

	UNIVERSITY SAFETY ENVIRONMENTAL MANAGEMENT SYSTEM University Heights Newark, New Jersey 07102	
	<b>Document Title:</b> <b>Radiation Safety Guide</b> N.J.A.C. 7:28	

## 1.0 Scope and Purpose

This policy is designed to ensure that all New Jersey Institute of Technology activities and operations involving the use of radioactive materials/x-rays are performed in such a way as to protect users, staff, patients, and the general public from exposure.

This policy applies to all NJIT employees, student, and visitors who receive, possess, use, transfer, own, or acquire any source of ionizing radiation or radioactive material.

Radioactive materials (RAM) include any material that spontaneously emits ionizing radiation.

Ionizing radiation is electromagnetic radiation (x-ray and gamma-ray photons) or particulate radiation (beta particles, electrons, positrons, neutrons, and alpha particles) capable of producing ions by direct or secondary processes.

The operating philosophy of the university is to maintain all occupational radiation exposures As Low As Reasonably Achievable (ALARA).

ALARA is achieved through good radiation protection planning and practice, backed by management and user commitment.

## 2.0 Responsibilities

### Radiation Safety Officer (RSO)

- The RSO is an individual responsible for the daily implementation of the radiation safety program in accordance with license provisions, and regulatory requirements.
- The RSO supervises all radiation control activities.
- The RSO advises RAM users on radiation safety and regulatory compliance issues.
- The RSO is responsible for ensuring the safe use of radiation and radioactive materials.

- The RSO establishes policies and enforces compliance with the program.
- The RSO has the authority and responsibility for approval of all proposals for radionuclide use and x-ray users.

#### Principal Investigator (PI) – Authorized User (AU)

- Each Principal Investigator (PI) must be added to NJIT’s limited scope license as an Authorized User (AU).
- Each PI is responsible for the health and safety of persons using RAM under his/her authorization, ensuring that workers are properly trained, and that work is done in accordance with relevant policies and procedures.

#### Radiation Workers

- All radiation workers and PI’s need to attend radiation safety training annually.
- All users of radioactive material are responsible for planning and conducting operations in accordance with the lab’s authorization to use and all associated requirements.
- Radiation workers conduct personal surveys and monitor workspaces before leaving the laboratory and take any necessary remedial or control measures.

### **3.0 Authorization to Use RAM**

An AU is an individual named on NJIT’s limited scope license, typically a PI, with their individual conditions of use approved by the RSO. AU’s are approved to use radioactive materials in laboratory research or classroom instruction. A signed and approved Application for Authorization to Possess and Use Radioactive Material (Attachment 1) will serve as the PI’s Authorization to Use RAM. The PI is responsible for all radiation control activities under his/her Authorization to Use.

All use of radioactive material must be done under the supervision of a PI who has been approved by the RSO and whose name has been added to the NJIT limited scope license.

Authorization to use radioactive materials is typically granted only to faculty members who are PI’s.

To request an Authorization to Use to use Radioactive Materials, submit the Application for Authorization to Possess and Use Radioactive Materials (Attachment 1) and a Protocol Summary Form (Attachment 2) for each radionuclide and protocol and forward it to the RSO.

The Authorization to Use evaluation takes into consideration the adequacy of facilities and equipment, training and experience of the PI and radiation workers, and the operating or

handling procedures described on the above-described forms.

A Radiation Worker is an individual who works with ionizing radiation and receives radiation safety training. He/she is responsible for following all applicable regulations pertaining to the use of x-rays and/or radioactive materials as presented in the Radiation Safety Guide, in the university's license, and in notices issued by the RSO.

### Student Worker Under Age 18

No one under the age of 18 may work in areas where RAM is used or stored or where radiation is produced without prior registration and training. Minors may not handle or use RAM in any manner during the course of their laboratory activities.

### Pregnant Workers

The NJDEP's dose limit to the fetus of declared pregnant women is 500 mrem (10% of the occupational dose limits for radiation workers).

If you are pregnant or believe you may be pregnant, contact the RSO. All inquiries will be kept in confidence. We will take the following steps:

- Provide an opportunity to declare your pregnancy in writing.
- Evaluate your dose history, exposure potential, and provide suggestions to reducing exposure.
- Provide you with information concerning risk.
- Monitor your radiation dose with respect to the NJDEP's limits with a monthly fetal dosimeter.

### Authorization to Use - Amendments

Changes to existing Authorization to Use may be requested by filling out a Radioactive Materials Authorization to Use Amendment Request Form (Attachment 3). A Protocol Summary Form (Attachment 2) is also required if the change is due to addition of a radionuclide or an increase in activity being used.

### Authorization to Use - Inactivation

PI's not planning to work with RAM for extended periods of time should inactivate their Authorization to Use. This will eliminate the need to keep radiation safety records. Reactivating can be accomplished by e-mailing a request to the RSO.

PI's who remain active must continue to maintain radiation safety requirements including:

- Monthly documentation of "no use" in monitoring records;
- Bi-annual inventory of RAM on hand;
- Security of any stored material;
- Completion of EH&S and licensee ALARA training; and

- Completion of Annual Authorization to Use Review.

### License Termination or Lab Relocation

PI's planning to permanently discontinue RAM work or use of a licensed room must notify the RSO in advance by e-mail to arrange a final survey of the area being vacated.

Prior to termination or relocation, the PI must:

- Remove all RAM (including waste) from the lab and update inventory records. Each stock vial must have a final disposal date.
- Perform and document final monitoring. Decontaminate laboratory work surfaces and equipment if necessary.
- Remove all radiation labels from within the lab. EH&S will remove the door sign after the final survey has been completed.
- Transfer your lab records to the RSO if the PI is leaving NJIT.
- If an area is being vacated because the lab is relocating within NJIT, refer to the Checklist for Laboratory Relocation for details (Attachment 4).

### Transfers Outside NJIT

Any transfer or shipment of RAM to another institution must be approved by the RSO before making the transfer. Additional approvals may also be required by the NJIT Office of Research. Contact EHS in advance for assistance with special packaging, shipment papers, and monitoring requirements.

## **4.0 Posting and Labeling**

### Posting Requirements

- Each room that is approved for the use or storage of RAM must be posted with:

***“CAUTION RADIOACTIVE MATERIALS”***

- Room signs will be posted by EHS.
- Areas or rooms where RAM is used or stored or a central bulletin board within the lab building shall be posted with the NJDEP's **“Notice to Employees.”**

### Labeling Requirements

- RAM Work Stations
- When possible, RAM use should be restricted to specific, labeled RAM work stations within the lab that are labeled with:

***“CAUTION RADIOACTIVE MATERIALS”***

- Surfaces and pieces of equipment located within a labeled work area should be considered contaminated until an appropriate survey of the area determines otherwise.
- Individuals working at a labeled work station must wear protective clothing (lab coat, safety glasses, and gloves).

### Containers

- Individual containers of RAM must be labeled with:

***“CAUTION RADIOACTIVE MATERIALS”***

### Equipment

- The following equipment must be labeled with:

***“CAUTION RADIOACTIVE MATERIALS”***

- Fume hoods where RAM work is performed
- Refrigerators, cabinets, and areas used to store RAM
- Centrifuges, pipettes, water baths, etc., that are used for RAM work must be labeled if potentially contaminated.

### Waste

- All radioactive waste containers must be labeled with:

***“CAUTION RADIOACTIVE MATERIALS”***

- Radioactive waste labels must also indicate the radionuclide contained. EHS will provide labeled waste containers. Make sure that radioactive labels are affixed to any container used for radioactive specimens, waste, sharps containers, etc.

## **5.0 Training**

All individuals who wish to work with ionizing radiation, including radionuclides or x-rays, shall receive appropriate instruction in radiation safety. Training requirements are determined by the RSO.

### New Employee Training

- Before beginning work in the lab, individuals who use radioactive material must attend radiation safety training, described below, and receive protocol specific training from their PI.
- Refresher training is required for all persons who work with RAM on an annual basis.

### Radiation Safety Training

- Documentation of an ALARA training session is required annually. The topics covered, the date of training, and the names of attendees must be recorded and available in the lab's records. Forms for documenting ALARA training can be obtained from EHS.
- The topics for this training must include, but are not limited to, the following:
  - Work habits: how to plan procedures
  - External exposure (time, distance, and shielding) and contamination control: how to shield and handle RAM to minimize personnel exposure and radioactive contamination.
  - Monitoring: how to properly monitor for contamination and document results.
  - RAM accountability and control: how to properly order, use, account for and dispose of RAM.

### In-Lab Training

- New PI's, AU's, and radiation workers will be required to have in-lab training as directed by the RSO. EHS in conjunction with the AU will conduct function specific training in the lab.

## **6.0 Surveys and Audits**

Radiation workers conduct personal surveys and monitor workspaces before leaving the laboratory, each time RAM is used, and take any necessary remedial or control measures. EHS also conducts periodic radiation surveys of the areas where radioactive materials are used or stored. The inspections are conducted in accordance with the requirements of the regulations or license condition.

### Radiation Safety Inspections

- EHS will perform unannounced inspections bi-annually. Radiation workers are required to maintain radiation safety records and to conform to requirements for the safe use of RAM as outlined in this guide and listed on the NJIT limited scope license.
- Although one person is typically responsible for maintaining records, all radiation workers should be aware of the location of records and should be able to answer questions when asked by inspectors.
- As a result of these inspections, each deficiency identified must be responded to immediately. Repeat infractions are not tolerated. PI's are required to respond in writing detailing the following:
  - Mitigating circumstances
  - Corrective actions taken
  - The date of compliance
  - Some of the items included in the semi-annual EHS inspections include:
    - Security

- Postings/labels
- Surveys (monthly and daily)
- Waste labeling and segregation
- Evidence of eating/drinking in lab
- Appropriate use of personal protective equipment

## 7.0 General Radiation Safety Practices

- A current copy of this NJIT Radiation Safety Guide will be available to all radiation workers. You can also download a copy from our web site.
- Wear laboratory coats and appropriate clothing (no shorts or sandals) when handling RAM or working in a RAM laboratory.
- Use safety glasses when handling RAM.
- Wear disposable gloves when handling RAM. Double gloves add an extra layer of protection.
- Do not eat, drink, smoke, store food, or mouth-pipette in areas where RAM is used or stored.
- Wash hands thoroughly and survey yourself and your work area after working with RAM.
- Use the appropriate shielding if needed.
- Use, store, and transport RAM in appropriate containers to contain a spill and prevent external exposure.
- Use smooth work surfaces and cover benches with protective covering or use a spill tray. Segregate your RAM work areas by designating a particular bench for RAM work.
- Perform the necessary contamination monitoring such as daily surveys and monthly wipe tests.
- In the event the lab anticipates using volatile sources such as unlabeled I-125, contact the RSO well in advance of the work.
- Follow the best practices below to prevent personnel exposure

### Minimize Time

- Radiation exposure is directly proportional to time. Minimizing the time of exposure to radiation will keep the total radiation exposure low. Some of the methods of minimizing exposure time include pre-planning experiments, and performing dry runs (without the radionuclide).

### Maximize Distance

- Radiation exposure levels decrease rapidly with increasing distance. This relationship is known as the inverse square law and it states that the intensity of the radiation exposure decreases in proportion to the inverse of the distance squared.
- For example, an exposure rate of 1000 mR/hr at 1 foot from a radiation source would be 10 mR/hr at 10 feet. Therefore, any increase in distance from a source (using tongs or forceps to handle specific types of radioactive material) will reduce radiation exposure to an individual.

## Use Shielding

- Because most work with radioactive material involves relatively small activities, shielding is not necessary in many cases. If shielding is necessary, it will be stated in your lab's Authorization to Use. If you have questions about shielding, call or e-mail the RSO.
- The type and thickness of material needed for shielding depends on the radioisotope and the activity of the radioisotope being used.
- For energetic beta emitting radioisotopes, shielding made from materials with low atomic numbers, such as Plexiglas, are used. For example, a minimum of 3/8" Plexiglas is recommended when working with P-32.

## Laboratory Monitoring

- When to Monitor:
  - Labs should be monitored by the radiation worker for contamination after each use of RAM using the appropriate survey meter (such as a Ludlum 3 with a 44-9 probe).
  - These surveys should be documented daily when using RAM. Use the Post-Experiment Survey Form (Attachment 5) to document contamination surveys. Completed Post-Experiment Survey Forms should be maintained in the lab in a binder or file and be available for review at the time of inspection.
  - A monthly wipe test must be performed in any calendar month that RAM is used.
  - If no RAM is used in a given month, an entry of "No RAM Use" must be recorded. If no RAM is to be used for extended periods of time, Authorization to Use inactivation is recommended.
- What to Monitor:
  - Include areas that may have potential radioactive contamination such as bench tops, the floor, telephones, doorknobs, faucet handles, freezer/refrigerator handles, etc.
  - Monitor all facilities and equipment (liquid scintillation counters, centrifuges, pipettes, refrigerators, fume hoods, sinks, etc.) used with RAM prior. Before performing any maintenance or repair work on equipment used for RAM, contact the RSO for further instruction.
- How to Monitor:
  - Survey meters are used in areas where radioactive materials are used. Wipe tests must be used to check for contamination in labs using RAM that cannot be easily detected with a survey meter (e.g., H-3).
- Use of Survey Meters:
  - Prior to use, assure that the instrument is functioning by performing a battery test, checking the background reading, and assuring that it responds to radiation. Put the meter on the lowest setting (usually x0.1 or x1).
  - Verify that the meter and probe are appropriate for the radionuclide being monitored. Use a low-energy gamma scintillation probe for I-125 or a pancake probe for beta emitters like P-32, S-35, and C-14.
  - To perform a survey, move the meter/probe slowly over the surface you are monitoring.



Keep the face of the probe parallel to the surface, and as close as possible without contaminating the meter.

- If contamination is detected (that is, a meter reading above background), decontaminate the area. Note the reading on the scale and the meter setting (i.e. x1 or x0.1). If you cannot get the results to background levels, contact the RSO for assistance.
  
- Performing a Wipe Test:
  - Wear the appropriate RAM work attire such as gloves, safety glasses, and lab coat.
  - A piece of filter paper or a cotton swap may be used as a wipe. Drag the wipe over the surface to be tested and cover approximately 100 cm<sup>2</sup> (that's the size of a dollar bill). To maximize the wipe area, draw a big "X" or an "S" over the bench top or area that you are wiping.
  - Put the wipe in a scintillation vial, add scintillation fluid and count the wipes in a liquid scintillation counter. Include one "blank" sample
  - Include one "blank" sample and count the appropriate standard (use the H-3 standard if the lab used H-3 during that month or use C-14 for radionuclides such as P-32 or Cd-109). If using other radionuclides, consult with the RSO. A standard may need to be made by the lab when using other radioisotopes.
  - Records must include:
    - A map of the lab
    - The date of the survey
    - The initials/name of the person performing the survey
    - The survey instrument used (note serial number)
    - The background reading in dpm, and
    - The survey results for each area in dpm.
    - Determination of Efficiency (E):
      - Use a standard of known activity. Remember that 1 uCi = 2.2 x 10<sup>6</sup> dpm.
      - Set the gain and discriminator levels (windows) according to the manufacturer's recommendation for the isotope to be counted.
      - Count a blank (background) and the standard for one minute to obtain counts per minute (cpm) for both.
      - Determine the net cpm of the standard by subtracting the background cpm from the standard cpm.
    - Calculate the efficiency (E):
      - $E = \text{net standard cpm} / \text{activity of standard in dpm}$
      - Divide cpm of wipe samples by the efficiency to convert to dpm.
  
- Wipe Test Results
  - Any wipe tests that are above 100 dpm/100 cm<sup>2</sup> must be decontaminated and re-wiped.
  - Record resurvey results in lab records, and
  - Contact the RSO for any contamination that cannot be cleaned.

## 8.0 Ordering and Receiving RAM

### Obtaining Approval

- All radioactive material received in the lab must be approved by EHS before the order is placed, including gifts, transfers from another PI, and transfers from another institution and may not exceed the maximum allowable limits printed on the NJIT Limited Scope License.
- To obtain approval, the PI-AU should complete the Isotope Order Approval Form (Attachment # 6) and forward to the RSO and/or Director of EHS for signature.
- Completed/approved forms will be forwarded to the NJIT Purchasing Department in advance of a PI-AU entering a Purchase Order Requisition.
- A radiation safety approval number will be issued and written on the above-described form when the order is approved.
- Each stock vial, sealed source, standard, etc. must have its own unique approval number. For example, if you are ordering 2 vials each containing 0.250 mCi of P-32, you should make two entries and receive two approval numbers.

### Placing the order

- All NJIT purchase orders must be completed using the university's on-line purchasing system.
- The Purchasing Department will receive approval from the Director of Environmental Health and Safety and/or RSO in advance of all RAM purchases. The approval process is described above.
- The PI-AU, or their designee, may enter the Purchase Order requisition into the NJIT on-line purchasing system.
- Each Purchase Order requisition of RAM must list the name of the PI, lab location, and specific form of the isotope being ordered. This information must agree with what is printed on the NJIT Limited Scope License.
- Each Purchase Order requisition of RAM will then be individually approved by the Director of EHS and/or the RSO before the Purchase Order requisition is processed to become a Purchase Order.
- Radioactive material vendors have been instructed not to accept orders for RAM placed any other way.
- Prior to shipping RAM, radioactive material vendors may request a copy of the NJIT Limited Scope License.

### To transfer RAM between licensees at NJIT

- The lab and PI receiving the material must obtain RSO approval and be listed on the NJIT Limited Scope License.
- Enter the name of the PI supplying the material in the "vendor" field in RAM Order Approval Form posted in the Radiation Safety section of the EHS website and included as Attachment # 6 to this Guide.
- The lab sending the material should record the transfer date on their inventory log.

## Receiving RAM

- Common radioactive material package signage includes:



- Packages containing quantities considered exempt by the Department of Transportation may not be shipped labeled packages.

## Procedures for Receiving Packages (inner vial)

- Vendors may deliver packages containing RAM to the NJIT Central Receiving Area (aka the Mail Room), directly to the laboratory, or to the EHS office depending on the specific delivery instructions entered by the PI-AU when submitting the Purchase Order Requisition.
- In all cases, packages of RAM will be placed in a pre-determined area, supplied with a leak-proof plastic bin. When a new RAM package arrives to any location, the RSO will be notified immediately.
- If necessary, the RSO and/or EHS personnel will assist with the transport of RAM packages to their final destinations.
- Receiving personnel in all locations should inspect the package for obvious damage or leakage. If found, they should not accept the package and/or notify the RSO.
- Once received in the lab, package monitoring should be performed immediately.
- If properly trained radiation workers are not in the lab, they should notify the appropriate personnel that the package has arrived and place it in a secure location until it can be monitored and opened.
- Radiation workers should wear lab coats, gloves, and safety glasses while handling and opening the package.
- Place the package on a bench cover or spill tray.
- All packages containing radioactive materials (labeled Radioactive I, Radioactive II, Radioactive III, UN 2910 and UN 2911) received by NJIT should be monitored at contact and at three feet by approved Radiation Workers in the lab.
- Read the shipping papers to ensure package contents match the order.
- Conduct a wipe test of all 6 sides of the package. If results are above 100 dpm, contact the RSO for guidance.
- Complete the radioactive material package survey record (Attachment #7), keep a copy, and forward the original to EHS.
- Following monitoring of the package, please consult with EHS prior to disposing of the outer packaging materials.
- Document the receipt in your lab inventory records.

## Procedures for Opening RAM Packages

- Remove the radioactive material stock vial immediately and store it in your lock box.
- Survey the outer and inner surfaces of the shipping container.
- If there are no readings above background, deface any radioactive words or symbols and contact the RSO and/or EHS for guidance regarding the disposal of non-contaminated outer packaging material.

## **9.0 RAM Inventory**

Each laboratory must maintain an accurate inventory and tracking system. The PI, AU, and/or radiation workers should continually track incoming shipments of material and account for its use, transfer, and disposal. In addition, they should ensure that material is secured and accessible only to approved persons.

### Receipt/Inventory Logs

- Inventory records must include the following:
  - Radionuclide
  - Date of receipt
  - Initial activity
  - Amount of each withdrawal from the stock vial
  - Date of final stock vial disposal

### Bi-Annual Inventory

- Twice per year an inventory of RAM on hand in the lab is required by completing the Bi-Annual Inventory of RAM (Attachment 8). The activity on hand for each radionuclide should not exceed the PI's possession limit for that radionuclide.
- Sealed sources should be inventoried and included on the summary.
- To complete your bi-annual inventory:
  - Dispose of any material no longer useful to your research and record the disposal date on the receipt log.
  - Perform a physical check of all remaining stock vials/sources in the lab. All records must match to the uCi.
  - Sum the activity on hand for each radionuclide.

## **10.0 Laboratory Security**

- Radioactive material must be secured so that unauthorized persons do not have access to licensed material.
- Stock vials and sealed sources must be secured (locked) at all times.
- Stock vials and sealed sources of RAM must be stored in a lockbox or a locked refrigerator or freezer.
- Laboratory doors must remain locked when no one is present.
- Material that is not in storage and being used must be maintained under constant surveillance.

## 11.0 Radioactive Waste

EHS handles and processes radioactive waste in a cost effective and environmentally safe manner in accordance with all applicable regulations.

### Waste Collection

- EHS collects radioactive waste from all laboratories on campus.
- In order to be collected, radioactive waste must be packaged and labeled as described in this Guide.
- This is necessary in order for the university and your laboratory to be in compliance with various federal, state, and local regulations.
- To arrange for a radioactive waste pick up the PI-AU, or their designee, completes the Radioactive Waste Removal Request Form (Attachment # 9) and sends to EHS via e-mail at: [healthandsafety@njit.edu](mailto:healthandsafety@njit.edu)

### Requirements for All Waste Types

- When practical, minimize the amount of radioactive waste generated by surveying items before putting them into the waste. If a survey in a low-background area shows no reading distinguishable from background, dispose of the material as non-radioactive waste. If readings exceed background, dispose of the material as radioactive waste.
- Segregate all waste by the radionuclide scheme below:
  - Carbon-14 and Hydrogen-3 (Tritium)
  - Cadmium-109, Nickel-63, Zinc-65, and Lead-210
  - Radium, Thorium, and Uranium
- Note: Radionuclides may be added to the university's license. If your isotope is not specifically mentioned above, ask the RSO for guidance. However, only isotopes specifically listed on the NJIT Limited Scope license may be shipped to NJIT, used in approved laboratories, and disposed via the NJIT EHS Department.
- Label the outside of all RAM waste containers with labels indicating "Caution Radioactive Waste - Do Not Empty" and with the radionuclide (See Figure 1)
- EHS will provide waste buckets, labels, and heavy plastic bags to line the containers. See Attachment 10 for the Radioactive Waste Container Request Form. If the containers EHS supplies do not meet your needs, you may purchase any appropriate container (plastic or metal) and plastic liners, and EHS will supply labels to affix to the containers.
- For information on how to obtain supplies, contact EHS.
- Shield the RAM waste containers, if necessary.
- Do not allow waste to accumulate in the lab or overflow its container.
- Do not allow empty waste containers to accumulate in the lab.
- Contact EHS for removal of extra containers (See Attachment 10)
- Survey waste containers that are no longer needed and, if found to not be contaminated, provide survey documentation to EHS.
- With EHS approval, obliterate all markings and dispose in the ordinary trash.

## Solid Waste

- Solid waste is any material that has been contaminated with radioactive material, usually gloves, paper towels, plastic ware, glassware, etc. In addition to the requirements for all waste types above, requirements for solid waste are as follows:
- Place solid waste, other than sharps, in heavy plastic bags or in wide mouth plastic screw top containers – both supplied by EHS. Securely close the bags or containers and attach a completed radioactive waste label to each bag or container.
- For sharps containers, attach the radioactive waste label directly to the sharps container.
- Do not put any red/orange bags or red/orange sharps containers in the solid waste. Red or orange usually denotes bio-hazardous waste, which is not permitted in the radioactive waste stream.
- Do not put scintillation vials in the solid waste.
- Do not put lead or organic solvents, or other material regulated under RCRA in the solid waste. Lead should be transferred to EHS separately. If you want to know if a specific material can be put in the solid waste, contact EHS.
- Sharps or glass plates in the waste must be placed in an appropriate rigid container of sufficient strength that the material will not puncture it.
- Do not put vials of stock material in the solid waste unless EHS personnel are in your laboratory to take the waste. Please refer to section below entitled, *Unused Material in Stock Vials*.
- Liquids should not be put in the solid waste. Residual liquids should be emptied into the appropriate liquid waste container and then the empty container may be placed into the solid waste.
- Do not put any infectious material or biohazard labels or biohazard bags in the solid waste. If radioactive material is mixed with bio-hazardous or RCRA regulated material, the lab will need prior approval by the RSO. See the section below entitled “Mixed Waste”.
- Attach a copy of the completed Radioactive Waste Removal Request to the container (See Attachment 9).

## Unused Material in Stock Vials

- Stock vials containing unused material should be kept in a lock box or otherwise secured until EHS personnel are in your laboratory to take the waste. If a request for waste pick-up includes stock vials, include a note in the “Additional Instructions” section.
- When EHS personnel arrive to collect the waste, they will contact someone in the lab. At that time, place the vial with unused material in a heavy plastic bag. The bag may already contain other dry waste so long as the Radioactive Waste Label for the bag reflects the correct total activity. Securely close the bags and attach a copy of the properly completed Radioactive Waste Removal Request Form to each bag.

## Liquid Scintillation Fluid in Vials

- All liquid scintillation vials and fluid must be transferred to EHS for proper disposal.
- Tightly cap each vial.

- Segregate used vials with contamination (e.g., with activity) by the following segregation scheme:
  - Carbon-14 and Hydrogen-3 (Tritium)
  - Cadmium-109, Nickel-63, Zinc-65, and Lead-210
  - Radium, Thorium, and Uranium
- Non-contaminated used vials (e.g., used vials without activity) should be maintained separately.
- Determine, from its label, whether the scintillation fluid contained in the vials is hazardous or non-hazardous. Frequently the term “biodegradable” “eco-friendly” or “non-flammable” are used on the label instead of “non-hazardous.” When completing the Radioactive Waste Removal Request Form, describe the scintillation fluid in the “Additional Information” section.
- Place vials into the appropriate waste container lined with a heavy plastic bag and label properly.
- Attach a copy of the completed Radioactive Waste Removal Request Form to each plastic bag of vials.
- The Radioactive Waste Removal Request Form must provide the type of scintillation fluid in the vials so that EHS can determine the applicable regulations for disposal of the vials.

### Liquid Waste

- Put bulk liquids into a new quart, gallon, or 5-gallon plastic container that is compatible with the liquid. Check with EHS to ensure the compatibility of the liquid and the container.
- Label each container of radioactive waste with the NJIT Radioactive Waste Label when waste is first added to the container.
- For information on completing the Radioactive Waste Removal Request Form, contact the EHS Department. The plastic containers should be filled no more than 90% full and capped with a tight fitting lid.
- Segregate liquid waste by the following segregation scheme:
  - Carbon-14 and Hydrogen-3 (Tritium)
  - Cadmium-109, Nickel-63, Zinc-65, and Lead-210
  - Radium, Thorium, and Uranium

### Mixed Waste

- Mixed waste is radioactive waste mixed with other hazardous components (e.g. poisonous, infectious, biohazardous, corrosive, certain scintillation cocktails, or flammable material).
- If you plan on generating any mixed waste, contact EHS prior to its generation so EHS can establish disposal procedures and a waste minimization plan.

### Sealed Sources

- Sealed sources are devices containing radioactive material which are engineered to prevent the material from ever escaping the device. The most common example found in research

laboratories are calibration standards for scintillation counters and gamma counters.

- To dispose of sealed sources, complete a Radioactive Waste Removal Request Form and e-mail to the EHS Department.
- Note the manufacturer, model, and serial number of the source.
- Place the source or sources in a plastic bag or other container, and securely attach a copy of the completed Radioactive Waste Removal Request Form to the outside of the container.
- EHS personnel will collect the sealed sources during routine waste collection.

## **12.0 Generally Licensed Material and Devices**

- Generally licensed materials and devices are devices that contain a radioactive source (i.e. scintillation counter, smoke detector, gas chromatograph with an ECD, and self-luminous exit signs). These can be purchased without a specific license from the NJDEP.
- Before purchasing one of these devices, contact the RSO for guidance. EHS needs to keep track of these devices.
- Some Uranium and thorium compounds can be purchased without a specific license. This is called “generally licensed material”. The university can only accumulate a certain quantity of these materials. If you have any of these compounds (such as uranyl acetate), contact the RSO to report your inventory.
- Contact EHS before disposing or moving a counter to make arrangements for the proper removal and disposal of the internal radiation source. Do not attempt to remove the source yourself.

## **13.0 Spills and Emergencies**

- All spills and emergencies involving RAM are to be reported to the RSO and/or the Director of EHS.
- Emergency Notification:
  - In case of emergencies involving radioactive materials call, please contact the following individuals:
  - Mitchell Gayer – Director, EHS, NJIT RSO
    - 973-596-5736 (office)
    - 973-508-3279 (cell)



- Payam Ghanbari – EHS Coordinator, NJIT Associate RSO
  - 973-596-8472 (office)
  - 973-652-0745 (cell)
- Noelle Screen-Reddick – EHS Coordinator
  - 973-596-3086 (office)
  - 973-289-6363 (cell)
- Tamara McNair – EHS Coordinator
  - 973-596-6237 (office)
  - 973-289-7231 (cell)
- Call Public Safety at 3111.
- In the event of an emergency, please call 9-1-1.
- Emergencies that require immediate notification are:
  - Radioactive contamination outside a licensed area
  - Deliberate misuse of radioactive materials. All inquiries will be kept in confidence. (Deliberate misuse of RAM will result in loss of use privileges and could result in criminal action.)
  - Known or suspected personnel contamination, inhalation, injection, or ingestion of RAM.
  - Any accident resulting in direct exposure to personnel.
  - Known or suspected loss of radioactive material, including loss to the air or sewer.
  - Contaminated or damaged radioactive material packaging.

### Spill Procedures

- Spills or contamination involving uCi amounts of activity and small volumes of liquid may be cleaned up by lab personnel.
- However, any time you are not sure how to proceed please contact EHS for assistance.
- EHS should be notified of all spills involving RAM or associated waste.
- Notify other persons in the area.
- Prohibit access to the area.
- Prevent the spread of contamination by covering the spill with absorbent material and limiting access.
- Clean up the spill using disposable gloves, lab coats, shoe covers and tongs (if appropriate).
- Proceed from the outermost edges of the contaminated area inwards, reducing systematically the area that is contaminated. Take care not to spread the contamination. Put all contaminated objects into RAM waste.
- Normal cleaning agents should be adequate. Keep cleaning supplies to the minimum needed to do the job. Place them into a plastic bag and into a clearly labeled RAM waste container.
- Survey: Following decontamination, monitor all personnel and the area for removable contamination with a wipe test. If the floor was contaminated, be sure to monitor the bottom of shoes. Continue decontamination until wipe test results are at background levels. Document results in lab records.

## Figures

1. NJIT Radioactive Waste Labels

## Attachments

1. Application for Authorization to Possess and Use Radioactive Materials
2. Application for Authorization to Possess and Use Radioactive Materials-  
Protocol Summary Form
3. Application for Authorization to Possess and Use Radioactive Materials-  
Amendment Request Form
4. Checklist for Laboratory Relocation
5. Bi-Annual Inventory of Radioactive Material (RAM)
6. Radioactive Package Receipt Record
7. Radioactive Waste Removal Request Form
8. Radiation Emergency Procedures
9. Radioactive Materials Post-Experiment Survey Form

**Figure 1 (NJIT Radioactive Waste Labels)**



**Radioactive Waste**

Building: \_\_\_\_\_ Room: \_\_\_\_\_

PI - AU: \_\_\_\_\_ Phone/Email: \_\_\_\_\_

Hands-On lab contact info (Name/Phone/Email): \_\_\_\_\_

Type of Radioactive Waste									
<input type="checkbox"/>	Liquid	<input type="checkbox"/>	Solid	<input checked="" type="checkbox"/>	Scintillation Vials	<input type="checkbox"/>	Mixed Waste	<input type="checkbox"/>	Sealed Source

#	Isotope	Activity	Chemical Constituents
1			
2			
3			
4			

Additional Instructions: \_\_\_\_\_

**Caution**  
**Radioactive Waste**  
**Do Not Empty**



## Application for the Authorization to Possess, Use, and Store Radioactive Materials

### Section 1: Applicant Information

Name: \_\_\_\_\_ Title: \_\_\_\_\_

Department: \_\_\_\_\_ Phone/E-Mail: \_\_\_\_\_

### Section 2: Location Information

Building/Room (where material will be used): \_\_\_\_\_

- Storage Location (If different than above): \_\_\_\_\_
- Waste Storage Location (If different than above): \_\_\_\_\_

### Section 3: Isotope Information (please list isotope information for each radioisotope being requested)

Radioisotope	Half-Life	Total Quantity (mCi)	Max. Amount per Experiment (mCi)	Chemical Form

### Section 4: Hazard Control and Personal Protective Equipment

- Is the material to be obtained or used in an especially hazardous form (e.g., highly toxic or volatile)?
- Radiation Protection (Please check special equipment to be used to control radiation exposure)

Item	Y/N	Item	Y/N	Item	Y/N	Item	Y/N
Glove Box		Mechanical Pipettes		Fume Hood		Ion Chamber	
Body Dosimetry		Wrist Dosimetry		Handling Tongs		Absorbent Liner	
Finger Dosimetry		GM Survey Meter		Scintillation Well Counter		Spill Tray	
Shielded Storage		GM Survey Meter Pancake Probe		Liquid Scintillation Counter		Transport Container	
Shoe Covers		GM Survey Meter NaI Probe		Radiation Signs and Labels		Other:	
Gloves		Lab Coat		Safety Glasses		Respirator	

- Radiation Protection (Please describe the use of the equipment designated above, if non-routine)

**Section 5: Waste Disposal** (Please check the appropriate items below. Describe all waste streams generated by these experimental protocols)

\_\_\_\_\_ Solid Waste \_\_\_\_\_

\_\_\_\_\_ Aqueous Waste \_\_\_\_\_

\_\_\_\_\_ Mixed Waste \_\_\_\_\_

\_\_\_\_\_ Animal \_\_\_\_\_

\_\_\_\_\_ Other \_\_\_\_\_

- Please refer to the Radiation Safety Guide for instructions concerning radioactive waste disposal

**Section 6: Security** (Please describe methods and procedures to be taken to ensure that radioactive material is secure against unauthorized access)

### Section 7: Experimental Protocol

- Please attach your experimental protocol.
- Describe experimental techniques especially those phases of the experiment involving radioactive material – this should be provided for each isotope requested.
- Describe measures taken to control both environmental contamination (lab equipment, work surfaces, etc.) and personal contamination (lab workers).
- Describe the use of any shielding, if required.
- Describe the material and waste storage area.
- Describe radiation monitoring equipment; describe method and frequency of contamination surveys.
- If animals are to be used, a thorough description of the animal protocol involving radiation is required.
- Describe adequacy of the physical features of the lab and equipment to support the proposed study in terms of radiation safety.
- Provide qualifications and training of individuals responsible for the study.
- Estimated time needed for completion of the study involving radioactive material.
- Provide a sketch of your lab indicating where RAM will be stored and used as well as safety equipment such as eye wash, safety shower, fume hood, etc.
- Please contact the NJIT RSO or Director of EHS for assistance regarding the completion of this form.

### Section 8: Signatures

- I affirm that the material supplied in this application are correct to the best of my knowledge and that I shall conduct and/or supervise the described work with full regard for the safety of those involved in the work and the general public.
- I have received a copy of the NJIT Radiation Safety Guide and I understand that I will comply with the requirements and procedures described therein.
- Upon terminating my authorization and prior to departing the university, I agree to contact the RSO and/or Director of EHS to arrange for the close out of my laboratory and the appropriate disposal of radioactive material and associated waste.

Applicant Name (please print): \_\_\_\_\_

Signature: \_\_\_\_\_ Date: \_\_\_\_\_

Radiation Safety Officer (please print): \_\_\_\_\_

Signature: \_\_\_\_\_ Date: \_\_\_\_\_

Director EHS: (please print): \_\_\_\_\_

Signature: \_\_\_\_\_ Date: \_\_\_\_\_

**Attachment # 2**

<p><b>RADIATION AUTHORIZATION TO USE APPLICATION PROTOCOL SUMMARY FORM</b></p>
--

Please submit one form for each proposed use.

<b>Date of Application</b>	
<b>PI-Authorized User:</b>	
<b>Email Address:</b>	
<b>Work Telephone No.</b>	
<b>NIIT Mailing Address</b>	
<b>Radionuclide:</b>	
<b>Chemical &amp; Physical Form:</b>	
<b>Substance is Volatile:</b>	<b>Yes</b> _____ <b>No</b> _____
<b>Procedure will be performed at standard temperature and pressure:</b>	<b>Yes</b> _____ <b>No</b> _____
<b>Building:</b>	<b>Room:</b>

**Protocol:**

Provide a brief description of the procedure as an attachment to this application. Also include information on chemical and physical form generated, any special equipment used to handle, shield or contain the radioactivity, and unusual hazards associated with the procedure.

<b>Total Activity Per Experiment:</b>
<b>Frequency of Experiment:</b>
<b>Mixed hazardous waste or unusual waste stream will be generated:</b> (i.e., any chemical, biological, or genetically hazardous material mixed with radioactive waste)

Attachment # 3

**RADIOACTIVE MATERIALS AUTHORIZATION TO USE  
AMENDMENT REQUEST FORM**

<b>Date of Request:</b>	
<b>Licensee:</b>	
<b>Email Address:</b>	
<b>Work Telephone No.</b>	
<b>NJIT Mailing Address:</b>	
<b>Chemical &amp; Physical Form:</b>	
Are you adding a radionuclide or changing activity limits?	[Yes <input type="checkbox"/> ] [No <input type="checkbox"/> ]
Are you adding or deleting a room?	[Yes <input type="checkbox"/> ] [No <input type="checkbox"/> ]
<b>Room Additions :</b> 1. Building _____ Room _____ 2. Building _____ Room _____ 3. Building _____ Room _____	<b>* Room Deletions :</b> 1. Building _____ Room _____ 2. Building _____ Room _____ 3. Building _____ Room _____

Radionuclide	Current Possession Limit (mCi)	Current Annual Limit (mCi)	Requested Possession Limit (mCi)	Requested Annual limit (mCi)

INACTIVATING LICENSE: Check to inactivate       TERMINATING LICENSE: Check to terminate

--	--



Attachment # 4

**Checklist for Laboratory Relocation**

	Completed
<b>I. Submit License Amendment to EHS</b> 1. Indicate building and room numbers added. 2. Indicate building and room numbers deleted.	_____ _____
<b>III. Remove Radioactive Material (RAM) From Vacated Labs</b> 1. Conduct an inventory of RAM on hand. 2. Consolidate RAM that is to be moved to the new location. 3. Dispose as waste all RAM that will not be transferred. 4. Maintain records of final inventory and reconciliation.	_____ _____
<b>IV. Monitor For Contamination and Presence of RAM</b> 1. Monitor all equipment (refrigerators, centrifuges, etc.). 2. Monitor all areas you are leaving and document results. 3. Perform minor decontamination, if necessary.	_____
<b>V. Prepare / Package RAM for Transfer</b> 1. Place material into a container that will contain a spill, shielded, if necessary, and labeled with: <i>“Caution Radioactive Material”</i> 2. Transfer RAM by hand or on a cart, dolly, etc. during normal working hours, <b>do not transport RAM or labeled equipment by vehicle.</b> 3. Only a trained radiation worker may transfer RAM. The movers must not transfer RAM or labeled equipment. 4. Inventory RAM that was transferred immediately upon arrival at the new lab. 5. Liquid scintillation counters contain a radiation source and require special attention prior to moving. Contact the manufacturer or EH&S for specifics.	_____ _____ _____ _____ _____ _____ _____
<b>VI. Final Survey by EH&amp;S</b> 1. Notify EH&S of expected date that the lab will be vacated and available for final survey.	_____

**NOTE: This checklist applies only to transfers made within NJIT. Any transfers of radioactive material outside NJIT requires special packaging and approval by the Radiation Safety Officer and the Director of EHS**

**Attachment # 5**

**Post-Experiment Survey Form**

<b>Date</b>	<b>Initials</b>	<b>Personal Survey</b>	<b>Equipment Survey</b>	<b>Bench Survey</b>	<b>Floor Survey</b>	<b>Trash Survey</b>	<b>RAM Secure</b>

**Attachment # 6**

**Isotope Order Form**

<b>PI-AU NAME</b>	<b>LAB LOCATION Building/Room</b>	<b>ISOTOPE</b>	<b>FORM OF RADIONUCLIDE</b>	<b>PO/REQ #</b>

Applicant Name (please print): \_\_\_\_\_

Signature: \_\_\_\_\_ Date: \_\_\_\_\_

Radiation Safety Officer (please print): \_\_\_\_\_

Signature: \_\_\_\_\_ Date: \_\_\_\_\_

Director EHS: (please print): \_\_\_\_\_

Signature: \_\_\_\_\_ Date: \_\_\_\_\_

# Attachment # 7

## Radioactive Package Receipt Record

Date Received \_\_\_\_\_ Surveyed By \_\_\_\_\_

Transported By \_\_\_\_\_

Type of Package                      cardboard box                      metal pail

Any visible damage?            **NO**                      **YES**    crushed    wet    opened

Survey Instrument

Model \_\_\_\_\_                      Serial # \_\_\_\_\_

Reading at Contact \_\_\_\_\_

Reading at 3 ft. \_\_\_\_\_

Smear Survey    \*attach LSC printout\*

Based on the LSC's minimum efficiency for the radionuclides in use at NJIT any wipe showing greater than 100 counts per minute above background should be considered contaminated. Place contaminated package in radioactive waste storage and contact the NJIT RSO and/or Director of EHS.

Package contaminated? Yes \_\_\_\_\_ No \_\_\_\_\_

Describe Radioactive Material (activity, physical form, and quantity)

---

---

---

**Entered Into Inventory** By: \_\_\_\_\_

Date: \_\_\_\_\_

**Reviewed By:** \_\_\_\_\_

Date: \_\_\_\_\_

## Attachment # 8

### Bi-Annual Inventory of Radioactive Material (RAM)

An inventory of all radioactive materials is requested two times per year (in January and July). To complete the inventory, you will need the radioactive materials receipt/disposal log.

1. Compare vials in stock to the receipt / disposal log. Correct any discrepancies.
2. Properly dispose of vials you will not use anymore.
3. For each radionuclide, add up the number of vials and activity remaining (“on-hand”) in stock on the date the inventory is performed. If the on-hand activity is close to the license’s possession limit, please contact the RSO – a license amendment may be required.
4. Please remember that all stock vials are potentially contaminated (especially old vials, where small cracks and deterioration of the septum may not be visible). They must be handled with disposable gloves, a lab coat, and dosimeters as required in the NJIT Procedures.

Year: \_\_\_\_\_

<b>1<sup>st</sup> Bi-Annual Inventory (Jan. 1 – June 30)</b>		<b>Radionuclide</b>				
On-hand number of vials						
On-hand activity (uCi)						
Quarterly disposal sum (uCi)						
<b>Initials / Date</b>						
<b>2<sup>nd</sup> Bi-Annual Inventory (July 1 – December 31)</b>						
Radionuclide						
On-hand number of vials						
On-hand activity (uCi)						
Quarterly disposal sum (uCi)						
<b>Initials / Date</b>						

## RADIOACTIVE WASTE REMOVAL REQUEST

Building: \_\_\_\_\_ Room #: \_\_\_\_\_

PI-AU: \_\_\_\_\_ Phone/E-Mail: \_\_\_\_\_

Name/Phone/E-Mail (hand's on lab contact information): \_\_\_\_\_

(Please complete a single line of the form below for each container of radioactive waste)

Type of Radioactive Waste									
<input type="checkbox"/>	Liquid (L)	<input type="checkbox"/>	Solid (S)	<input type="checkbox"/>	Scintillation Vials (SV)	<input type="checkbox"/>	Mixed Waste (MW)	<input type="checkbox"/>	Sealed Source (SS)

#	Isotope	Activity	Container and Waste Type (L, S, SV, MW, SS)	Size and Volume	Chemical Constituents	Location in Lab
1						
2						
3						
4						

Additional Information and/or Instructions:	
<b>In the spaces below please provide additional information or specific instructions</b>	
Is scintillation fluid hazardous or non-hazardous? Non-hazardous scintillation fluid may be labeled biodegradable, eco-friendly, or non-flammable	
If you have stock material to dispose, please keep locked in secure location until EHS arrives in your lab to complete waste pick up	
Other Specific information:	

**Label All Containers of Radioactive Waste with the NJIT Radioactive Waste Label. State and Federal Regulations prohibit the EHS Department from Transporting Containers of Radioactive Waste that are not Properly Labeled.**

Submit this form and any other questions to:

**[healthandsafety@njit.edu](mailto:healthandsafety@njit.edu)**

**EHS Phone Number: (973) 596 3059**

## RADIOACTIVE WASTE CONTAINER REQUEST

Building: \_\_\_\_\_ Room #: \_\_\_\_\_

PI-AU: \_\_\_\_\_ Phone/E-Mail: \_\_\_\_\_

Name/Phone/E-Mail (hand's on lab contact information): \_\_\_\_\_

(Please complete a single line of the form below for each container of radioactive waste)

Type of Radioactive Waste									
<input type="checkbox"/>	<b>Liquid (L)</b>	<input type="checkbox"/>	<b>Solid (S)</b>	<input type="checkbox"/>	<b>Scintillation Vials (SV)</b>	<input type="checkbox"/>	<b>Mixed Waste (MW)</b>	<input type="checkbox"/>	<b>Sealed Source (SS)</b>

Containers For Liquid Radioactive Waste		
Size and Type of Container	Quantity	Purpose and Category of Waste Container <small>*please be specific*</small>
<b>Plastic Closed Top</b>		
30 Gallon Drum		
5 Gallon Screw Top Container		
1 Gallon Screw Top Container		
1 Quart Screw Top Container		
Plastic Bin–Secondary Containment		
<b>Containers For Solid Radioactive Waste</b>		
<b>Steel Open Top</b>		
55 gallon drum		
30 gallon drum		
<b>Plastic Open Top</b>		
55 Gallon Drum w/Lid		
30 Gallon Drum w/Lid		
5 Gallon Bucket/Pail w/Lid		
1 Gallon Bucket/Pail w/Lid		
Plastic Bin–Secondary Containment		
<b>Other Containers and Labels</b>		
Sharps Containers		
Radioactive Waste Labels		
Other Items Not Listed		

**Please Note: EHS Department Does Not Provide Shielding, Bench Liners, Benchtop Spill Trays, etc. These Supplies are to be Purchased by Individual Laboratories as Required**

**Submit this form and all other questions to:**

[healthandsafety@njit.edu](mailto:healthandsafety@njit.edu)

Phone Number: (973) 596 3059

## RADIATION EMERGENCY PROCEDURES

### **Major Spills, Involving Radiation Hazards to Personnel**

1. Notify all persons not involved in the spill to avoid the area of the spill. Limit the movement of persons to confine the spread of contamination until they are monitored.
2. If the spill is liquid and the hands are protected, right the container, otherwise use long tongs.
3. If the spill is on the skin, immediately wash with warm water and soap. Repeat if necessary. Monitor accordingly.
4. If the spill is on clothing, discard outer or protective clothing at once, monitor and decontaminate.
5. Turn off fans, try to avoid creation of airborne contamination.
6. Vacate the room but take care not to track or spread contamination.
7. **Contact the NJIT Department of Public Safety at ext. 3111 as soon as possible. The Department of Public Safety will contact the Director of Environmental Health and Safety and the Radiation Safety Officer.**
8. Take immediate steps to decontaminate personnel involved as necessary.
9. EHS will direct the decontamination.

### **Minor spills, Involving No radiation Hazard to Personnel**

1. Notify all persons in the room and area at once.
2. Survey people which were in the immediate area of the spill.
3. Permit only the minimum number of persons necessary to deal with the spill into the area.
4. Confine the spill immediately.
  - A. Liquid spills
    - a. Don protective gloves
    - b. Drop absorbent on spill.
  - B. Dry spills
    - a. Don protective gloves
    - b. Dampen thoroughly, taking care not to spread contamination. Water may generally be used, except where chemical reaction with the water would generate an air contaminant: oil should be used instead.
5. Decontaminate: make a plan first.
6. A complete history of the accident and subsequent remedial or protective measures should be submitted to the RSO.



## **Injuries to Personnel, Involving Radiation** **Hazard**

1. Gently wash minor wounds immediately under warm running water; try to avoid further abrading of the skin. If at all practical collect and retain cotton sponges, fluids, etc. for analysis.
2. Report all radiation accidents involving personnel wounds, overexposure, ingestion, or inhalation to the RSO and/or Director of EHS as soon as possible.
3. No person involved in a radiation injury should return to work without the approval of the attendant physician, the RSO and/or the Director of EHS.
4. Prepare a complete history of the accident and subsequent activity for the RSO and/or Director of EHS.