



UC IRVINE RADIATION SAFETY FACTSHEET

The purpose of this *Factsheet* is to acquaint UC Irvine personnel who work in radioisotope laboratories with basic EH&S radiation safety regulations and guidelines in a concise manner. More complete information can be found in the **UC Irvine Radiation Safety Manual**: www.ehs.uci.edu/programs/radiation/Radiation%20Safety%20Manual%20June03.pdf

RUAs

A **Radiation Use Authorization (RUA)** gives the **Responsible Principal Investigator (RPI)** permission to use specified radioisotopes in particular experiments performed by authorized, trained individuals in specified locations (rooms) while taking specified precautions. Deviations from the conditions spelled out in the RUA (using unauthorized radioisotopes, rooms, personnel, etc.) are not allowed unless EH&S is first notified and approves the changes. *[Further references to the PI in this Factsheet will mean the Responsible PI in whose name the RUA was approved by EH&S.]*

RADIATION SAFETY TRAINING

Radiation Safety Part I training must be taken *prior* to starting work with radioisotopes. This course is available online at the UC Irvine Training & Employee Development website (www.ted.uci.edu). Several required forms are downloadable as attachments from the online course. These include the *Statement of Training & Experience*, the *Prenatal Policy and Form (for women only)*, the *On-the-Job Training Form* (see page 2 of this factsheet), and the *Dosimetry Badge Request Form*. Only those people who work with individual vials containing 5 mCi or more of ^{32}P or ^{125}I , those using high-energy gamma ray emitters such as $^{99\text{m}}\text{Tc}$ or ^{18}F , and those working in the Brain Imaging Center and Nuclear Reactor Facility need to submit a *Dosimetry Badge Request Form* to EH&S. Radioisotope work may begin as soon as the online course is completed and EH&S receives the *Statement of Training & Experience*, the *Prenatal Policy and Form*, and the *Dosimetry Badge Request Form*, when applicable.

Radiation Safety Part II training is required within 6 months of starting work with radioisotopes. This is a 90-minute classroom-type course presented at EH&S that provides more in-depth information about radiation safety than was presented in the online course. Radiation Safety Part II training is offered 6 times per year with registration also at www.ted.uci.edu.



All personnel who will be using radioisotopes on the UC Irvine main campus must be registered as authorized users and receive radiation safety training here. This includes undergraduate students who have attended Biological Sciences 194S, UC Irvine Medical Center personnel, temporary and long-term visitors from other UC campuses and from non-UC universities and facilities, and even personnel who will only be conducting wipe tests in research laboratories and not directly handling any radioisotopes.

In addition, EH&S must be notified immediately when an individual who has completed EH&S radiation safety training and has registered as an authorized user under one RUA starts to work with radioactive materials under another RUA and needs to be registered under that RUA.

The PI must train each of his/her staff members regarding the radiation safety aspects of the ***specific procedures*** that they will be performing with radioisotopes and document this training by completing the previously-mentioned **On-the-Job Training Form** for each such staff member. These forms must be returned to EH&S within one month after the start of work with radioisotopes. In addition to being a downloadable attachment from the *Radiation Safety Part I* course, the form can also be downloaded at this link:

<http://www.ehs.uci.edu/programs/radiation/radtrain.html>

☞ Never be embarrassed to ask questions of EH&S personnel, your PI, or more experienced persons in your laboratory. It is much better to ask what you believe might be a foolish question than to have a major accident involving radioactive materials in your laboratory.

To obtain more information regarding radiation safety training, call 949-824-6200.

SECURITY

Rooms in which only very small quantities of radioisotopes are used or stored are subject to **normal building security procedures**. This means keeping these rooms locked whenever they are not occupied except for very brief absences (while using the restroom, etc.).

If more substantial quantities of radioisotopes are present, such as individual vials with 1 mCi or more of P-32 and/or I-125 or 10 mCi or more of H-3, C-14, P-33, and/or S-35, the room access doors must be locked at all times that the room is not occupied (*even for short absences*) unless the sources are further secured in non-removable (physically secured) storage containers like **locked refrigerators or freezers, locked cabinets or drawers, etc.** Radioisotopes of these quantities also need to be kept in secured storage containers when they are stored in large multi-user laboratories. Alternatively, they can be stored in other rooms under the sole control of the PI. **Radioactive materials must never be left unattended in unsecured locations such as hallways, loading docks, etc.**

POSTING AND LABELING

The doors to all rooms in which radioactive materials are used or stored must be labeled with EH&S-provided stickers/signs that read "Caution -- Radioactive Material".

All radioactive material work areas must be labeled with radiation caution tape. In

addition, all radioactive material storage areas (hoods, freezers, etc.) must be labeled with EH&S provided radiation caution stickers. Keep all items (beakers, pens, pipettors, test tubes, microcentrifuges, etc.) which are potentially contaminated, and therefore labeled with radiation caution tape, in labeled radioactive material use areas.

Ensure that radiation safety signs and labels do not get obscured by placing/posting other items over them.

CLEAN AREAS

Clean Areas are regions within laboratories that are free of radioactive materials, biological agents, chemicals, and other hazardous materials. If they are labeled with EH&S-provided "Clean Area" signs, beverages and food may be kept and consumed at these locations. **No food (lunches, ice cream, etc.) or beverages must ever be stored in refrigerators or freezers used to store hazardous materials such as radioisotopes, chemicals, or biohazardous agents – even for very brief periods of time.** In addition, Clean Area waste (lunch bags, coffee cups, etc.) must be placed into trashcans inside the Clean Areas – not into radioactive waste boxes or other lab waste receptacles in the lab.

Clean areas must be separated by at least 3 feet or by a physical barrier/partition from other laboratory areas. They are not to be used as safe havens for food and beverages to be consumed while you are handling radioactive material in other areas of the laboratory. Finish your radioisotope work, remove your potentially-contaminated safety attire, *wash your hands*, and then you can safely consume food and beverages. A radiation survey meter can also be used to verify that you are not contaminated with radioactivity (*not possible for H-3*) before entering a Clean Area.

If you have any questions regarding the suitability of a location in your laboratory for establishing a Clean Area, contact EH&S for advice.

RADIATION SHIELDING

Use appropriate shielding for all radioactive materials work, storage, and waste areas:

H-3, C-14, P-33, S-35 -- No shielding needed. *Betas stopped by outer dead layer of skin.*

P-32, Cl-36 -- Use 0.5 inch Lucite shielding. *More penetrating betas emitted.*

I-125 -- Use thin (1 mm thick) lead shielding. *Low energy gammas emitted.*

F-18, Cr-51, Tc-99m -- Use thick (≥ 0.5 inch) lead shielding. *High-energy gammas emitted.*

SURFACE CONTAMINATION CONTROL

Absorbent, plastic-backed paper (*with the paper side up, plastic side down*) must be placed on all surfaces upon which radioactive materials will be used or stored. When it gets contaminated or damaged/torn, it must be replaced.

All manipulations in which radioactive aerosols or gases can be emitted (I-125 iodinations, etc.) must be performed in a properly operating fume hood such that the radioactive effluents are captured and disposed of as radioactive waste. Make sure that the fume hoods have been checked

and certified to have sufficient airflows within the past year by EH&S. If they have not been checked, call the Industrial Hygiene Section of EH&S at 949-824-6200.

Remember that all items used in manipulations with radioactive material such that they can become contaminated must be labeled with radiation caution tape and kept in labeled radioactive material work areas. Inscribe the name of the radioisotope on the tape for large disposable items such as plastic beakers, etc. That will assist in determining into which waste box they will eventually need to be placed.

Sinks must never be designated as radioisotope use areas since disposing of radioisotopes down the drain into the sanitary sewer system is strictly prohibited. *The Irvine Ranch Water District reclaims waste water and uses it to irrigate community areas such as greenbelts.*

PROTECTIVE ATTIRE

Individuals handling radioactive materials must be wearing buttoned lab coats and impermeable disposable gloves. In addition, long pants and closed-toed shoes (no sandals or thongs) must be worn to protect portions of the body below the lab coat in the event radioactive materials are dropped, spilled, or splattered. *These items must be worn even in the summer months when it is hot!* It is highly recommended that chemical eye protection/safety glasses be worn as well.

One means of avoiding the spread of contamination is to change your gloves frequently while performing experiments with radioisotopes. Whenever you suspect that your gloves are significantly contaminated, change them promptly.

It is much easier to simply remove contaminated attire than to scrub your legs or between your toes with a coarse brush to remove spilled radioactivity. Wearing sufficient protective attire is the best way to avoid that problem.

Never carry radioactive material on your person (in your lab coat pocket, etc.)!

RADIATION AND CONTAMINATION MONITORING

Areas in which radioactive material is used must be checked for contamination at least every 30 days or whenever contamination is suspected. [NOTE: You do not need to check sealed radiation sources (Ni-63, etc.) or the areas in which they are used for contamination; EH&S performs these checks.] This entails performing a **wipe (swipe) test and a Geiger counter scan** of **all appropriate rooms/areas** and retaining the records of the wipe test counts and Geiger counter scans with your radiation safety records. **Make sure that a background/blank wipe test sample is counted and identified in the monitoring records. Areas and items contaminated more than 3 times background must be decontaminated.** Ideally, an area scan with a Geiger counter will be performed following each radioisotope experiment to ensure that the areas involved are not significantly contaminated. Check the battery charge status prior to each use of a Geiger counter.

EH&S will visit your laboratory approximately every two years to perform a calibration or operational check of all of your Geiger counter to ensure that they are functioning properly. Your

laboratory or department is responsible for ensuring that the contamination monitoring results obtained using your liquid scintillation counter or gamma counter are reasonably accurate.

During extended periods in which radioactive material is stored but not used, wipe tests of work areas need not be performed. However, storage areas, including refrigerators, freezers, and radioactive waste areas, must be checked for contamination (leakage, etc.) at least every 90 days and records of these tests retained with your radiation safety records. ***"No use" statements indicating that no radioisotopes were used in the laboratory during such periods must be written into the monitoring records every 30 days.*** Once all radioactivity has decayed or been disposed of as waste, contamination monitoring and no-use statements are no longer required.

RADIATION DOSIMETRY

Individuals handling considerable quantities (≥ 10 mCi at a time) of radioisotopes such as P-32 or I-125 or who are working with high-energy gamma emitters (≥ 1 mCi) or gamma irradiators are provided with radiation dosimeters by EH&S. Often, only dosimeter rings will be assigned. In some cases, dosimeter body badges will be assigned. Check with EH&S for more information.


Assigned dosimetry must be worn at all times that significant quantities of the radioisotopes for which they were assigned are used. The dosimetry cannot be worn by any individual other than the one to whom it was assigned (the person whose name is inscribed upon its label). Do not store dosimetry in areas where it can be exposed to radiation. Store it well away from radioactive material use and storage locations, preferably in a Clean Area or office.

At the end of a monitoring period (normally 3 months), new dosimetry will be mailed to your laboratory. Return the dosimetry for the just-ended monitoring period to EH&S in a timely manner. You can use the same bag in which the new dosimetry arrived for this purpose.

ACQUISITION OF RADIOACTIVE MATERIALS

Only radioisotopes listed on your PI's RUA may be purchased, and only in the quantities and chemical forms specified. This is due to the fact that radiation safety measures required in a laboratory are directly related to the types of radioisotopes purchased, the quantities purchased, and how the materials will be used.

All purchase order forms must contain the PI's name. *If a package arrives without the PI's name, it frequently requires a great deal of time for EH&S to track down the lab to which the package belongs sometimes resulting in a substantial delay in the lab receiving it.*

 All radioisotope shipments must be addressed to:

UC Irvine
EH&S/Radiation Safety
Attention: Name of PI
4600 Health Sciences Road
Irvine, CA 92697-2725

EH&S delivers radioisotope packages to campus in accordance with the schedule below. Laboratory personnel will be informed of the package delivery locations when they are notified that a package has arrived for their research group/PI:

- Biological Sciences, Physical Sciences, and Social Ecology laboratories: 2:00 – 2:25 pm
- Medical Sciences laboratories: 2:30 – 2:55 pm

From 3:15 – 5:00 pm, packages not picked up at the loading docks will be available at the EH&S Services Facility (call 949-824-6200). Alternatively, arrangements can be made to deliver your package the following workday.

Radioactive material packages are logged into campus inventory records and checked for contamination prior to EH&S delivering them to campus labs. Both the internal vials and the outer shipping boxes are checked. If anything is contaminated, your laboratory will be informed.

After EH&S is finished logging in and checking your package for contamination, your laboratory will be notified by phone that a package has arrived for you. **Please wait for us to call you; as soon as your package is ready and known to be contamination-free, we will contact you.**

If you receive a radioactive package directly from a delivery company (FEDEX, DHL, etc.) before it has been inspected by EH&S, please call us right away at 949-824-6200 – ask for Radiation Safety. We will pick up your package, log it into our inventory system, and check it for contamination. We can return the package to you later the same day.

If it has been more than 30 days since we have inspected your contamination monitoring (wipe test) records, you will be asked to bring your most recent wipe test results with you when you pick up the package. If you fail to do so, you could leave empty handed.

RADIOACTIVE WASTE DISPOSAL

All radioactive waste must be disposed of through EH&S. This waste must be segregated by radioisotope and stored in EH&S-provided containers that are labeled with the name of the radioisotope contained. Make sure that you dispose of radioactive waste promptly once containers are full – do not accumulate full waste containers in your laboratory. EH&S provides all primary radioactive waste containers free of charge (not including waste container shielding). Call **949-824-4862** to request radioactive waste containers as described below.

Dry solid waste (gloves, paper, etc.) must be disposed of in EH&S-provided 2 ft³ cardboard waste boxes with thick plastic liners (DO NOT USE OTHER LINERS such as red or orange biohazardous/infectious waste bags). Liquid waste must be disposed of in either EH&S-provided 1-gallon plastic-lined glass bottles or 2.5-gallon plastic jugs. **Full scintillation vials are disposed of in 1.5 ft³ plastic-lined cardboard boxes.** Never place radioactive waste into normal trash containers.

Liquid waste containers must be kept capped unless waste is actively being added to them,

and they must be stored in **secondary containment** (plastic pans, etc.) of sufficient size to contain a spill or leak.

Radioactive sharps must be placed into labeled, puncture-proof screw-top containers (such as plastic or glass bottles) that can be subsequently placed into radioactive waste boxes for disposal. Avoid using soda cans for sharps since these are not considered to be sufficient. **Call EH&S regarding the disposal of radioactive biological materials such as animal tissue and contaminated animal excreta.** Disposal of radioactive animal waste can be expensive.

All radioactive waste must be labeled with the following: the name of the RUA holder/PI, the date, and the radioisotopes contained (types and amounts). Liquid waste must also be labeled with the chemical forms and quantities of the waste (buffers, etc.). Call EH&S for guidance before generating organic solvent-based radioactive liquid waste since disposal of this type of “mixed” waste is very expensive!

When you request an EH&S pickup of radioactive waste from your laboratory by EH&S, it must be ready for disposal. Liquid waste must be in the proper containers, the containers must not be filled to the brim (leave a couple of inches or more at the top for expansion of the liquid with temperature), and the containers must be labeled correctly. **The pH of liquid waste must be between 7 and 11.** Waste boxes need to be labeled properly and sealed with strapping tape or the equivalent. Containers that are not adequately prepared will not be picked up at the scheduled time.

The disposal of radioactive waste containers with short-lived radioisotopes (with half-lives less than 90 days such as P-32, S-35, I-125, and P-33) is relatively inexpensive. Those containers can be stored by EH&S for the decay of the radioisotopes. However, the disposal of containers with long-lived radioisotopes, such as H-3 and C-14, is much more expensive. **Do not mix long-lived and short-lived radioisotopes in waste containers.** This will end up costing your PI considerably more money.

The radioactive waste recharge rates charged by EH&S are at:

<http://www.ehs.uci.edu/programs/enviro/05-06%20Recharge%20Rates1.pdf>

To arrange for EH&S to pick up radioactive waste, go to <http://www.ehs.uci.edu/apps/waste/radcollect.jsp>. For general radioactive waste-related questions or information, please call 949-824-4862 or 949-824-4557.

All containers for radioisotope vials which contain lead (known as lead “pigs”) can be disposed of through EH&S by saving these containers in a cardboard box or plastic bag and giving them to EH&S personnel at the time of a waste pickup from your laboratory. At the present time, there is no additional charge for this service. Radioactive contamination monitoring of these lead “pigs” must be performed by laboratory personnel prior to their release to EH&S. If they are found to be contaminated, they must be cleaned prior to disposal.

Empty radioisotope vials and PLASTIC vial containers (plastic “pigs”) can be disposed of in

the 2 ft³ cardboard dry waste boxes provided by EH&S.

Boxes in which radioactive shipments were received do not need to be disposed of as radioactive waste unless they become contaminated. Once all of the "radioactive" symbols and inscriptions are defaced, the boxes may be disposed of in the regular trash. This goes for anything containing the radiation symbol or related inscriptions such as radiation tape, etc. Never place such items into normal trash without defacing the labels, and only if they are not contaminated.

More in-depth information on radioactive waste disposal can be found at:
<http://www.ehs.uci.edu/programs/enviro/rwasteguidelines.html#segregation>

RADIOISOTOPES IN LABORATORY ANIMALS

The use of radioisotopes in live animals must be authorized by EH&S (the use of cells and tissue cultures do not require this special authorization).

Vivarium personnel who will be handling radiolabeled laboratory animals must be trained in radiation safety. All cages containing radiolabeled animals must be properly labeled. The doors to the rooms containing these cages must also be labeled. Properly decontaminate the cages once the radiolabeled animals are removed from them.

Since the excreta (urine and feces) from radiolabeled animals are frequently radioactive, the excreta must be handled/disposed of as radioactive waste. Segregate this waste from other dry waste as it is considered to be biological waste in addition to radioactive waste. Call 949-824-4578 for more information.

RADIATION SAFETY RECORDS

These records must be maintained in a neat and orderly fashion and must be available for inspection by EH&S personnel and off-campus regulatory agencies. ***Be sure to maintain all radiation safety records going back at least 3 years.***

All the persons in your laboratory need to know their location, in case the person who primarily manages the records is unavailable when your laboratory is visited by EH&S or outside regulatory inspectors.

Contamination Monitoring Records

These must be in chronological order, and must contain the date, a map or description of the areas monitored (one map at the front of the monitoring records is sufficient), and the counting results (normally an LSC or gamma counter printout). Also, include evidence that areas found to be contaminated more than 3 times background have been cleaned and re-wiped to verify that the contamination has been removed. The signature or initials of the person performing the wipe test is also required. Records of Geiger counter scans performed at the time of the wipe testing must also be included in the records.

Receipt, Use and Disposal Records

Whenever your lab receives a radioactive shipment, an entry must be made in your receipt log that includes the name of the radioisotope received, the quantity received, and the date it was received. The chemical form received (ATP, protein, thymidine, etc.) is also useful for your own tracking purposes.

When aliquots are removed from vials containing radioactive materials, a dated entry into a **radioisotope use log** needs to be made which indicates the quantity removed by volume (in "lambda", μ l or ml if the specific activity [e.g., mCi/ml] is listed) and/or in radioactivity units (μ Ci, mCi). Use logs are frequently posted on the doors to the refrigerators/freezers in which the vials are stored.

Copies of radioactive material waste/transfer forms must be maintained and kept with your radiation safety records. **Print a copy of your online waste pickup request form prior to hitting the "send" button.**

Semiannual Radioisotope Inventory Updates

Radioactive material inventories must be updated at least every 6 months online by logging into **CiBR-Trac** at the website below. *EH&S sends email reminders about CiBR-Trac to all PIs every January and July to indicate that an inventory update is due:*

ucirvine.ecompliance.net (no www!!), or through the EH&S website (www.ehs.uci.edu; at upper right)

Indicate the vials that were disposed of or for which the radioactivity has decayed to background since the previous inventory update. Radioactive decay calculations are incorporated into CiBR-Trac and are effected when inventory changes are saved by the person updating the inventory. As noted above, **updates of the CiBR-Trac inventories are required every January and July (i.e., every 6 months) following a reminder email message sent to all RPI's by EH&S.** Printouts of the updated inventories (after changes are saved) must be retained with the other radiation safety records in the laboratory.

If you have any questions regarding the CiBR-Trac program, contact Debbie Hamano at 949-824-1081 or Dick Sun at 949-824-2188.

EMERGENCY PROCEDURES

Personnel Contamination

If a person in your laboratory becomes contaminated with radioactive material, make sure that he/she does not panic. **The quantities of radioisotopes used in almost all of the laboratories on campus are small enough so that no health effects at all should be produced provided that the contamination is removed reasonably quickly.**

Remove all contaminated items of clothing. Wash contaminated skin areas (use a Geiger counter to assist in this determination – except for H-3 contamination) with **cold water and a non-**

abrasive soap. Don't worry about contaminating a sink or shower -- these can be cleaned later. Notify EH&S as soon as possible (949-824-6200, 949-824-6098, or 949-824-1081).

Laboratory Contamination

Isolate the contamination to prevent its spread. For small spills, clean it up with a product like "409" and paper towels. Expensive cleaners such as *Radiacwash*® are not needed. Verify the area is decontaminated using a Geiger counter and a wipe test.

For large spills, or spills involving high radiation exposure rates, notify EH&S immediately and assistance will be dispatched.

For after-hours or weekend/holiday emergencies, call the UC Irvine Police (x911 from a campus phone, or 949-824-5222 from a cell phone); the Police will notify appropriate EH&S personnel.

Radioactive waste generated during spill cleanup (paper towels, rags, etc.) must be placed into the appropriate radioactive waste box. Personal items that become contaminated such as lab coats can be placed into plastic bags and stored for decay in a safe area (label the bag with radiation caution tape and the radioisotope name), or disposed of as radioactive waste.

CONCLUSION

A good way to avoid safety problems of all types, including spills of radioactivity, is to establish good "housekeeping" practices in your laboratory. Cluttered laboratories can present a variety of problems including cramped workspaces, the need to place open containers of hazardous materials near the edge of the work bench, etc.

We are all responsible for radiation safety here at UC Irvine: EH&S, PIs, and the staffs of the radioisotope labs. If we all do our part, radiation safety problems will not develop.

We in the Radiation Safety Division at EH&S consider ourselves to be radiation safety advisors, doing what we can to ensure that radioisotopes are used safely in your lab. We visit research laboratories either two or four times per year but you are there almost every day. You are the first line of defense against safety problems. Please feel free to call us if you have any radiation safety concerns or questions.

If you have any questions regarding any of the material presented in this *Factsheet*, please call the Radiation Safety Division of EH&S (949-824-6200, 949-824-6098, or 949-824-1081).

