Radioactive Waste

For more information, refer to the Radiation Safety Manual, 2017 RSP-3 and the Quick Step for waste in the radiation safety records binder.

What is the riskiest part of using radioactive materials?

Waste handling is the riskiest part of the whole procedure.

- Improperly packaged waste can leak in the lab, on the way to its final destination or while it decays in storage.
- If your waste is not labelled or packaged correctly, when you are not there. Other workers may move it or spill it.
- When fire fighters, sprinklers or burst pipes pour water over your lab, could your radioactive waste be spread around? Improperly labeled waste could be disposed of incorrectly harming the environment or causing workers to be exposed to hazards.

Everyone working with radioactive material is trained to work safely. It is critical that the same care and control used for the experimental procedure continues when sorting and packaging waste. Each individual is responsible to use reasonable care to protect themselves, fellow workers, ancillary staff (Physical Plant), safety staff and the environment.

Why is it important to record information on the radioactive waste tag?

Complete information on the radioisotope, the chemical form and the concentration of liquid waste, volume or weight and the activity (MBq) (amount of radioisotope in your waste) must be documented on the radioactive waste tag. This information is important because:

- EHS staff needs to know how to protect themselves and reduce their radiation exposure when treating your waste.
- EHS needs to know what the waste is so they can access a (M)SDS – especially if an emergency situation occurs while handling, transporting, or storing your waste.
- EHS also needs to know the volume or weight of the waste and the activity in the container to dispose it legally in accordance with the University licence and to facilitate reporting requirements.

To ensure safety of yourself and others, and meet compliance – take care to sort, package and record information on the radioactive waste tag properly.

What do I need to do first?

Before starting an experiment, an important part of pre-planning is to consider what type of waste you will be generating.

- All waste generated in the laboratory from the use of radioactive material shall be segregated, contained and labelled. For example, the gloves used to handle radioactive materials or containers of radioactive material can only be disposed as ‘radioactive waste’.
    - *It would be incorrect to place them in a waste container that is emptied by caretakers! Caretakers move their carts through many areas and combine waste generated by many people including people that are not trained to work in a lab. Even sealed bags given to caretakers could become ripped putting them and others at risk.*
    - *EHS collects all waste generated by work with radioactive material to ensure specific disposal limits are not exceeded and to maintain comprehensive records to demonstrate compliance for all users.*

- Once you start to work with radioactive materials you will need to have already assembled containers for all the anticipated waste. At a minimum:
    - You will need a container to dispose of gloves and paper towels.
    - You should have a container for liquids. It is critical that the container be big enough for the liquids you generate during the procedure and that it is resistant to the chemicals you are using.
    - If you will use sharps (needles, blades, tips) you need to have a puncture proof container *and there are more details regarding sharps disposal below.*
    - At the end of the experiment, you will need to dispose of the used under pads or bench cover.

- It is important to consider if mixed waste with a biological or chemical hazard as well as radioactive materials will be generated. This may need special consideration. Talk to EHS before combining radioactive materials with other hazardous chemicals or biohazards.
- Refer to the *Waste Disposal Chart for Radioisotope Laboratories* posted in your lab. This will help you choose the appropriate container(s) (type and size).
- Shield the waste if required.
- Use secondary containment for all liquid waste stored on the floor or in a cupboard. Secondary containment controls leaks and keeps waste together if the overhead sprinklers or firefighters spray water into the lab.
- Consider the chance of the container being knocked over – big funnels or layers of soft absorbent pads underneath have caused spills in the past.
- Empty any temporary waste containers on the lab bench and close all containers with radioactive waste before you step away from the work area.
- Label the secondary containment and/or shielding for the waste with the striped tape and attach the radioactive waste tag to the waste container or shielding.

What is an Incidental Release?

- Water used to wash glassware, after being used with radioactive material, may be flushed down the designated lab sink (label with the striped tape), no need to collect.
- No record keeping is required but the sink used for the above should be monitored for contamination
- Hands are to be washed after in the hand washing sink.

How are liquid wastes from radioisotope procedures collected?

- Use a wide mouth, high-density polypropylene container (HDPE) or 10 L barrier pack (NO glass) with a lid that fits. These containers are chemically resistant, can last a long time (to allow for decay) and are easy for you to fill and for EHS to empty.
- Attach the radioactive waste tag to the container with string (tape dries out and tags fall off). List the hazardous chemicals present (e.g. 20% methanol, bleach, ultima gold scintillation fluid) and these tags are kept as records so attaching with string is secure during storage and unlike tape, allows the tag to easily be removed and filed.

- To allow appropriate handling and disposal of the chemical hazards, use separate containers for different types of liquids. Separate aqueous (buffers), scintillation fluid and halogenated solvents (chloromethane, brominated chemicals).
- If possible, keep radioisotopes separate. The exception is liquid scintillation fluid used for wipe testing to detect contamination for a variety of radioisotopes.
- Avoid solid objects such as tips, paper or scintillation vials in the liquid waste (use a funnel with a screen or a faucet aspirator). Solids in liquid containers may create splash hazards or plug pipes when wastes are processed. It is very expensive for the University to dispose of liquid chemical wastes that contain solid objects.
- Containers can be filled to a maximum of 90% of their capacity, do not overfill as this can lead to leaks from expansion or during transport. It is also challenging to pour, without spilling, a container that is overfilled.
- Secondary containment is required if the waste is stored on the floor or in a cupboard.

How do I collect the solid waste from radioisotope procedures?

- Use a sturdy cardboard box lined with a clear plastic bag (double bag for wet solids).
    - Wet solid is the empty scintillation vials and the materials used to clean up a spill and once collected, contact EHS to dispose of promptly. Keeping wet solids in a plastic lined box for too long can result in leaks.
    - Dry solid is gloves, paper towels, tips, blue pads, tubes and can be collected in a container for up to six months in your lab.

- Attach the radioactive waste tag with one piece of tape at the top, do not tape over the whole tag, EHS has to remove and retain the tag for recordkeeping.

- Remove or deface radiation warning labels before you place the item in the solid waste container. Once the package has decayed, it will go to the landfill and it would be unsafe to open your box of lab waste to deface items inside. If items with radiation warning symbols are found in the landfill, they may be investigated to ensure they are not a hazard and if they can be traced back to the University, we would get the bill for the investigation.

- Keep radioisotopes separate if possible as they have different half-lives as they would need to be stored for different lengths of time. One exception would be empty scintillation vials used for wipe testing. Even if these contain a variety of radioisotopes, they can be combined together.

What do I do with the stock vials or kits?

- Keep stock vials in their original container.
- Return kits in the original package.
- Do not empty contents of stock vials or kits into liquid waste.
- Do not dispose stock vials or kits into solid waste.
- Return to EHS with the corresponding gold sheet (keep a copy on white paper for your records).

How do I collect radioactive sharps?

- Do not use a biohazard sharp container. (Biohazard container could inadvertently be autoclaved and we never want to autoclave radioactive waste as this could spread radioactive contamination.)

- Use a puncture proof container with a secure lid.
- Sharps include needles, blades, broken glass.
- Do not overfill container.
- If sharps came into contact with blood or other biohazard agents, treat with bleach prior to disposing in the container (more details below).
- Keep radioisotopes separate if possible.
- Attach waste tag with one piece of tape or string.

What if the radioactive waste also has a Biological hazard?

Radioactive waste should NOT be autoclaved! Care must be taken when work involves both potentially infectious and radioactive materials. Plan ahead!

Most experimental procedures follow this standard procedure:

Standard Waste Procedure for radioactive waste involving Cell Culture, Blood, or Bacteria

Never autoclave mixed Rad-Bio waste.

Rad-Bio Liquid waste

- Keep pipette tips out of the liquid waste (no solid material in the liquid waste).
- Treated (bleached) liquid will be disposed of as radioactive liquid waste through EHS.
- Label with the Radioactive Waste Tag. Clearly indicate in the Chemical/Biological Components section of the waste tag the decontaminating product and concentration.
- Liquids such as the cell culture medium containing radioactive materials will be treated with 20% household bleach (1 part household bleach to 4 parts liquid waste, final concentration 1.05% of NaOCl) unless there are other chemical hazards. For example, NEVER use bleach with radioiodines.
- Biologically hazardous samples (risk group 1 and 2) mixed with Liquid Scintillation Fluid are effectively disinfected. Never add bleach to Liquid Scintillation Fluid. Adding bleach to Liquid Scintillation Fluid may create other hazards.

Rad-Bio Solid waste

Solid waste (dry, wet and sharps)

- Dispose through EHS.
- Label with the radioactive waste tag and indicate how the biological component was treated.
- Solid materials must be separated from liquid (use a large sieve).
- Collect dry and wet solid waste separately in clear bags (double bag for wet solids). Do not use red or orange biohazard bags. Package securely in a box prior to disposal to EHS.

Gloves or paper towels that are incidentally contaminated with biological and radioactive agents may be bagged and boxed as Dry Solid Radioactive Waste.

Pipettes, pipette tips and empty assay vials (flasks, petri dishes) formerly in contact with radiological-biological liquid will be soaked in 20% household bleach (rinsing fluid) for 20 min. Discard the rinsing fluid (see bullet below) and dispose as wet solid radioactive waste.

Syringes and needles Draw 20% household bleach into the syringe and needle, and soak for 20 minutes. Discard the rinsing fluid (see bullet below), then place syringe and needle in a puncture proof container (not a biohazard sharp container) and dispose as radioactive sharps waste.

Used rinsing fluid (20% household bleach solution) may be flushed down the sink designated (labelled with the striped tape) for radioactive use. Such rinsing fluid may be released without any record keeping but you should monitor the sink for contamination.

This approval is limited to work with Biologicals in Risk Group 1 and 2.

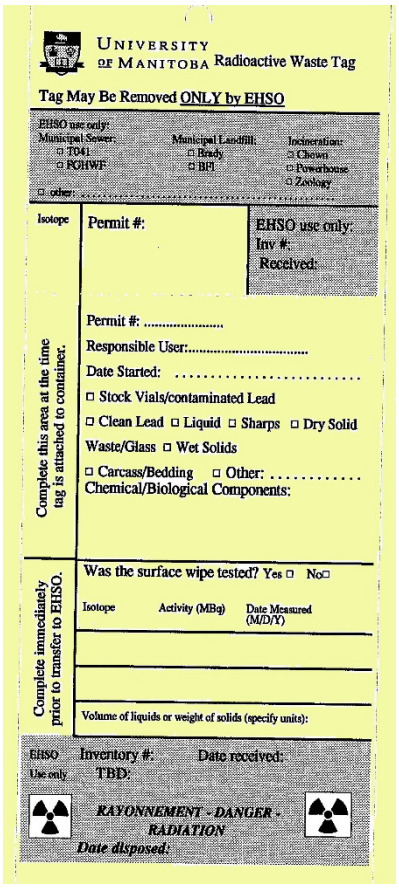
Experiments involving laboratory animals are not covered by the standard procedure.

Radiological-Biological Waste Approval (RBWA) is required

- Whenever a procedure in a lab or a biological agent deviates from the standard procedure above, a written procedure for mixed Radiological-Biological waste decontamination must be developed to mitigate the potentially infectious hazard and approved by EHS prior to beginning the experiment.
- Whenever animals are involved, you need a Radiological-Biological Waste Approval for all incorporations of radioactive material into animals (healthy or not). You must have prior written EHS approval of the intended waste handling or disposal procedure (carcasses and bedding).
- The approved waste disposal procedure will be referenced on the current Internal Radioisotope Permit (Section 5, Approved Usage) and available in the lab's Radiation Safety Manual behind the divider Permit Specific Safe Work Procedures.

Why is the Radioactive Waste Tag so important?

- The tag indicates the type of hazard to all personnel.
- These waste tags are official records from your lab. EHS is required to keep them for 8 years for CNSC inspection.
- The information on the tag is used to comply with CNSC disposal limits, to determine the disposal method and to keep waste handlers safe.


University of Manitoba Radioactive Waste Tag

Tag May Be Removed ONLY by EHSO

EHSO use only:
Municipal Sewer: □ T041 □ FOHWF
Municipal Landfill: □ Brady □ BPI
Incineration: □ Chown □ Powerhouse □ Zoology
□ other: .....

Isotope | Permit #: | EHSO use only: Inv #: Received:

Complete this area at the time tag is attached to container.

Permit #: .....
Responsible User:.....
Date Started: .....
□ Stock Vials/contaminated Lead
□ Clean Lead □ Liquid □ Sharps □ Dry Solid Waste/Glass □ Wet Solids
□ Carcass/Bedding □ Other: .....
Chemical/Biological Components:

Complete immediately prior to transfer to EHSO.

Was the surface wipe tested? Yes □ No□

Isotope	Activity (MBq)	Date Measured (M/D/Y)

Volume of liquids or weight of solids (specify units):

EHSO Use only | Inventory #: TBD: | Date received:

RAYONNEMENT - DANGER - RADIATION

Date disposed:

Upper part of the waste tag is filled in before waste is collected

- Record the radioisotope, permit #, responsible user and date started.
- Check off the type of waste.
- Indicate type of liquid and chemical name in full for EHS to access a MSDS (e.g.: Scintisafe scintillation fluid, buffer containing 30% Methanol).
- Indicate if biological liquid waste was treated with bleach and indicate concentration (20% bleach treated cell media).

Lower part of tag is filled in before disposal

- Surface wipe test the outside of containers to ensure there is no removable contamination and check the box (refer to RSP-3, Section 10 & 12).
- Indicate the radioisotope.
- Record the activity of the contents in MBq (this indicates the amount of radioactivity in the waste), this cannot be determined using a meter.
- Record the date measured (Liquid waste) or estimated (Solid waste).
- Indicate volume of liquid waste or weight of solid waste.

How do I determine the activity in my radioactive liquid waste?

- Take a 1 ml sample, add scintillation fluid until the vial is at least half-full and count it on the Liquid Scintillation Counter. (If the waste is scintillation fluid, you can count the volume needed to half fill the vial!)
- If the liquid scintillation counter reports the activity of the liquid waste in counts per minute (cpm), subtract the background reading and divide the number by the efficiency for the measured radioisotope to obtain dpm (disintegrations per minute).

Typical efficiencies for most liquid scintillation counters

H-3……20-60%	C-14, S-35……80-97%
Cr-51……35%	I-131……70%
I-125, Co-57……..78%	P-32, Na-22, P-33, Ca-45…..100%

Once you have disintegrations per minute (DPM), calculate the total amount of activity in the liquid waste container. For example:

Let's say you have a total of 4L liquid waste and count a 1 ml sample resulting in 60 000 dpm/ml reported.
Since there are 60 second in a minute, then
60 000dpm/ml = 1000 dps/ml
And since 1dps equals 1Bq and 4L is equal to 4000ml
1000 dps/ml x 4000ml = 4 000 000 Bq or 4MBq

This formula can only be used for calculating the activity of liquid waste counted on a liquid scintillation counter.

How do I determine the activity in my solid waste?

Solid waste activity is estimated.

- Check the 'date started' on the waste tag and consider how much radioactivity has been used in the lab during the time you have been collecting waste in this specific waste container:
    - Review the entries (amounts used) on your 'Radioisotope Inventory Forms (gold sheets of stock vials still in your lab or white copies of stock vials that have already been disposed to EHS).
    - Consider the half-life of the radioisotope (how many half-lives have occurred).
    - Consider the types of experiments that you did with this radioisotope - What types of waste was generated and how was it disposed in other containers (did most of it end up in liquid waste or wet solid waste).
- Remember it is an estimate – it is not necessary to calculate an exact number!!

In summary for all radioactive waste

- Use masking or packing tape to secure cardboard boxes not radiation warning tape, the waste handler removes all radiation warning symbols (RWS) prior to disposal.
- The cap/lid is secure on the liquid waste container and no liquid is leaking out.
- Ensure a RWS is clearly visible (maximum of 2 per container, hint: there are two on the radioactive waste tag).
- Attach the radioactive waste tag with string for liquid waste containers and with tape at the top of the waste tag onto boxes. EHS removes the radioactive waste tag prior to disposal and keeps the tag for 8 years.
- Ensure the information on the tag is complete, the activity in MBq and indicate volume or weight.
- For liquid radioactive waste, record the type of liquid waste, the chemical name and concentration on the radioactive waste tag (eg. scintillation fluid - Ecolume, TBE running buffer with 30% Methanol, 20 % bleach treated cell media).
- All waste containers must be wipe-tested prior to transfer to ensure there is no presence of removable surface contamination.
- Transfer the wet solid waste containers to EHS as soon as possible.
- Transfer all other waste containers within 6 months of the date started.

How do I transfer the waste to EHS?

The procedure depends on the campus. There are two radiation waste facilities at the University; one at each campus. A Waste Disposal Calendar for each campus is annually distributed.

At Fort Garry, waste is picked up by radiation safety staff. Contact EHS by

- Complete the Radioactive Waste Removal Form (found on web) and fax to 789-3906 or
- Send an e-mail to radsafety@umanitoba.ca indicating type of waste, amount (# of containers), size of cardboard box or volume of liquid, location, contact person and permit holder & number.
- EHS uses this information to prepare for the pick-up.

At Bannatyne, waste is transported to radiation safety staff at room 071 Brodie.

- Use a sturdy cart, shielding if required and secondary containment for liquid waste containers.
- Use the service elevator in either Brodie or BMSB if possible.
- **IF YOU HAVE FLAMMABLE LIQUID WASTE**, you must fill in a Radioactive Waste Removal Form and send it at least the day before bringing the waste to EHS.
    - Send the completed form to Radiation Safety at P310 Pathology Building or
    - Scan and email to radsafety@umanitoba.ca.
    - EHS requires this information in order to prepare TDG documents for transport to the Fort Garry facility.

Examples of common flammable radioactive liquid waste

- buffers containing more than 20% alcohol, and flashpoint below 37.8°C
- CytoScint Liquid Scintillation Fluid
- Scintillation fluid with a flash point below 37.8°C or contain solvents such as toluene or xylene (check the SDS)