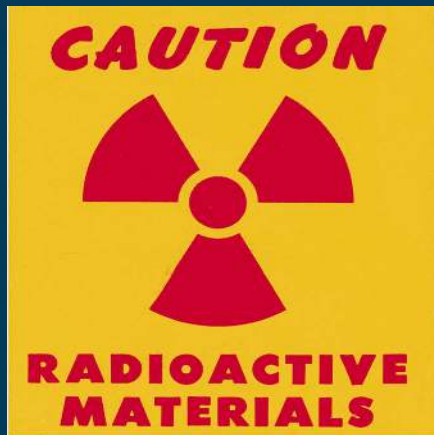

THE GEORGE
WASHINGTON
UNIVERSITY

WASHINGTON, DC



Radiation Refresher Training

Presented by the Office of Laboratory Safety

Email: labsafety@gwu.edu

Tel # 202-994-8258

"A safe, healthful, and secure environment for scholarship and research."

Training Refresher Topics

- License and authorization
- Ordering radioactive material & inventory
- Waste
- Safe radioactive material use
- Monthly surveys
- ALARA
- Security
- Exposure response

Radiation Exposure

Small quantities of radioactive materials are used at GW. Only very small radiation doses are expected for the users of radiation/radioactive material. No doses are expected for any other personnel. No biological effects are expected at these low dose levels.

License

- GW is licensed to use radioactive material (RAM) by the Nuclear Regulatory Commission (NRC).
- Our license is a “Broad Scope License” and allows us to use a wide range of isotopes within activity limits, providing that we conduct our Radiation Safety program in accordance with our license application as submitted to the NRC as well as comply with Federal regulations. Some important elements of the program are:
 - Radiation Safety Officer (RSO)
 - Radiation Safety Committee (RSC)
 - Authorized User (AU)
 - Training with examination
 - Document RAM use and waste
 - Security of RAM
 - Conduct periodic surveys

Safety Culture

- Overall attitude and behavior of both leadership and individuals to emphasize safety
- Has consistently been used in Nuclear Power Plants (NPP) with positive effects.
- A positive safety culture helps prevent accidents and compliance violations



Safety Culture Characteristics

1. Safety is a clearly recognized value
2. Leadership for safety is clear
3. Accountability for safety is clear
4. Safety is integrated into all activities
5. Safety is learning driven

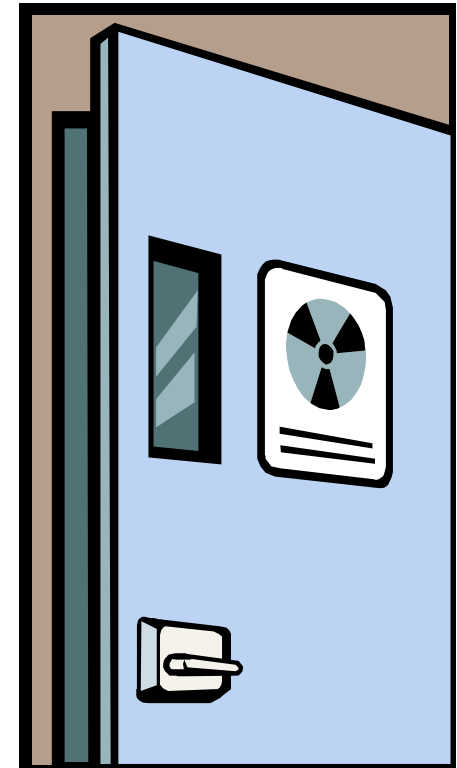
Ref: IAEA, Safety Culture Assessment Review Team 2008

Authorization

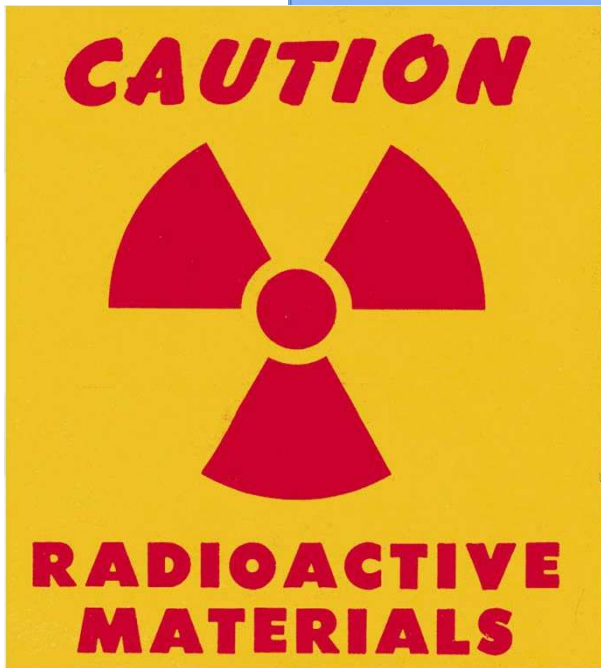
- Authorized Users - approved by the Radiation Safety Committee (RSC)
- Only AUs or those under them can use RAM
- AU - principal investigator with the responsibility for ensuring that his/her workers follow procedures.
- Each AU authorization is specific for each isotope, activity limits (on hand and annual), rooms for use.
- All users of RAM must be trained and pass an examination as well as demonstrate competence in handling RAM.
- Authorizations are renewed by the AU and approved by the RSO annually and include a physical inventory of RAM on hand.

Authorization (cont.)

- Only rooms on the authorization can have RAM storage or use. These rooms must have:
 - Placard in hall
 - Caution sign on lab door
- AU programs must have means to conduct contamination surveys.
- AUs must maintain the radiation binder which contains at minimum:
 - AU guide
 - Utilization logs
 - Protocols
 - Reg guide 8.29 and 8.13



Hall Placard



George Washington University • Laboratory Hazard Information Sheet

Room #: _____ Department: _____ BioSafety Level ____ Lab _____
 Principal Investigator: _____ Phone: (____) _____ - _____
 24-Hour Emergency Contact Information:
 Home: (____) _____ - _____ Cell: (____) _____ - _____ Pager: (____) _____ - _____

Routine Access Information:

[] Housekeeping and Support Services may enter to clean floors and empty trash only
 [] Housekeeping and Support Services may enter the lab only when escorted
 [] **NO ROUTINE ACCESS**

	<p><u>Special Hazards:</u></p> <table style="width: 100%;"> <tr> <td style="text-align: center;"> IRRITANT <input type="checkbox"/></td> <td style="text-align: center;"> FLAMMABLE <input type="checkbox"/></td> </tr> <tr> <td style="text-align: center;"> CORROSIVE <input type="checkbox"/></td> <td style="text-align: center;"> OXIDIZER <input type="checkbox"/></td> </tr> <tr> <td style="text-align: center;"> RADIATION <input type="checkbox"/></td> <td style="text-align: center;"> TOXIC <input type="checkbox"/></td> </tr> <tr> <td style="text-align: center;"> BIOHAZARD <input type="checkbox"/></td> <td style="text-align: center;">SC <input type="checkbox"/> CARCINOGEN</td> </tr> <tr> <td style="text-align: center;">SM <input type="checkbox"/> MUTAGEN</td> <td style="text-align: center;">ST <input type="checkbox"/> TERATOGEN</td> </tr> </table>	 IRRITANT <input type="checkbox"/>	 FLAMMABLE <input type="checkbox"/>	 CORROSIVE <input type="checkbox"/>	 OXIDIZER <input type="checkbox"/>	 RADIATION <input type="checkbox"/>	 TOXIC <input type="checkbox"/>	 BIOHAZARD <input type="checkbox"/>	SC <input type="checkbox"/> CARCINOGEN	SM <input type="checkbox"/> MUTAGEN	ST <input type="checkbox"/> TERATOGEN
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SM <input type="checkbox"/> MUTAGEN	ST <input type="checkbox"/> TERATOGEN										

Personal Protective Equipment:

 LAB COAT <input type="checkbox"/>	 GLASSES <input type="checkbox"/>
 GLOVES <input type="checkbox"/>	 COVERALL <input type="checkbox"/>

The Office of Research Safety, Bio-Security & Emergency Management is responsible for all University research laboratory facilities and is located in Ross Hall, Suite 617 - PHONE: 4.3282, FAX: 4.2522, EMAIL: safety@gwumc.edu.
 WEB: www.gwumc.edu/research/labsafety.htm. ORSBSEM is on-call 24x7 to respond to emergencies.
 Employees are entitled to Material Safety Data Sheets (MSDS) or other information on suspect hazards.

Authorization (cont.)

- Renewals – annually you will be sent a renewal form to correct, sign and return to OLS.
- Substantial changes to an authorization such as room change, new isotope, on-hand limit, etc. will need an amendment form (on the website)
- New users
 - Study user manual & Perkin Elmer guide
 - Complete new user/dose eval form
 - Attend training & exam (Schedule as needed)
- Almost everything you need is at the OLS website
- If anything is amiss on the website, please contact the Office of Laboratory Safety (labsafety@gwu.edu)

LAB SAFETY

OFFICE OF THE VICE PRESIDENT FOR RESEARCH



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Radiation Safety

Radioactive materials (RAM) and radiation producing equipment is commonly used in a wide variety of research. Radioactive materials in the District of Columbia are regulated by the [Nuclear Regulatory Commission \(NRC\)](#) who provides institutions with licenses to work with RAM. Virginia is an agreement state with the NRC and has their own [regulations](#) for RAM.

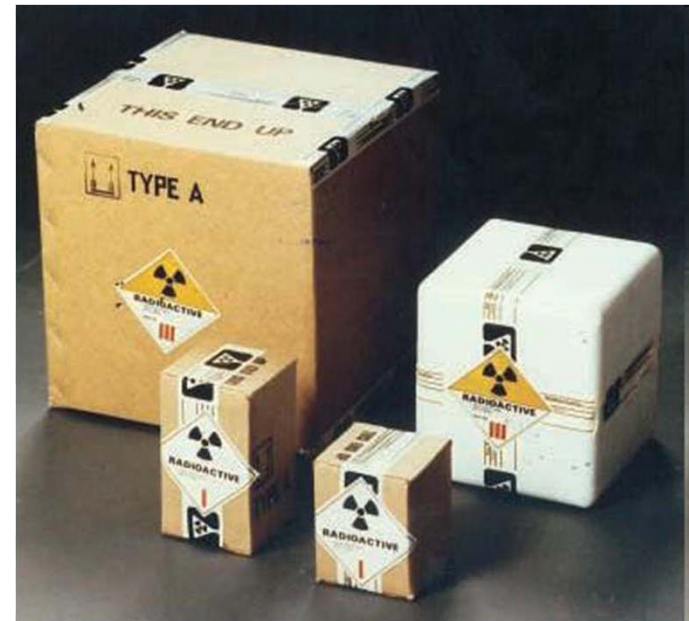
According to our licenses any person wishing to use RAM or the irradiator at GW must be authorized by the appropriate internal procedures before any use can occur. This includes registration of protocols with the [Radiation Safety Committee](#), completion of [training](#) and exam and required documentation logs of use.

**REGISTER
FOR TRAINING**

**REQUEST
TRAINING**

Ordering RAM

- Radiation Safety receives quotes from vendors for RAM for agreed prices.
- Your department places orders through EAS Oracle or iBuy. OLS will approve the order if lab is authorized for product and within limits (annual and on-hand)
- Contact OLS if your lab needs to place an order differently than the above steps

The Oracle logo, featuring the word "ORACLE" in a bold, red, sans-serif font.The GW iBuy logo, featuring the letters "GW" in a large, blue, sans-serif font above a blue rectangular button containing a white shopping cart icon and the text "iBuy" in white.

Ordering RAM (cont)

- Proper ordering details:

- * – Addressed to: Authorized User

Office of Lab Safety, Ross Hall B04

- * – Account: 54521- Radioactive Lab Supplies

- DOT Hazard Class (7)

- Supplier Item Number is included along with a description

- Proper shipping charges

- Questions need to be directing to OLS prior to order

Inventory

- Isotopes - received by a user and secured (locked) immediately. You will receive a utilization log sheet with the order (fridge or binder)
- RAM used must be entered on the utilization log (fill in all blanks)
- Stock vials must be kept stored in their container (pig) and it must be labeled with the 4 digit inventory #.
- Inventory **cannot** be given to other labs without OLS approval. Please contact Dan Hibbing if RAM needs to be moved between labs.



ISOTOPE RECEIPT and UTILIZATION LOG

AU: <u> S </u>	Pkg #: <u> 10fiZ </u>
Supplier: <u> fr.r/.. E1rr. </u>	Cat. #: <u> BLV 17 T </u>
<u> 1.0 </u> mCi	Received on: <u>)11/07 </u>
of gross per hour 995 cm	I meter: <u> v.002 </u> , Surface: <u> .p,14> </u> Detector: <u> S of OH </u> Bkgd: <u> 0.0:10 </u>
per 300 cm ²	Detector: <u> ((CCL c </u> Bkgd: <u> r t </u>
Chem/bio. Hazard? : <u> Af., </u>	RSO Tech: <u> .f..fS </u>

Example

DATE	ACTIVITY RECD, mCi	ACTIVITY USED, mCi	ACTIVITY LEFT, mCi	STORAGE PLACE	LABELED & LOCKED?	STAFF INITIALS
<u> 11/07 </u>	<u> 1.0 </u>	<u> 1u⁶-Ai </u>	<u> 1.1 </u>	<u> Frr P19' </u>	<u>)/ No </u>	<u> d' - - </u>
<u> 11/07 </u>	<u> UJ </u>	<u> 0.1 </u>	<u> a 4 </u>	<u> " </u>	<u> LY / No </u>	<u> 6-DJ </u>
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	
					Yes / No	

Comments: _____

(This form must be retained for three years after the last date recorded on the form).

HN2.3 Rev. 05115196



Waste

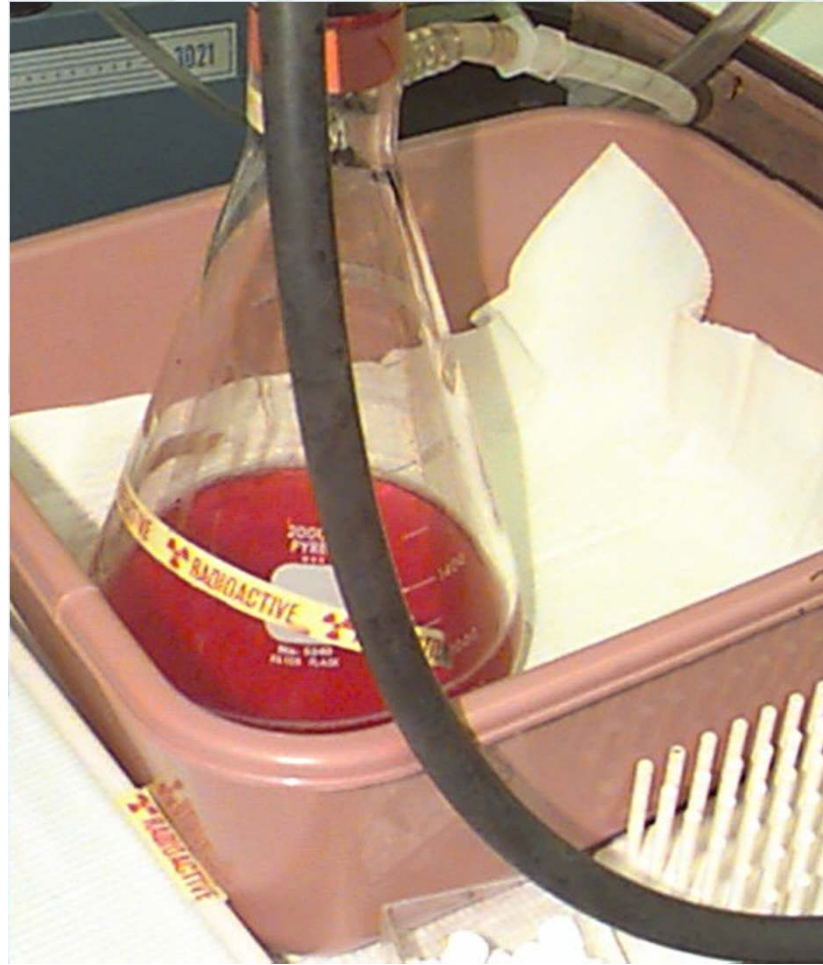
- Dry Solid Material (DSM)
 - Segregate by isotope in separate boxes (“hat box”), labeled correctly.
 - All waste added is entered on the DSM log on waste box.
 - Call for pickup when full (or 1 yr)
 - NO STOCK VIALS (even if empty).
 - NO LIQUIDS
 - NO HAZ MAT – ie: lead, mercury, chemicals
 - NO SHARPS OR BIOWASTE
 - NO FOOD



Waste (cont.)

- Liquid radioactive waste (non-hazardous waste)
 - Liquid waste - disposed of in a designated “Hot Sink” which must be marked with rad tape and have a sign posted.
 - Run large amounts of water before, during and after release.
 - Don’t splash. No contamination on bench around sink. Limit contamination in basin.
 - Estimate activity and record on the Hot Sink disposal log. Logs will be picked up periodically.
 - Must not exceed monthly disposal limits per isotope.
 - Must be sewer disposable: no hazardous waste (pH 5 - 9)
 - *No liquid disposed direct from stock vial.*

Secondary containment for all radioactive liquids



Waste (cont.)

- Stock vials
 - To dispose of a stock vial call Radiation Safety. We will collect the vial, sign utilization log and give you a copy.
 - Do not discard vials in dry waste or pour remaining liquid in hot sink
 - Vials do not need to be decayed prior to pickup, contact OLS as soon as a vial is no longer needed.
- Scintillation vials
 - ^3H / ^{14}C – If $<50,000$ cpm discard in “cold trash” waste. Update exempt vial disposal log.
 - All other hot vials must be placed upright in trays and labeled “Caution Radioactive Material”, isotope and estimate activity. Call for pickup or if large volumes expected.
 - Never discard vials with DSM waste.

{ f'it
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DISPOSAL LOG

3H and 14C Only

Liquid Scintillation Vials Only

AFTER REMOVAL OF ALL RADIOACTIVE LABELING, VIALS CONTAINING BIODEGRADABLE LIQUID SCINTILLANTS WITH 111,000 dpm per g of media or less of H-3 and C-14 ONLY MAY BE PUT IN "COLD TRASH" NORMAL TRASH (OR IN MEDICAL WASTE WHEN NEEDED), IN A BAG WITH ABSORBENT. LOG THE DATA OF EACH DISPOSAL BELOW RADIATION SAFETY WILL RETAIN THIS LOG.


ROOM #: - q, f... AUTHORIZED USER: ==> r. A. S. -

Date	Circle isotope	Total Activity (dpm)	Number of Vials	Size of Vials	Person Making Disposal Please print name.
1/11/11	14C	<00, 00.0	5	7, ...	6.it.a. T .s
1/11/11	14C	20.0	1	7, ... L.	--s
	H3 / C-14				
	H3 / C-14				
	H3 / C-14				
	H3 / C-14				
	H3 / C-14				
	H3 / C-14				
	H3 / C-14				
	H3 / C-14				
	H3 / C-14				
	H3 / C-14				
	H3 / C-14				
	H3 / C-14				
	H3 / C-14				
Date Sheet Collected: _____ Approved by: _____ Date: _____					

HR12.2 Revised 1/12/07 (These records must be maintained until the licenses terminated).

Hot Sink Sign

HOT



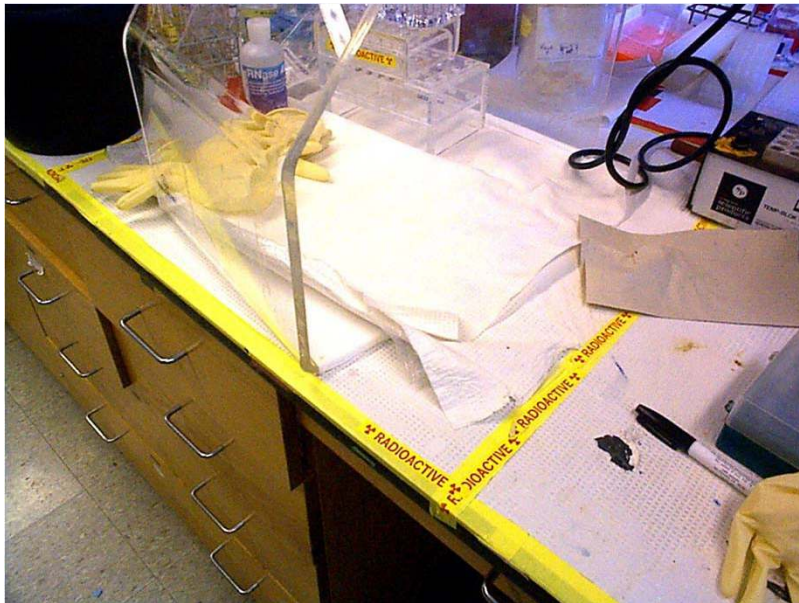
SINK

NOTICE

1. **Maintenance Personnel Contact the Office of Radiation Safety Before Working on Drain Piping.**
2. **Written Records of All Sewer Disposals of Radioactive Material Are Required BY LAW. Record date, quantity (in microcuries) and radionuclide for each disposal.**
3. **Disposals May Be Made Only in Conjunction With Projects Approved By Campus Radiological Health Authorities.**
4. **For Further Information Contact The Office of Radiation Safety at 4-2630**

RAM Use – work areas

- RAM is only to be used in designated use areas - mark with radiation tape and use plastic backed absorbent paper. OLS will help delineate radiation areas from cold areas.
- Any equipment where RAM is used or stored must be labeled ie: hoods, refrigerators, centrifuges, etc.



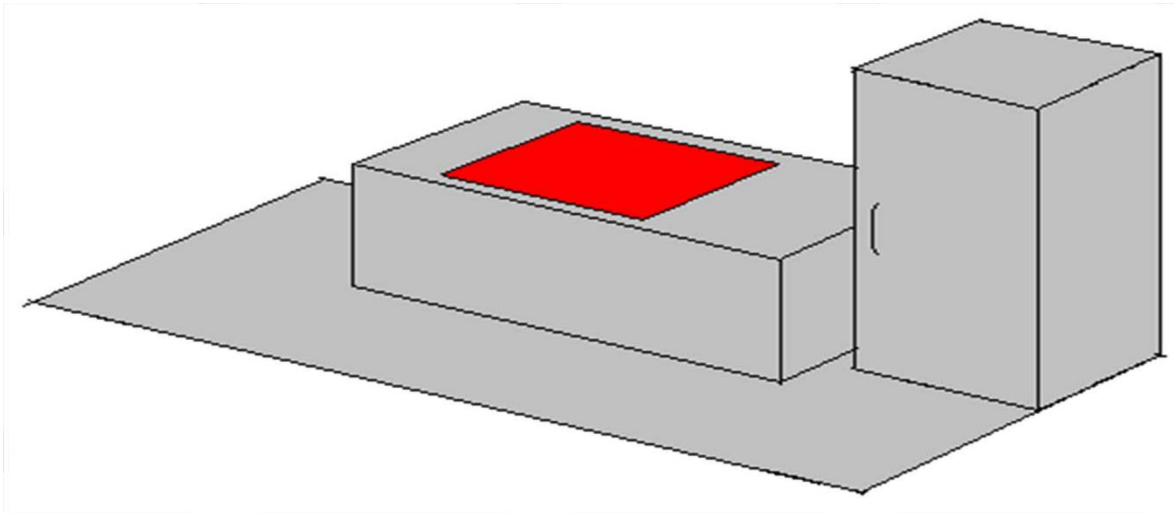
RAM Use - surveying

- As you work, survey your gloves to detect any contamination
- The meter must always be on when working with RAM (if detectable)
- When work is finished, benches, clothing, floors and other equipment should be surveyed to detect any contamination (Move the detector slowly)
- Contamination:
 - > 2X background (meter)
 - > 150 cpm (wipe test)



RAM Use - contamination

- No contamination should be present **outside** of rad use areas.
- If contamination is discovered, it should be cleaned up immediately. If you suspect contamination with ^3H do wipe tests to survey. (^{35}S or ^{14}C may need wipe tests if low activity).



RAM Use - contamination

- Contamination ***inside*** radiation areas should be avoided. if discovered, clean as soon as work is complete (contaminated bench paper goes in DSM)
- Small amounts of contamination may persist in work areas due to residual in equipment and may be unavoidable, but, must be below following levels when measured at the edge of the bench:
 - For ^{125}I and ^{51}Cr , using a 44-3 meter < 15000 cpm
 - For all other isotopes, using a GM meter < 1500 cpm
- Dose rate limit at radiation area boundary is 0.5 mRem/hr. The above count rates are designed to keep doses well under this level.



RAM Use – clean up

- Contamination should be cleaned with bubbling spray such as Count-Off or Dow cleaner and paper towels.
- Clean small areas at a time to avoid spreading any contamination
- The area should be surveyed until no removable contamination is detected and discarded in DSM.
- For more than incidental contamination, contact Radiation Safety for assistance and inform your AU. Mistakes will happen, but please get help.



Safe Lab Practices

- No eating, drinking, chewing gum etc in rad labs.
- Never store food in rad storage areas, e.g. fridges.
- Wash your hands promptly after handling any radioactive material.
- Wear prescribed dosimeters. Dosimetry will not be prescribed when using tritium or extremely low doses expected.

**CAUTION:**
RADIOACTIVE MATERIAL

LABORATORY SAFETY PRACTICES:

1. Never eat, drink, smoke, etc., and never pipette by mouth, in isotope use areas.
2. Never store isotopes with food or drink (or cups, etc.), incompatible items, or bulk flammables.
3. Never leave items related to food, etc., in any isotope work area, e.g., in any waste receptacle.
4. A laboratory coat and gloves (latex, etc.) should be worn when using isotopes (button the coat).
5. Wash your hands promptly after isotope use, before eating, and before leaving the lab.
6. Hands, shoes and clothing should be surveyed after isotope use, before leaving the workplace.
7. Use isotopes in a hood, unless benchwork is approved for the isotope, activity and protocol used.
8. Use isotopes on a tray (or on any impervious surface for a few ml); cover it with absorbent paper.
9. When using isotopes, survey the area whenever contamination is suspected; always survey at least daily, unless weekly survey is approved for the isotope and activity used. Clean up any "hot spots."
10. For external radiation, utilize time, distance and shielding to reduce exposure whenever possible.
11. Wear your radiation badge around radiation (& ring if using isotopes); store these in office areas.
12. Dispose solid radwaste in an approved radwaste container, in one labeled with the isotope. Dispose bulk liquid radwaste in the "hot sink" (nonflammable true solutions \leq monthly limits).
13. Record promptly: all receipts, all dispensing for use, and all disposals and transfers of isotopes.
14. Each isotope transfer – to or from another GWU user or off-campus – requires RSO approval.
15. Label all isotopes as required, except containers attended or posted; deface labels upon disposal.
16. Lock all isotope storage areas (freezers, etc.) whenever possible, and always at the end of the day. Always lock the doors of any isotope lab, at the end of each day, and whenever leaving a lab when isotopes are in use or unlocked. Report any lost stock!
17. Report all isotope ingestion, spills and losses to your supervisor and to the Radiation Safety Office.
18. Before using isotopes, all lab staff: must know all radiation safety rules, and all relevant protocols; must pass the Radiation Safety Office "Hazards Exam." Review radiation safety rules frequently.
19. Always comply with NRC regulations, University radiation safety rules, and approved protocols.
20. In any emergency involving isotopes, call the Radiation Safety Office 4-2630

10HP26.1 04/25/97

Personal Protective Equipment

- Lab coat, disposable gloves and eye protection are required at all times.
- Refer to authorization for specific requirements.
- Do not wear baggy clothing, dangling jewelry, and cinch up loose long hair.
- Legs must be covered and close toed shoes worn.

Survey Meters

Survey Meter w/ “end window” Geiger Muller GM detector



Survey Meter w/ “pancake” GM detector



Survey Meter w/ low energy gamma detector
Ludlum 44-3
(^{125}I , ^{51}Cr , γ emitters)



Survey Meters

- Will not detect ^3H (must use liquid scintillation to detect)
- Are calibrated annually
- Always check batteries to make sure they are in range as well as a physical check for damage.
- Check the meter before each use by holding the probe against the check source. It should closely match calibration number on sticker.
- A properly working GM meter has a background count rate of about 40-60 cpm. If it is not working contact OLS.



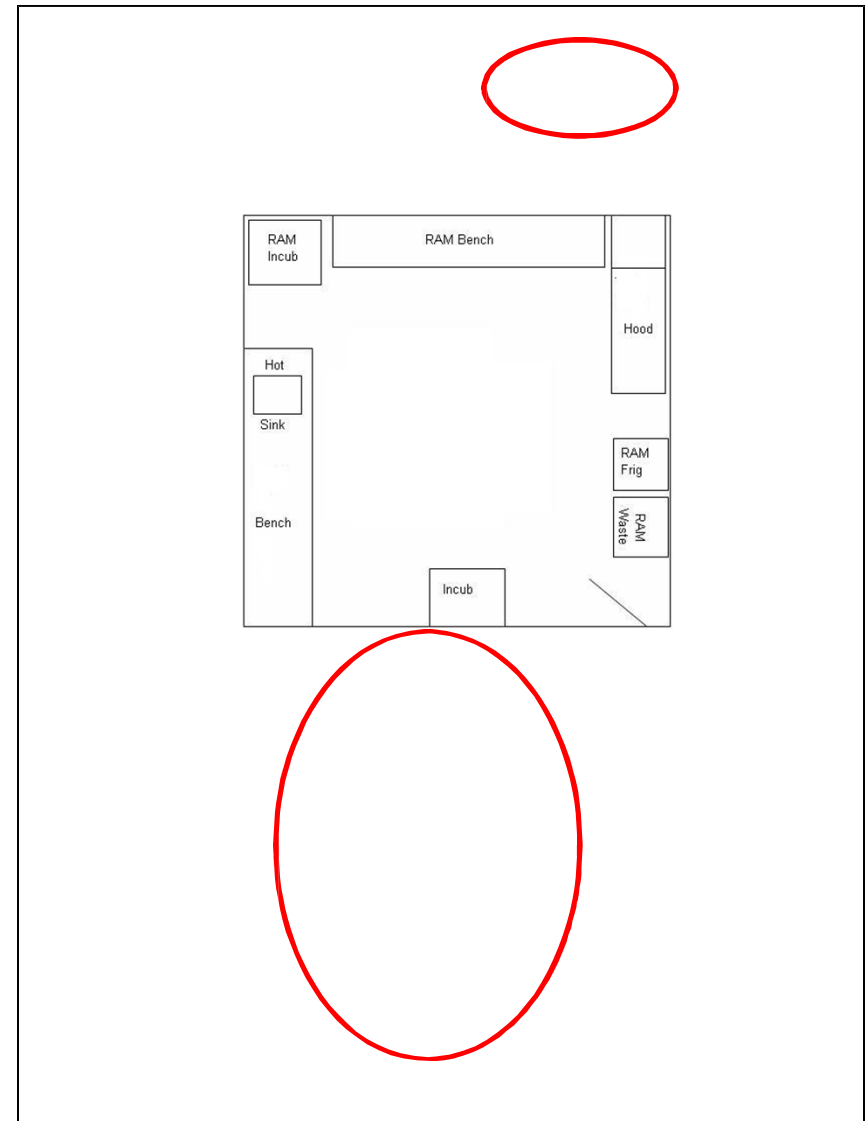
Wipe Surveys

- Used to determine if contamination is removable or fixed
- Use 2.5 cm filter disc for LSC counting
- Cover at least 100 cm² of surface
- Limits are based on 100 cm²
- Only way to detect ³H
- For instructions on LSC counting, contact OLS or discuss with your PI



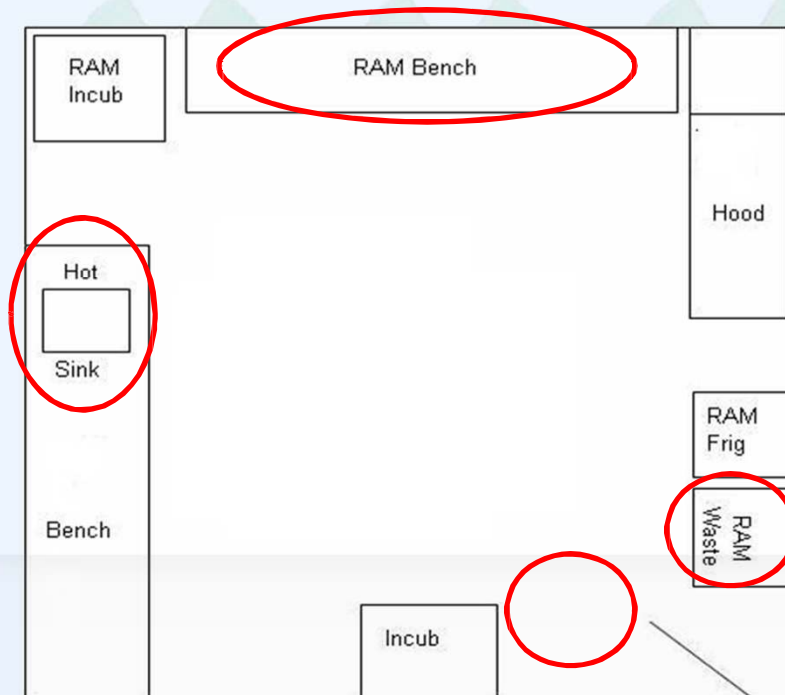
Monthly surveys

- A documented survey must be done each month when RAM was used with a meter and LSC swipes
- Labs not using that month still must fill out a survey form
- Therefore, there must be a sheet in the binder for every month of the year



Monthly surveys

- Take swipes of areas that are likely to have contamination such: hot sink, rad bench, rad area floors, door handles, floors near exit, equipment such as fridges and centrifuges.
- Be sure to differ swipe locations from month to month



New Inspection Checklist

- **RAM inventory is correct and up to date (Look at utilization logs & inventory)**
- **Lab and equipment has proper labeling and signage (Equipment, RAM area, door, form 3, etc.)**
- **RAM binder is up to date (Annual renewal, documents, etc.)**
- **RAM Surveys are complete for each month**
- **Waste logs are correct and up to date (Sink, dry waste, exempt, liquid)**
- **Proper security of RAM is maintained (Locked up and secure, all RAM, restrict access)**
- **ALARA recommendations are consistently followed (Shielding, dosimetry, RAM areas)**
- **Survey meter is available, working, and used; if applicable (Calibrated, battery check, correct type)**
- **Violations, spills, and loss of material are reported to OLS**
- **Training is up to date (Everyone trained, approved protocols, etc)**
- **Contamination is below limits in all areas (Inside RAM work and free release)**
- **Proper safety devices, PPE (Coat, gloves, eyewear, eyewash, close toed shoes)**
- **Standard lab safety protocols followed (Trash, labeling, no food/contacts, plants/animals etc.)**

ALARA

As low as reasonably achievable (ALARA) – To minimize dose from external sources there are 3 primary methods:

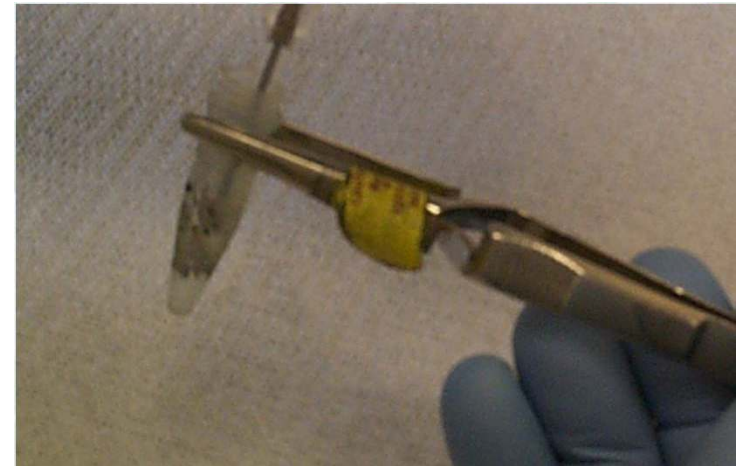
- Time**
- Distance**
- Shielding**

As Low As Reasonably Achievable (ALARA)

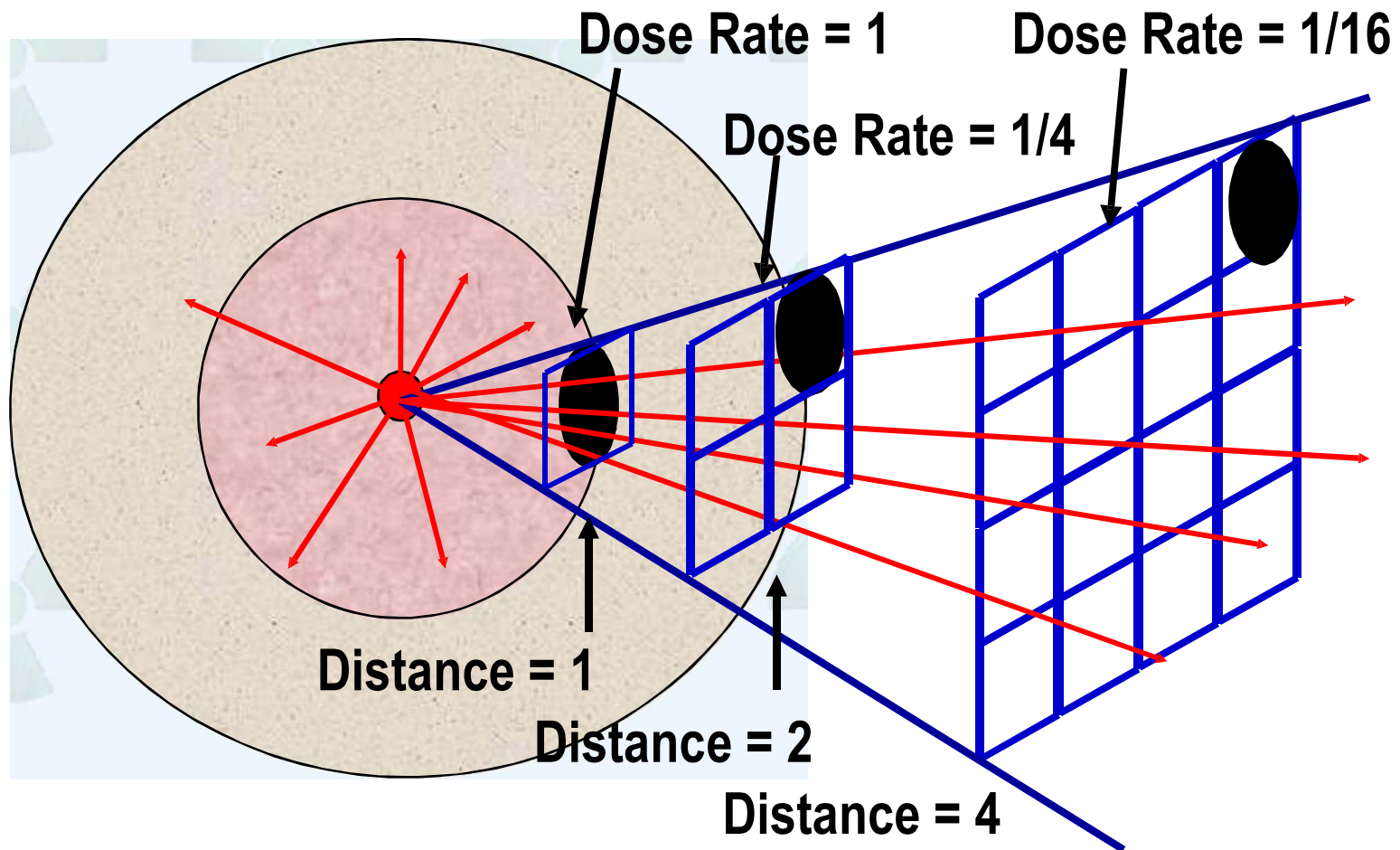
- TIME - minimize the time spent receiving a dose
 - Plan you experiment and have all materials present before introducing RAM
 - Work methodically and at a good pace but don't rush as this could cause accidents
 - Put stocks away soon after you are finished with them

As Low As Reasonably Achievable (ALARA)

- DISTANCE – keep as much distance between you and the source as possible
 - Doubling the distance from the source reduces the dose to one quarter
 - Set stock vials away from you when not handling them
 - Use tongs or tweezers to hold containers when feasible
 - Store waste in a low traffic area



Inverse Square Law



As Low As Reasonably Achievable (ALARA)

- **SHIELDING – block radiation with a suitable material**
 - Use an appropriate material at an adequate thickness to stop radiation.
 - Protects your body when working and protects those nearby from stocks or waste.
 - High energy beta emitters (^{32}P) – plexiglass (1cm)
 - Gamma emitters (^{125}I) – lead (sheets, foil or bricks)
 - Put vials back in protective packaging, such as plastic vials or lead foil, when finished.

Security

- Radioactive material is only to be used by those who are authorized by OLS.
- RAM must never be left unattended, rooms must be locked and RAM must be locked in a fridge or cabinet.
- Access must be limited to those who have a need to be there and all must wear identification
- If someone is not wearing a badge ask if you can help them and direct them and escort them to the front desk for assistance.
- Report any suspicious activity to security



Procedure if Individuals are Contaminated

If you find personnel contamination, take the following steps:

1. Have someone call OLS, 4-8258
2. Remove clothing that is contaminated (take measures for modesty if someone must disrobe)
3. Start washing area.
4. Complete a GW incident form and submit it to MC safety. Medical treatment is available if necessary



Decontamination



To decontaminate skin:

1. If a large area, wash with mild soap and water right in the sink.
2. If only a small area, use a wet towel and mild soap to start decontaminating.
3. Check towel with meter.
4. Avoid spreading the contamination to other areas.

Decontamination



Don't scrub contaminated area!

Your skin turning red is a way of letting you know to stop

DO NOT USE ANYTHING EXCEPT MILD SOAP!

Emergency Contacts

Office of Laboratory Safety

4-8258

labsafety@gwu.edu

Also check “NRC Notice to Employees” posted in the radiation use and storage areas

More Information

- Refer to the NRC REGULATORY GUIDE 8.29 on "Instruction Concerning Risks from Occupational Radiation Exposure," and NRC REGULATORY GUIDE 8.13 on "Instruction Concerning Prenatal Radiation Exposure". These documents are available from the Office of Laboratory Safety (call 202-994-8258).
- The OLS will provide confidential advice to those who are pregnant. A pregnant person need not declare their pregnancy in order to receive this advice.

Questions?