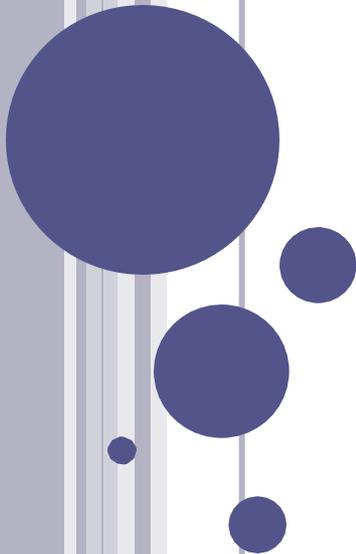


RADIATION SAFETY TRAINING

**PORTLAND VA MEDICAL CENTER
RESEARCH AND DEVELOPMENT SERVICE**

Once you have completed all of the sections, there will be a short test for you to complete.



RADIATION SAFETY

Introduction

Radiation workers are to be instructed annually of the following:

- 1) Areas where radioactive materials are to be stored, transferred, and used.
- 2) Health protection associated with exposure to radiation.
- 3) Precautions and procedures to minimize radiation exposure.
- 4) Purpose and function of protection devices employed.
- 5) Applicable portions of the U.S. Nuclear Regulatory Commission (NRC) regulations.
- 6) The responsibility to report conditions that may lead to excess exposure, or that violate NRC regulations.
- 7) The appropriate response to unusual occurrences or malfunctions.
- 8) Individual rights to radiation exposure records.
- 9) The right of a woman to declare (or not) her pregnancy.



RADIATION SAFETY

Introduction

Radiation workers should understand that if they have any further questions or problems relating to these matters or any other radiation safety issues that they are to contact the Radiation Safety Office (P2IMAG) Bldg. 100/Room 2D 128, ext. 54483 or pager 41 2745. After hours or emergencies, call the Energy Center at x56300 or *20.



RADIATION SAFETY

Radioactivity Receipt and Inventory

Ordering

Ordering may be performed through the following sources:

1. PVA Research Foundation
2. PVA Research
3. Credit Card
4. OHSU (Oracle)

Delivery should **always** be to the **authorized user's name, c/o Nuclear Medicine, Room 2D159, Bld 100, Portland VA Medical Center**. The RSO staff need to identify and record all radioactive shipments prior to receipt by the research labs.

Occasionally the vendor will need a copy of our license in order to ship material. Contact the RSO if this is required.



RADIATION SAFETY

Radioactivity Receipt and Inventory (cont.)

Receipt

If a package is received directly (from our mail room, the OHSU warehouse, etc) **inform the RSO** as soon as reasonable. RSO staff need to log it in and generate the proper paperwork.

If you receive a package directly **AND** it is crushed, damaged or leaking, call the Energy Center at x56300 or *20 and have them page the RSO “stat”. If possible, please detain the delivery person.

When you receive a package from the RSO, you should get a "use sheet" with a unique number for each vial of material.



RADIATION SAFETY

Radioactivity Receipt and Inventory (cont.)

Inventory

Research Authorized Users (RAU) are required to account for ALL of the radioactive materials they have received. For each vial of material received, you can keep track of the use of the material by any means you wish.



RADIATION SAFETY

Radioactivity Receipt and Inventory (cont.)

Inventory

- 1) The RAU can, at any time, be asked for a current inventory of their radioactive materials on hand. This can happen during an inspection. You must have a current use sheet for each vial, which details where the activity went with a total remaining activity equal to the amount in the vial.
- 2) When you are finished with the vial (i.e., the radioactive material is used up or decayed), the usage sheet (given to you by the RSO when he delivered the vial) must be completed and returned to the Radiation Safety Office (mail routing symbol (P2IMAG)). Remember to retain a photocopy of the use sheet for your records.



RADIATION SAFETY

Radioactivity Receipt and Inventory (cont.)

Inventory

There are **two sheets** for inventory for each vial of radioactive materials:

- One with a unique number given to you by the RSO when he delivered the material, and which is to be returned to him when you are finished.
- The second is your own accounting for the material while it is in use in your lab.



RADIATION SAFETY

Waste Management

There are two main methods for disposal of radioactive waste by research labs:

1. DOWN THE SINK: Radioactive liquids can be put down the sink provided:

- 1) There is no chemical or biological property (e.g., EPA hazardous wastes, such as ignitable, corrosive, reactive, toxic or specifically listed material that would prohibit their disposal).
- 2) A separate record sheet is kept for each isotope, providing the date of disposal, the amount of activity disposed (in microcuries), the cumulative total for the year, and the identity of the person disposing of the material.



RADIATION SAFETY

Waste Management (cont.)

All sinks for radioactive disposal are to be pre-approved by the RSO. They must be labeled as a “Hot Sink” with a sign provided by the RSO that includes the radiation symbol. Note that no disposal is allowed down an unlabeled sink.

2. SOLID WASTE TRANSFER TO THE RSO: refer to the following:

RSO Information Notice 99-1: “Transfer of Radioactive Waste to the RSO”. The purpose of this notice is to update personnel on the procedure for transfer of radioactive waste to the RSO. This notice should be on file in your Research Radiation Safety Manual.



RADIATION SAFETY

Waste Management – Packaging and Sorting

All waste will have the approved radioactive “stickers” filled out in duplicate (one for the container, one for a logbook). These stickers are obtained from the RSO and must be filled out completely. Print the name of the Authorized user/PI. List the activity contained in "microCuries" (sometimes it is difficult to distinguish the written μ from m). DPM or CPM is NOT acceptable for activity. For liquids, specify the liquid.

There is to be no radioactive waste that contains EPA hazardous materials (ignitable, corrosive, reactive, toxic or other specifically listed material) unless you have previously informed the RSO. This is called "mixed waste" and disposal of such waste is very expensive.



RADIATION SAFETY

Waste Management – Packaging and Sorting (cont.)

Packaging must be sufficient to minimize breakage or spillage.

Package material in a manner to prevent puncture of the “bag” (e.g., store pipettes vertically).

Radioactive waste must be segregated and packaged as follows:

1) Dry solid waste containing isotopes with half lives greater than 150 days:

These include isotopes such as H-3, C-14, Na-22, Cl-36, Cd-109, Co-57, and Ca-45. These isotopes will have to be shipped for burial or incineration.



RADIATION SAFETY

Waste Management – Packaging and Sorting (Half lives >150 days)

- Pack in clear double plastic bags. We need to be able to examine contents. The bag may be placed in a box.
- You may combine any of these isotopes in the same bag. You are not to include any isotopes with half lives less than 150 days.
- Radiation labels are ok (i.e., they do not need to be defaced).
- No scintillation vials, scintillation fluid or betaplates should be included.
- No liquids or absorbed liquids (i.e., liquids absorbed into any medium that when compacted would leak out).



RADIATION SAFETY

Waste Management – Packaging and Sorting (Half lives >150 days)

- No lead or other hazardous material are to be included.
- Biohazardous material must have been treated (disinfected) to the fullest extent possible.
- No shielding is to be present inside the bag. However, you should appropriately shield the bag containing the material while you are storing/collecting it.



RADIATION SAFETY

Waste Management – Packaging and Sorting (cont.)

2) Dry solid waste containing isotopes with half lives less than 150 days:

These include P-32, P-33, S-35, Cr-51, Fe-59, and I-125. These isotopes will be Decayed In Storage (DIS) in our waste shed. After ten half lives, they will be surveyed (with no shielding interposed) to insure radiation levels are indistinguishable from background and then disposed as non-radioactive trash.



RADIATION SAFETY

Waste Management – Packaging and Sorting (Half lives < 150 days)

- Pack in clear double plastic bags. We need to be able to examine contents. The bag may be placed in a box.
- You may **NOT** combine any of these isotopes in the same bag. If you were to have P-32 and I-125 in the same bag, we would have to hold it for 594 days not 140 days if it were P-32 alone!
- Radiation labels **MUST** be defaced. The material after it has decayed goes in its appropriate trash pathway and anyone seeing it would appropriately believe it radioactive if intact radioactive stickers or labels were still visible.



RADIATION SAFETY

Waste Management – Packaging and Sorting (Half lives < 150 days)

- No scintillation vials, scintillation fluid or betaplates should be included.
- No liquids. However, with the approval of the RSO you may have liquids absorbed into a medium (because the material will be DIS and then disposed as non-radioactive waste)
- No lead or other hazardous material is to be included.
- Biohazardous materials are to be treated or sterilized (i.e., autoclave, bleach) to the fullest extent possible.
- No shielding is to be used inside the bag. However, you should appropriately shield the bag containing the material while you are storing/collecting it.



RADIATION SAFETY

Waste Management – Packaging and Sorting (cont.)

3) Scintillation vials:

Scintillation vials containing H-3 or C-14 are collected according to a procedure established by the Safety Office. If you need assistance, call Dave Quimby at x57752 or Jenika Schindlbeck at x54765.

Because H-3 and C-14 in **concentrations of 0.05 microcuries or less** in scintillation fluid are considered non-radioactive, this fluid is treated as chemical waste only. Specify the name of the scintillation fluid used (e.g., Biosafe, Radisafe).

Scintillation vials containing isotopes other than H-3 & C-14 are to be picked up by the RSO. Call our Office and fill out a radioactive waste “sticker” in duplicate. We will also need to know the identity of the scintillation fluid/cocktail used.



RADIATION SAFETY

Waste Management – Packaging and Sorting (cont.)

4) **Betaplates:**

These are to be stored and collected separately from all other waste. In addition to the other information on the radioactive waste “sticker”, you must tell us the type of scintillation “cocktail” used.



RADIATION SAFETY

Waste Management – Packaging and Sorting (cont.)

5) Other Liquid Waste:

Liquid radioactive waste, other than that contained in betaplates or scintillation vials, is to be disposed down a “Hot” sink unless the nature of the liquid prohibits such disposal. Prohibited liquids include EPA hazardous wastes (ignitable, corrosive, reactive, toxic or specifically listed materials). If you have radioactive material in a prohibited liquid, it becomes **mixed waste**, and you need to contact the RSO before attempting to dispose of this material.



RADIATION SAFETY

Waste Management – Packaging and Sorting (cont.)

5) Other Liquid Waste (cont.):

Any waste that does not meet these criteria will not be picked up. If after having picked up the waste, we are processing it in the waste storage shed and discover that the contents of the bag do not meet requirements, *the bag will be returned to you.*

6) Mixed Waste:

Mixed waste is radioactive material that is mixed with EPA hazardous wastes (ignitable, corrosive, reactive, toxic or specifically listed material). You are to consult the RSO (x54483) and Industrial Hygienist (x56329) before generating, and to receive proper instructions for disposal, of mixed waste.



SURVEYS



RADIATION SAFETY

Surveys

Surveys can determine several things. The radiation level, the amount of contamination and whether the contamination is fixed or removable. Instrumentation for surveys includes survey meters with various probes and gamma or beta (liquid scintillation) counters.



RADIATION SAFETY

Surveys (cont.)

The frequency of surveys that each lab using radioactive material is required to perform are as follows:

Each day of use: Before, during and after, using an appropriate survey meter. There is no requirement to record this survey activity.

Monthly or weekly: See following pages

At any given time: If a spill is suspected, perform surveys as necessary to determine if there was a significant spill; and, if there was, to document the extent of the spill clean up.

Note that an initial assessment (the “quick and dirty” method) for suspected removable contamination can be performed by taking a wipe sample and placing it next to a survey meter probe.



RADIATION SAFETY

Surveys (cont.)

The requirements and procedures for weekly/monthly surveys are condensed (from a copy of the RSO Information Notice) below:

General Requirements:

Individual laboratories will perform and document surveys, using both for removable contamination (wipe tests) and for meter surveys, for either radiation levels or fixed activity at a frequency determined by the RSO. Documented surveys are required to be performed weekly if more than 200 microcuries are used at any one time. If less than 200 microcuries are used at any one time, only monthly surveys must be performed and documented.



RADIATION SAFETY

Surveys (cont.)

General Requirements (cont.):

Meter surveys are to be performed after each use of radioactive material and should be performed before and during use of radioactive material. However, unlike the required weekly or monthly surveys, these surveys do not have to be documented.

If you do not use radioactive material a particular week and/or month, no survey is required. In your logbook or folder where your documented surveys are kept, you need to indicate **no survey** was performed because **you did not use** radioactive material that week/month.



RADIATION SAFETY

Surveys (cont.)

Specific Requirements:

Documentation of surveys must meet the following requirements:

- 1) There must be a map of the area(s) surveyed that indicates the location where the wipes were taken.
- 2) The instruments used for counting and survey will be identified as to make, model and a serial number.
- 3) Each documented survey must be signed and dated.
- 4) Action levels must be specified.

The RSO can provide a spreadsheet file that has the format for this documentation.



RADIATION SAFETY

Surveys (cont.)

Specific Requirements (cont.):

In the laboratory folder containing the survey records there should be a calendar. You are to use this calendar to record or indicate the dates the surveys were performed and to indicate weeks and/or months in which there was no use of radioactive material (thus no survey required).



RADIATION SAFETY

Surveys (cont.)

Records:

Individual labs will maintain records of radioactivity surveys in a folder provided by the RSO. The RSO will also provide a spreadsheet file.

Training

The RSO will provide training in radioactivity surveys as needed to all individual labs.

Note: Anyone who uses radioactive material must be able to demonstrate use of a survey meter. Exception: Users who handle only H-3.



RADIATION SAFETY

Surveys (cont.)

Procedure:

Frequency: Weekly or Monthly

Type: Gamma/Beta

Use liquid scintillation counting for beta emitters such as H-3, C-14, & S-35. Use a gamma counter for Cr-51 and other higher energy gamma emitters. For I-125, you may use either.



RADIATION SAFETY

Surveys (cont.)

Procedure (cont.):

Materials required:

- Gloves
- Wipe papers (foam for beta wipes)
- Counting tubes (gamma) or vials (beta)
- Scintillation fluid for beta wipe

Instrument:

- Gamma counter (for gamma wipe)
- Scintillation counter (for beta wipe)
- Survey meter -- NaI (gamma) or pancake (beta)



RADIATION SAFETY

Surveys (cont.)

Procedure (cont.):

- 1) Wipe designated areas (numbered on diagram provided by RSO), using a minimum of 4 square inches (=100 cm x cm) and a maximum two square feet. Choose spots around the lab where contamination (if any) is most likely to occur (e.g., benchtop where radioactivity is used; around the sink, hood, floor near use or disposal; refrigerator/freezer handle) and also a few representative locations (e.g., floor by exit door) where contamination would likely be “tracked”.
- 2) Fold the wipe and drop into a numbered tube or vial.
- 3) For beta wipes, fill the vials with scintillation fluid.



RADIATION SAFETY

Surveys (cont.)

Procedure (cont.):

- 4) Count tubes or vials on appropriate counter. Note that an appropriate standard also must be counted to insure the machine is working satisfactorily.
- 5) Enter the counts on the form provided by the RSO and calculate DPM using an appropriate formula, taking in account the efficiency of the counting instrument for that particular isotope. If you do not know the efficiencies of your instrument, the radiation safety office will provide assistance in this determination.



RADIATION SAFETY

Surveys (cont.)

Procedure (cont.):

- 6) Survey the entire lab with a meter, paying special attention to the areas marked on the “map” and any other areas more likely to be contaminated. You are also to survey non-radioactive trash cans. Note: survey meters can not detect H-3 and are very inefficient for C-14 & S-35.



RADIATION SAFETY

Surveys (cont.)

Procedure (cont.):

- 7) If there are any wipe DPM count or survey readings exceeding action levels, notify the RSO and clean the area(s). Rewipe and resurvey. The resurvey must also be recorded.

The action levels for removable contamination (wipes) and meter survey is 22,200 DPM.

Calculations: $DPM = CPM / \text{Efficiency}$

For example, a meter that is 5% efficient for C-14 reads 100 CPM. The DPM is $100/0.05 = 2000$ DPM, where 2200 DPM = one nanoCurie



RADIATION SAFETY

Surveys (cont.)

Procedure (cont.):

- 8) If there are any wipe DPM count or survey readings exceeding 3 or 4 times background, you should investigate these to insure there is not a problem.

If you have any questions, please contact the RSO at x54483.



RADIATION SAFETY

Instruments and Equipment

A. Survey Meters

Each lab that uses radioactive material (other than H-3 exclusively) is required to have access to an appropriate survey meter. Although ideal, the meter is not required to be physically located in the lab. Appropriate probes are pancake/gm probes for C-14, P-32, P-33 and S-35 and NaI probes for I-125 and Cr-51.

You should survey with the appropriate meter before, during and after working with radioactive material. These surveys need not be recorded.

Before using a meter, you are to verify that it has been calibrated (required annually), that the battery is ok (if the meter has that option), and that the probe registers the check source reading (if it has this feature). The information on date of calibration, check source reading, and efficiency is on a sticker attached to the meter.



RADIATION SAFETY

Instruments and Equipment

A. Survey Meters (cont.)

If you use a meter, you should be knowledgeable of the typical background reading. For Ludlum 3 meters, the pancake probe (44-9) typically reads 30-50 CPM and the thin NaI probe (44-3) reads 200-300 CPM.

You also should be aware of the efficiency (conversion CPM to DPM, and thus activity) of each of the probes. For Ludlum 3 meters, the pancake probe (44-9) typically the efficiency is 25-33% for P-32 and ~ 2-5% for C-14, S-35. Thus if you detect 2200 CPM of P-32, you have about 6600 to 8800 DPM of P-32. 2200 DPM is one nanocurie.

During lab inspections by federal regulatory agencies, a few personnel will be asked to demonstrate use of the meter. We will be cited if personnel who handle radioactive materials can not demonstrate proper use and knowledge of survey meters.



RADIATION SAFETY

Instruments and Equipment

B. Turn In of Equipment

There is a policy and procedure for turn in of equipment and items that may contain **radioactive sources** (such as beta counters, survey meters, gamma camera) or **may be contaminated with radioactive material** (e.g., refrigerators, centrifuges, nuclear counting instruments). All such equipment and items must be approved for release by the RSO. Equipment or items are suspect either by specific use or by the presence of the radiation symbol. Personnel are responsible for informing the RSO when excessing such equipment, and personnel in A&MM-warehouse also will review such equipment items during pick up.

Please also note that even if you are only moving such equipment from one lab in the Portland VA to another, **the RSO needs to know.**



RADIATION SAFETY

Instruments and Equipment

B. Turn In of Equipment (cont.)

If you are **transferring such equipment** off station (to another VA or other institution) or receiving it from another institution, **you need permission from the RSO before this is done.** We had an incident a number of years ago where a liquid scintillation counter (beta counter) with an embedded source was damaged in transfer to the Portland VAMC, excessed, and the source was detected (and recovered) by a scrap metal dealer. This was a serious event in the eyes of the NRC. A couple of other VAMCs have had similar incidents, resulting in unfavorable press.



RADIATION SAFETY

Audits and Inspections

A. Self Audits

As a requirement of the Research Biosafety Subcommittee, each authorized user / principle investigator is required to perform a self-audit of their radiation safety program. This is accomplished by completing the [Project Safety and Hazard Assessment](#).



RADIATION SAFETY

Audits and Inspections

B. RSO Annual Review

The RSO, as part of his annual program review, will review the use of radioactive material in research laboratories. The audit may include, but may not be limited to, some or all of the following:

- 1) Ensuring that permit holders are using only the isotopes authorized, only in the amounts as authorized and only in the rooms authorized.
- 2) Ensuring security of materials (i.e., could someone unknown walk into a lab unquestioned, take something, and walk out?).
- 3) Ensuring that personnel are aware of their right to declare (or not) their pregnancy.
- 4) Ensuring that inventories are accurate, that the lab can demonstrate the disposition of material delivered to them, and that they can account for all material delivered to them.



RADIATION SAFETY

Audits and Inspections

B. RSO Annual Review (cont.)

- 5) Ensuring that each lab has a meter available when working with isotopes, and that personnel know how to use the meter.
- 6) Ensuring that workers have received and documented the required initial and annual refresher radiation safety training.
- 7) Ensuring that Emergency Instructions and form NRC-3 are posted, and personnel know where they are located in the laboratory.



RADIATION SAFETY

Audits and Inspections

B. RSO Annual Review (cont.)

Also included will be a performance-based aspect. This consists of asking radiation workers to demonstrate certain job requirements, such as how they use a meter to survey, and observing them as they work to ensure gloves are worn, dosimetry is used, hands and floor are monitored, etc. This is in addition to asking them how they record waste disposed down the sink, who to contact in an emergency, where the isotope inventories are located, and if they have been told of their right to declare pregnancy, etc.



RADIATION SAFETY

Audits and Inspections

C. Unannounced Outside Inspections

The VA National Health Physics Program (NHPP) (and perhaps the NRC on occasion) will inspect this Medical Center with unannounced visits every one to two years. The level of detail and amount of time they spend in research is extremely variable. When they come, each person in Research Service must be prepared to answer questions appropriate to their involvement in use of radioactive material. If you do **not** know the answer to a question, please say so (“ I know I have been told, but I forget”). If you failed to do something, be HONEST admit your mistake, and indicate that you know what is to be done and how it is performed. The **ABSOLUTE WORST** thing for an inspection is an attempt to “cover up” something.



RADIATION SAFETY

Audits and Inspections

C. Unannounced Outside Inspections (cont.)

If you have been conscientiously reviewing the self-inspection forms, you will be prepared for an inspection. The current trend is less of a records review and more of a performance-based inspection.



RADIATION SAFETY

Security

Radioactive material is to be secured (locked up) or “in attendance” at all times. “In attendance” in an unsecured area (e.g., the Nuclear Medicine clinic) means that if the door is not locked, someone must be able to observe people going into the room or the room can be left open only for a minute. In the secured research areas it means that it is ok to leave the room unattended for several minutes (e.g., to go to the restroom or to another lab), but if you are going longer than 20 minutes or so (e.g., lunch) you should lock the room.

Also, for research, you are not to let anyone inside the keyed areas unless you recognize them as employees (research, engineering, environmental management, etc). If you do not recognize someone ask them to wait at the door and have them call the person they are visiting or escort them to the person they wish to see (but do not leave them alone in a lab).



RADIATION SAFETY

Security (cont.)

If an alarm sounds or suspicious activity is noted in or around any room posted as using radioactive material, do the following:

First, for your personal safety:

- 1) Avoid confrontation with the person and immediately leave the area if the person makes threats or appears to have any potential for violence.
- 2) Do not attempt to restrain or use physical force to detain the person.
- 3) Comply with demands by the person for access to the room, if the person uses coercion or threats of violence.
- 4) Do not follow the person, if the person leaves the area.



RADIATION SAFETY

Security (cont.)

After you are comfortable about your personal safety:

- 5) Offer to provide assistance and request explanation of the apparent unauthorized access or suspicious activity.
- 6) Ask the unauthorized person to identify himself or herself and state their purpose for being in the area.
- 7) Contact VA Police Service (*20 in an emergency), ACOS Research, and/or Radiation Safety Officer for assistance.
- 8) Note identifying information such as height, weight, gender, and clothing about the unauthorized person for later report to the VA Police Service.
- 9) Maintain constant visual surveillance of the unauthorized person, if the person remains in the area.
- 10) Provide assistance to the VA Police Service, ACOS Research, and/or Radiation Safety Officer who respond.



You have now completed the
Radiation Safety training.

[Click here to take the Post-Test](#)

