Quick Step Guide for Radioactive Waste

Careful attention to waste disposal practices will

- Protect both lab workers and ancillary staff workers from unnecessary exposure to radiation hazards
- Protect the environment and the public
- Save money by ensuring waste is disposed correctly
- Ensure the regulatory requirements are met and required records are transferred to Environmental Health and Safety (EHS)

What is a 'radioactive waste' and how is it collected?

To ensure waste contaminated with radioactive material do not end up in regular garbage, at the University every bit of waste created while working with radioactive chemicals must be collected as 'radioactive waste'.

- Be sure to prepare appropriate waste containers for each type of waste expected before you handle radioactive materials. See the Waste Chart for Radioisotope Laboratories posted in every room listed on your permit.
- It is critically important that wastes created while using radioactive chemicals are NOT disposed with other lab garbage that could be handled or removed by caretakers.
- Every glove, paper towel, under pad, tip, syringe or disposable tube that is used while working with radioactive chemicals is to be placed in waste containers labelled with a 'radioactive waste tag'.
- Remove or deface all radiation warning symbols on items before placing them in the radioactive waste container!!
- Be sure to record the date started on the waste tag.
- NEVER leave waste unattended outside of the permitted space.
- All radioactive waste must be transferred to EHS to ensure appropriate disposal and recordkeeping.

How is the Radioactive Waste Tag used?

Before the waste is transferred to EHS, both the upper and the bottom part of the tag must be completed in full.

- The radioactive waste tag must be securely attached.
  - For bottles - attach tags with string NOT tape! Tape dries out and the tags fall off during storage.
  - For boxes - attach tags with one piece of tape at the top -DO NOT tape over the whole tag (EHS removes the tags for recordkeeping.)
- Record the activity in MBq.
- List the full names of chemicals in the waste to allow the appropriate Safety Data Sheet to be found.
- Record the weight or volume of the waste.
- Use masking tape or packing tape NOT radioactive warning tape to secure packages and labels.
- A radioactive warning symbol must be clearly visible (MAXIMUM TWO PER CONTAINER). Hint: the radioactive waste tag has two symbols.
- All waste containers are wipe-tested by lab staff prior to transferring to EHS. Surface contamination as determined by a wipe test must not exceed 0.5 Bq/cm2. Refer to Wipe Test Procedure RSP-3, section 12.

How does the waste get to EHS?

Radioactive wastes from the Bannatyne Campus and from University permitted locations at the KIAM and RIOH are to be transported to the Bannatyne radioactive waste facility. For details refer to the annually distributed Waste Calendar. Call EHS to make arrangements if unable to bring waste on the scheduled waste day.

Radioactive waste generated on the Fort Garry Campus will be picked up by EHS personnel. To arrange for the pick-up, email radsafety@umantioba.ca and list the type and number of containers of waste or use the Radioactive Waste Removal Form and send to radsafety@umanitoba.ca or use the form on the web.

How is waste safely transported by lab staff?

Whenever wastes are transported by lab staff, care should be taken to minimize the risk of exposure or spill.

- Use a cart and shielding, minimize the time and maximize the distance between people and the waste containers to minimize exposure to ionizing radiation. These practices would not apply to low level emitters such as H-3, C-14, S-35, or Ca-45.
- Liquid wastes should always be transported in secondary containment with a capacity of at least 110% of the volume being transported.
- Once waste is on the cart or in secondary containment, before you move the waste through public areas, remove your lab coat and disposable gloves and wash your hands. Never wear a lab coat or disposable gloves in public areas. You may bring a lab coat and gloves along in a bag or pail or inside out and placed on the cart.
- Consider transporting in pairs (so no one works in isolation).
- When a freight elevator is available, use the freight elevator and not the public elevator.
- Preplan your path; ideally pre-walk the route.
- Consult with EHS to ensure compliance with transport regulations, prior to transporting radioactive wastes over public roadways or in a motorized vehicle.

How do I estimate the total activity in a liquid waste container?

1. Take a one-milliliter sample from the waste container, transfer it to a scintillation vial and add enough scintillation fluid to fill the vial to at least half full.
2. Count the vial on a liquid scintillation counter using appropriate channel and read in dpm or dps.
3. If the counter reads only in cpm or cps, subtract the background reading and divide the number by the efficiency for the measured isotope to obtain dpm (see below).
   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 dpm, calculate the total amount of radioactivity in the liquid waste container:
Example: 4L liquid with 60000 dpm/ml reading
60 000dpm x $\frac{1\text{dps}}{60\text{dpm}}$ x $\frac{1\text{Bq}}{\text{dps}}$ x 4000 milliliters = 4000000 Bq or 4MBq
This number is recorded on the bottom of the radioactive waste tag.

How do I estimate the total activity in a solid waste container?

- When making an estimate, consider how much radioactivity has been used in the lab during the time you have been collecting waste in the specific waste container.
- Check the 'date started' on the waste tag.
- Review the entries on your 'Radioisotope Inventory Forms' (gold sheets of vials still in your lab or white copies of vials that have already been disposed to EHS).
- Consider the amount of each type of waste generated from the experiments during the time period (did most of it end up in the liquid waste?).
- Also, consider the half-life of the radioactive material, calculate the activity for the decay corrected amount.

Example:
A stock vial containing 500 uCi (18.5 MBq) of P-32 in a volume of 50 ul is all used in experiments and the waste is transferred to the EHS for disposal two months after receiving the stock vial.
If 75% of the radioactive waste generated was liquid and the remaining 25 % was solid waste.
To estimate how much activity is in the solid waste 18.5 MBq x 0.25 (25%) = 4.6 MBq
Then to correct for decay, consider P-32 has a half-life is 14 days. Two month is about 4 half-lives so $2^4 = 16$
or 4.6 MBq ÷ 16 = 0.29 MBq This number would be recorded on the bottom of the radioactive waste tag.

If you prefer to use ul to estimate the activity and 12.5 ul is estimated to have been disposed in the solid waste, then
18.5 MBq ÷ 50 ul = 0.37 MBq /ul
12.5 ul x 0.37 MBq/ul = 4.625 MBq

Now decay correct as above 4.6 MBq ÷ 16 = 0.29 MBq

It is that simple!