

Applies to: (examples; Faculty, Staff, Students, etc)

Faculty , Staff , Students

Policy Overview:

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This policy is designed to provide Authorized Users, Radiation Workers and other staff of University of Health Sciences and Pharmacy in St. Louis and the affiliated personnel of the Center for Clinical Pharmacology a convenient reference to the compliance requirements of the Radiation Safety Program related to the use of radioactive materials.

Applies to laboratory personnel engaged in research involving use of radioactive materials.

Definitions:

Term	Definition
RAM	Radioactive materials

Details:

1. Personal Protective Equipment
 - a. Laboratory coats and disposable gloves must be worn at all times while handling unsealed radioactive materials. Gloves should be removed and disposed of before leaving the laboratory. Hands must be monitored with an appropriate survey instrument either after completing procedures involving radioactive materials or before leaving the area, e.g., at lunch and at the end of the workday. Lab coats must also be monitored before being worn outside the laboratory if they have been used for protection during radioactive material procedures. Face and/or eye protection should be worn if warranted by the type of procedure being performed.
2. Training Requirements
 - a. Radiation Safety Examination (one time)
 - b. PET Examination (one time, if applicable)
 - c. Irradiator Examination (one time, if applicable)
 - d. Lab Specific Training (Upon initial hiring and annually thereafter)
 - e. Annual Refresher Training
3. Bioassays
 - a. Individuals who handle more than 1 mCi of inorganic radioiodine in single operations or procedures should cooperate with Radiation Safety personnel who perform the required thyroid checks each calendar quarter.
 - b. Personnel should provide urine samples to Radiation Safety for analysis when they handle sufficiently large activities to require bioassay (see Table 10-3, Chapter 10). Users are reminded of this rare urinalysis requirement via a notice that is attached to the package of materials that is delivered to the laboratory by Radiation Safety. Contact WU Radiation Safety for more information on bioassays.
4. Prenatal Monitoring
 - a. All radiation workers should be aware and understand the special precautions concerning exposure during pregnancy, especially that the dose equivalent to the embryo or fetus from occupational exposure of the expectant mother should not exceed 0.5 rem (500 mrem) for the entire gestation period and the reasons for it. Personnel exposed to ionizing radiation are encouraged to disclose their pregnancy, in confidence and in writing, to the Radiation Safety Office. You also may call or email Radiation Safety's main office at 314-362-3476 or <https://radsafety.wustl.edu/An1Pages/An1-RMManualIntro.htm> After the formal declaration of pregnancy, women will be provided with supplementary monthly "fetal" dosimeter for the duration of pregnancy if their anticipated annual body dose is more than 50 mrem.
 - b. Radiation Workers are also provided with prenatal counseling if they so choose.
5. Emergency Actions
 - a. Laboratory personnel should be aware of the actions to take in case of an accident involving radioactive materials. The most common radiation emergency involves handling a spill of radioactive material. Emergency instructions are posted in

all areas where unsealed radioactive materials are used or stored. These instructions (a) describe the immediate actions to be taken in order to prevent further contamination of personnel and work areas, (b) specify the names and telephone numbers of the responsible person to be notified in case of an emergency, (c) describe appropriate methods for reentering and decontaminating areas and (d) provide basic guidance for decontaminating personnel. Our 24-hour emergency cell phone number is 314-299-1322. You also may call or email our main office at 314-362-3476 or radsafety@wustl.edu.

6. Food and Drink

- a. Eating, drinking, smoking, gum chewing, the application of cosmetics, the storage of food and beverages or similar activities are not permitted in laboratories or other facilities where radioactive materials or radiation sources are used, handled or stored. Food waste, wrappers, containers, etc. must not be placed in laboratory trash cans as this is considered evidence of food or beverage consumption within the laboratory. Such activities are permitted in an area (defined as a room with floor to ceiling walls and a closed door) separated from the laboratory space – often referred to as a “break area”. This procedure is consistent with the [UHSP Eating, Drinking and Related Activities in Laboratories policy](#).

7. Periodic Radiation Surveys

- a. Periodic radiation surveys must be conducted and documented by any laboratory group whose authorization is on “active” status in all areas in which unsealed radioactive materials are approved for use or storage. The surveys are conducted once a week or once a month depending on quantities used in single operations. Each survey could include a test for removable contamination, the so-called “wipe test”, and a survey instrument reading of the exposure rate level (mR/hr), depending on the kinds of isotopes present in the lab. A record of each survey and of any corrective actions must be made and maintained. Refer to [WU RSM](#) for more detailed information.

8. Security of Radioactive Materials

- a. Adequate security of radioactive materials when the materials are not in use or not under visual surveillance is a highly important issue. Operational compliance with the regulations of the US Nuclear Regulatory Commission (NRC) requires that all rooms where RAM are used or stored must be attended or locked at all times. During use of the material (or during use of a laboratory containing radioactive materials that are not secured against access or removal) laboratory personnel must be present in order to maintain “constant surveillance” of the materials. If all personnel leave the laboratory, even for a brief time, the laboratory must be locked. As an alternative, locking the radioactive materials and wastes in non-removable storage containers may satisfy the NRC rules. If it is necessary for a laboratory to be kept unlocked when not attended, a “security exemption” may be requested. Under this exemption radioactive materials and wastes must be securely locked in a non-removable storage compartments or containers when not actively attended. If the requested exemption is approved, the laboratory will be posted with an “off-hours security not required” sticker.

9. Annual Inventory

- a. An inventory of the radionuclides in the possession of each Authorized User must be prepared and ready for collection by WU Radiation Safety each year by June 30th. Users should keep inventory records until collected by WU Radiation Safety.

10. Radioactive Waste

- a. Radioactive waste must be segregated according to waste category, appropriately stored and shielded.
- b. The disposal by drain of certain low levels of water soluble radioactivity can be permitted with prior written approval from the Radiation Safety Staff.
- c. Other Radiation safety disposal should be done by contacting [myRad](#) for pickup. Radwaste should be kept segregated according to category until Radiation Safety can dispose of it.
- d. More information on Radiation safety procedures can be found in the [UHSP Chemical Hygiene Plan](#).

Procedures:

1. Responsibilities of Authorized Users

- a. Those faculty members who are granted authorization to use radioactive material are responsible for the safe use of the material by individuals working under their control. Authorized Users must:
 - i. Use radioactive materials consistent with the representations made in the application to become an authorized user or in subsequent amendment or renewal applications;
 - ii. Comply with the institutional policies pertaining to the use of radioactive materials;
 - iii. Instruct employees under their control regarding the ALARA philosophy as well as specific instructions pertinent to the procedures to be conducted;
 - iv. Assure that employees have passed the Radiation Safety Examination before they are assigned work that requires the handling of radioactive materials;
 - v. Adequately plan experiments to assure that proper safety precautions are taken, including instructions regarding emergencies;
 - vi. Require personnel to comply with recommendations regarding personnel radiation monitors;
 - vii. Require personnel to comply with bioassay requirements;
 - viii. Maintain adequate records of:
 - i. personnel training,
 - ii. laboratory surveys,
 - iii. package surveys,
 - iv. radionuclide accountability, and
 - v. radioactive waste disposal

- ix. Prepare annual inventories of radionuclides on hand as requested by the Radiation Safety Office;
 - x. Assure that radiation survey instruments are calibrated as required;
 - xi. Notify the Radiation Safety staff of changes of location where RAM is used or stored by amending their authorization;
2. Procurement
- a. Procurement of RAM will be facilitated through Washington University.
3. Opening of RAM Packages
- a. Each package of RAM must be opened in the following manner:
 - i. Put on gloves to avoid contamination, remove the packing slip, open the package and remove and examine the final source container(s). Verify that the label on each container agrees with the description of the material specified in the packing slip and that the identity and activity of the material are consistent with what was ordered. Report any discrepancies to Radiation Safety personnel at 314-362-3476;
 - ii. Quickly check the integrity of the final source container looking for a broken seal or a cracked vial or for evidence of loss of liquid, e.g., discoloration of the packaging material. If anything is other than expected, report the situation to Radiation Safety personnel at 314-446-8133 and ask for guidance;
 - iii. Perform both wipe and meter surveys on the shipping carton and the packing material for contamination before discarding. If contaminated, treat as radioactive waste. If not contaminated, obliterate all radiation labels before discarding in the regular trash and;
 - iv. Sign and date the middle section of the report to document that the proper steps concerning the opening of the package have been performed.
4. Laboratory Rules for Safe Handling of RAM
- a. Certain work habits are essential in minimizing personnel radiation doses and reducing the chance of accidental contamination. The following practices are required as a condition of our license to possess and use radioactive materials and they must be observed when working with unsealed radioactive materials:
 - i. Wear lab coats and disposable gloves at all times when handling unsealed RAM;
 - ii. Wear personnel monitoring devices, if issued by Radiation Safety, while in areas where RAM is used or stored. Monitors should be stored in an area of normal background radiation during non-working hours;
 - iii. Equipment used for RAM work such as seal-a-meals, gel dryers, glassware, etc., should be clearly labeled as radioactive and kept free of contamination of accessible surfaces;
 - iv. Avoid contaminating objects such as telephones, light switches, water tap handles, doorknobs, etc.;
 - v. Monitor work area, hands, shoes, and clothing for contamination after each procedure and before leaving area;
 - vi. Dispose of radioactive waste only in specially designated and properly labeled containers. Dry waste must be disposed before it overflows. Promptly transfer waste containers with high levels of radioactivity to Radiation Safety;
 - vii. Do not eat, drink, smoke, chew gum, apply cosmetics or store similar items in areas where radioactive materials or radiation sources are used or stored;
 - viii. Such activities may be allowed in separate, designated "break areas", provided strict adherence to UHSP Eating, Drinking, and Related Activities in Laboratory Policy;
 - ix. Break areas must be separated from the laboratory space and have floor to ceiling walls and a closed door. Only covered food or beverage items may be carried through the laboratory to a break area. Filling or rinsing of food or beverage containers in designated laboratory "wash sinks" is not allowed. Food and beverage containers may not be stored in the laboratory and washed containers or utensils may not be dried on laboratory drying racks. Refrigerators used for storing food or beverages should be dedicated as food only and should be located outside of the laboratory. These procedures must be maintained in the laboratory "Blue Book", and all individuals with access to the laboratory must be trained on this policy.
 - x. Never pipette RAM by mouth.
 - xi. Handle sources of RAM with tongs or tweezers if appropriate to the operation.
 - xii. Hall freezers, freezers in common rooms, etc., must be kept locked at all times to ensure that RAM is secured against theft.
 - xiii. Laboratories containing RAM stock and/or waste must also be kept locked when unattended to prevent RAM theft.
 - xiv. Significant activities of potential volatile RAM, e.g., sodium iodide, sodium borohydride, Tritiated water, etc., must be used in a fume hood which has been tested and posted by Environmental Health & Safety. In addition, the following practices are strongly recommended in order to maintain personnel doses as low as reasonably achievable:
 - i. All work involving unsealed RAM should be conducted on surfaces which have been covered with absorbent pads. Use easily discarded pads, absorbent on the top surface only, for containing and easily disposing of contamination.
 - ii. After each experiment involving unsealed RAM, monitor the area with a radiation survey instrument capable of detecting the radionuclide to identify areas of contamination. When using ^3H , consider doing a wipe test for removable contamination in the area(s) of use.
 - iii. Liquid RAM in glass or plastic containers other than those provided by Radiation Safety should have secondary plastic containers in case of breakage or leakage. Liquid waste containers should be capped when not in use.
 - iv. Whenever possible, new procedures should first be performed with non-radioactive materials in order to discover and remedy potentially hazardous aspects of the procedure and to train personnel in the safe and efficient execution of the technique.
 - b. As a general practice, procedures involving RAM should be confined to as small an area of a laboratory as is realistic and as far from desks as practical, thus limiting the affected area in cases of accidental contamination. All processes involving substantial activities should be conducted in a fume hood to provide an ample safety margin and to avoid the need of periodic bioassays. Use appropriate shielding, e.g., lead for gamma-emitters, Plexiglas™ for high energy beta

-emitters, lead/Plexiglas™ combination for gamma-/high energy beta-emitters, etc. Decontamination supplies should be easily accessible to all personnel. Floors should be kept clean and waxed.

5. Radiation Monitoring Program

- a. It is important to know the radiation levels to which personnel are exposed. The US Nuclear Regulatory Commission (NRC) requires licensees to monitor and maintain records of personnel radiation doses and to annually report the doses to the individuals if the individuals are likely to receive more than 10 percent of the annual dose limits established by the NRC. The NRC employs several dose equivalent variations, including the following:
- i. Deep dose equivalent to the dose due to external radiation computed for a tissue depth of 1.0 cm.
 - ii. Eye dose equivalent to the dose to the lens of the eyes due to external radiation computed for a tissue depth 0.3 cm.
 - iii. Shallow dose equivalent to the dose due to external radiation computed for a tissue depth of 0.007 cm (representative skin thickness).
 - iv. Committed organ dose equivalent to the dose due to internal radioactivity to a specific organ during the 50-year period following the intake.
 - v. Committed effective dose equivalent to the computed effective dose equivalent (EDE) due to internal radioactivity during the 50-year period following intake. The EDE is obtained by adjusting (weighting) the dose equivalents to certain organs according to the organ's relative sensitivity to radiation harm and then summing the weighted doses.
 - vi. Total effective dose equivalent to the sum of the deep dose due to external radiation and the committed EDE. The NRC occupational dose limits are given in Table 10-1: Table 10–1. NRC Occupational Dose Limits Adults Dose Category Limit Total effective dose equivalent (TEDE) 5 rem/yr Total organ dose equivalent for maximally exposed organ 50 rem/yr Lens dose equivalent 15 rem/yr Shallow dose equivalent 50 rem/yr Embryo/fetus of a Declared Worker Embryo/fetus dose equivalent 0.5 rem for entire pregnancy
- Fortunately, it is very rare for any research or laboratory medicine personnel to ever have annual radiation doses greater than 10% of any of the NRC limits. Hence, the regulations of the NRC generally do not require personnel radiation monitoring. However, we have adopted a policy to provide quarterly body monitors for individuals evaluated to "likely exceed a whole body deep dose equivalent of 100 mrem per year" (2% of the corresponding NRC limit). In addition, ring monitors are provided for individuals who are identified by the authorized user responsible for the radioactive material work as "likely to handle more than 100 mCi of 32P or other energetic beta emitter(s) per year" or more than 2mCi per experiment. Also, a monthly fetal monitor is provided to each radiation worker during the term of pregnancy after the worker has declared her pregnancy. In addition, certain individuals who handle unsealed radioactivity in relatively large quantities are monitored by Radiation Safety personnel for internal contamination using methods that are referred to as bioassays. The bioassays are of two distinct types: measurement of radioiodine accumulation in the thyroid and measurement of the radioactivity in an urine specimen, so-called urinalysis.

Responsibilities:

<u>Position/Office/Department</u>	<u>Responsibility</u>
UHSP EH&S	Collect records of training compliance for individuals working with RAM.

Resources:

- [Washington University Radiation Safety Manual](#)
- [UHSP Chemical Hygiene Plan](#)
- [UHSP Eating, Drinking, and Related Activities in Laboratories Policy](#)

Policy Contacts:

<u>Name</u>	<u>Contact Information</u>
Eric Knoll	314-446-8375
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