laboratory properly designated for both animal and radioactive material use. They are not to be returned to the central animal care facilities without specific approval of the Radiation Safety Officer and the Director of the Animal Care Center.
- a. All hands-on care of animals containing radioactive material must be provided by the laboratory research personnel performing the research. The researchers must have training in the general use of radioactive materials by the Environmental Health and Safety Department (EH&S) and specific training related to radioactive animal care by the laboratory's radioactive materials supervisor. This training must include specific instructions requiring the laboratory staff to:
 - i. Perform all feeding and cleaning of animals;
 - ii. Perform regular contamination surveys to prevent the spread of contamination, and to ensure that radiation levels are maintained as low as reasonably achievable;
 - iii. Clean and decontaminate cages and facilities;
 - iv. Packaging and handling of all animal, animal wastes, and carcasses, and other wastes;
 - v. Contact EH&S to perform free-release surveys to allow reuse of equipment;
 - vi. Contact EH&S prior to disposal of waste
 - vii. Any bite or scratch from animals injected with radioactive materials must be immediately reported to EH&S due to the potential for internal contamination.
 - viii. Animal Disposal: After euthanasia animals that have been injected with radioactive materials must be stored in a freezer that is clearly designated and marked for radioactive material use. Animals must be double bagged and labeled with the isotope, date, estimated activity, and name of Authorized User. Animals should be stored until radioactive decay to background level prior to disposal with biological waste, or disposed of under the direction of the Radiation Safety Officer.

APPENDIX 8. ADMINISTRATION OF RADIOACTIVE MATERIALS IN PLANTS

Plant Uptake Studies

General:

- All plant studies will be carried out in accordance with procedures approved by the FIU Green House Use Committee.
- All procedures requiring the use of radioactive materials will be carried out in accordance with procedures approved by the Radiation Safety Committee.
- All areas where radioactive materials are handled will first be approved by the University Radiation Control Committee.
- Adequate provisions will be made for safety and security in areas where radioactive materials are used.

Procedure:

- Plants will be grown in either laboratory growth chamber or in FIU's green house facility.
- Soil will be inoculated with appropriate radioactive chemical at desired concentrations.
- Seeds or seedlings will be planted in potted soil and watering will be carried out regularly.
- Plants will be harvested; roots and shoots will be separated and transported to the laboratory. Soil also will be transported to the laboratory. The labs to be used are restricted access and approved for the use of radioactive materials.
- Both shoots and roots will be dried in an oven at 80 C for three days. Samples will be ground for solvent extractions for parent and metabolic products and analyzed by thin layer chromatography, followed by autoradiography.
- Soil samples will be extracted for radioactive parent compounds as well as metabolites by using selective solvents. The extracts will be rotary-evaporated to 0.5 mL. The concentrated extracts will be spotted on thin-layer chromatography, followed by autoradiography.
- All surfaces on which work will be done and all surfaces on which the soil and plants will be placed will be covered with absorbent pads to minimize the risk of contamination. All personnel will wear disposable gloves, lab coats and shoe coverings. All personnel will wear applicable whole body personal radiation dosimetry badges.
- Following the analysis, the waste will be picked up by radiation safety officer, and will be stored in radioactive waste storage area prior to disposal through a contractor.
- The maximum activity to be used on any single day is 5 mCi. After each experiment the room will be carefully surveyed for radioactive contamination. If contamination is detected, established decontamination procedures will apply.

APPENDIX 9. PROCEDURE FOR EXCHANGE OF CONTAMINATED AIR FILTER

Purpose

To provide direction and guidelines for the replacement of H.E.P.A. filters in radioactive material use fume hoods.

Policy

H.E.P.A. filters serving the radiation safety flow hoods, in labs such as EC 2371, will be replaced as per manufacturers' recommendations and in conformance with industry, radiation and other safety requirements.

DEFINITIONS

- H.E.P.A.: an acronym: High Efficiency Particulate Air (the filter in use includes, in addition, an activated char-coal filter)
- Radioactive Material: an element or an isotope spontaneously emitting energetic particles and/or rays by the transformation of their unstable atomic nuclei.
- Lab Manager: A person responsible for the day to day operation of the lab
- Survey meter: Instrument used to evaluate radioactivity/radiological conditions.
- Radioactive Waste: Waste that includes radioactive material(s).
- Radiation Safety Hood: Draws air in from the room for filtration; provides protection from radioactive materials
- H.E.P.A. filter: Part Number: FF560GXF5/EU5 076M
- Pre-filter: Tri pleat brand, 12"x12"x2" (113/4"x113/4"x13/4"), Part Number: ES40LE

Authority and Responsibility:

- Lab Manager: Maintains service records for the H.E.P.A. filter. Assures appropriate and timely replacement of the filter.

GENERAL

- This filter exchange procedure is specific for the CVEC filtration assembly. At present CVEC uses short half-life (less than 90 days) materials only. Other departments may use long-lived radioactive materials or different filtration housing/ exchange arrangement such as bag-in bag-out filter disposal system for safely removing and replacing the filter without detaching the hose. Their filter exchange procedures will differ slightly but the basic safety rules will be applicable to all. Filters are to be treated and disposed of as radioactive materials. Filter replacement is to be performed by personnel with radiation-safety certification in effect. Whenever an component of the filter assembly is removed/disassembled it shall be placed on/wrapped in a plastic

- sheet/bagged to prevent spread of contamination.

PROCEDURE

- Write the following information on removed filter:
 - ❖ Date and time of removal
 - ❖ Name of the individual who removed the filter
 - ❖ Survey meter reading at the time of removal on contact and at 1 meter from the filter
 - ❖ Surveyor
 - ❖ Enter survey information-(surveyor , signature, date, survey meter manufacturer, model and serial number) in log book
 - Write the following information on new filter:
 - ❖ Date and time of installation
 - ❖ Name of installer
1. Before you begin:
 - ❖ Dress in personal protective equipment- Tyvek suit, gloves and dust mask
 - ❖ Spread plastic sheet under and around the filter assembly to collect dust falling from the filter assembly
 - ❖ Turn off power switch of fan housing
 - ❖ Unplug fan power cord
 2. In compliance with appropriate safety requirements and standing on a safe ladder/stool take the following steps:
 - ❖ Detach safety strap from wall
 - ❖ Remove four rubber straps from clits on lower housing
 - ❖ Holding the two handles on the upper housing, remove the housing and set aside (leave the exhaust tubing connected)
 - ❖ Remove pre-filter assembly and set aside
 - ❖ With both hands, lift the H.E.P.A. filter out of the lower housing, put in a plastic bag and set aside. Write the information mentioned above on the removed H.E.P.A. filter with a permanent marker
 - ❖ Write the information mentioned above on the new H.E.P.A. filter
 - ❖ Install the new H.E.P.A. filter in the lower housing with the arrows pointing in the air flow direction
 3. In the compliance with appropriate safety requirements and working on an appropriate working surface, take the following steps:
 - ❖ Place the pre-filter assembly with the round surface down
 - ❖ With a wrench, release the four nuts fastening the pre-filter bracket (leave the flow straighter assembly intact)
 - ❖ Remove the pre-filter bracket and remove the pre-filter
 - ❖ Label the removed pre-filter as above and place in the bag with the H.E.P.A. filter

- ❖ Label the new pre-filter as above
- ❖ Place the new pre-filter in position on the flow straightened with the arrow pointing to the flow straightened (with the metal support mesh against the flow straightened)
- ❖ Reinstall the pre-filter bracket; secure in place with washers and nuts; fasten with a wrench
- ❖ Place the pre-filter assembly on the lower housing with the sound surface facing the H.E.P.A. filter
- ❖ Replace the cover over the pre-filter assembly; fasten to the lower housing with the rubber clits
- ❖ Reposition the filter assembly on the shelf so that the safety strap could be reinstalled; orient such that the switch and speed control are easily accessible for the operator
- ❖ Reconnect power cord
- ❖ Do flow test as necessary
- 4. Disposition of removed filters:
 - ❖ Seal bag and place in box
 - ❖ Dispose of in accordance with radioactive material disposal procedures
- 5. Radiation survey
 - ❖ Check PPE and plastic sheet for contamination. Place in plastic bag and label.
 - ❖ Check tools for contamination. Decontaminate, if they show detectable contamination.
 - ❖ Check body parts for contamination. Decontaminate, if the contamination is detected.
 - ❖ Perform survey and record in the log book.
- Emergency:
 - ❖ Contact lab manager (x71409) and FIU RSO (x70489) in case of emergency

References:

- University Radiation Protection Manual.
- CE Radiation Safety Compliance Plan, Rev. 1.
- FIU Lab Safety Manual.

APPENDIX 10. POINTS FOR NON-COMPLIANCES AND RECURRENCE OF NON-COMPLIANCES (VIOLATIONS)

POINTS FOR NONCOMPLIANCE RECURRENCE	On Due Date	30 Days After Due Date	90 Days After Due Date	1 Time Violation	2 Times Violation	3 Times Violation	Total Points for the Violation Category
B. CAUSE OF NON-COMPLIANCE*							
1. Radiation training not attended				5	8	10	
2. Refresher training not attended		1	2				
3. Failure to wear appropriate protective dress (lab coat, shoes covering feet, etc.)				1	3	5	
4. Not wearing TLD while working with radioactive materials				1	3	5	
5. TLD/(exposure acknowledgment receipt) not returned	1	2	4				
6. Survey meter not calibrated/repared	1		2				
7. Signage/posting missing/inadequate/misused				1	2	3	
8. Unauthorized persons working with radioactive materials (RAM)				5	8	10	
9. Radiation survey not performed/incomplete				2	4	6	
10. Incomplete inventory of RAM				2	4	6	
11. Incomplete inventory of generally licensed materials				2	4	6	
12. Evidence of eating/drinking, including candy wrapper in garbage container				3	6	10	
13. RAM procurement procedure not followed				1	5	8	
14. Radioactive waste not stored/labeled properly				2	3	4	

APPENDIX 10

15. Incident (e.g., > 10 µCi contamination on surface other than work areas like table top, hood. Example – contamination on floor) not reported RSO					3	6	10
16. Rad lab relocation to unauthorized area					Automatic suspension		
17. Rad lab relocation to authorized area without RSO consent					5	Automatic suspension	
18. Rad lab relocation to authorized area without decontaminating previous lab					5	Automatic suspension	
19. Lab security inadequate/lab left unlocked and unattended					5	8	
20. Warning letter not posted (for a minimum of 5 working days, or until action correcting the violation has been completed, whichever is later).				1			
Gross Total Points							

* List not exhaustive. Other instances of non-compliance can exist.