



University at Buffalo
State University of New York
Environment, Health & Safety Services
Radiation Safety Division

GUIDE TO RADIOACTIVE WASTE MANAGEMENT

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GUIDE TO RADIOACTIVE WASTE MANAGEMENT

These procedures for disposal of waste have been developed to ensure the safety of those individuals who handle radioactive and chemical waste at the University at Buffalo (UB) and to comply with New York State and Federal regulations. The importance of strict adherence to this policy cannot be overemphasized.

Environment, Health & Safety (EH&S) Services collects and disposes of all forms of radioactive waste. Radioactive waste must never be disposed of as “regular” trash. **Specifically, dry solid radioactive waste must not be placed into normal trash receptacles and radioactive liquids must not be poured into lab sinks.** The radioactive waste stream must be documented on the “Radioactive Material Package Receipt and Disposal Record” provided with each radioisotope delivered to the lab and on the “Statement of Waste Container Contents” provided with each EH&S waste container delivered to the lab.

The proper disposal of laboratory waste involves considerable expense (disposal fees and labor). Currently, it is the policy of the UB administration to obtain funds associated with the collection and disposal of radioactive waste from the Departments and Schools, not the individual generators (Principal Investigators). Full containers and containers that are no longer needed should be scheduled for pick-up by EH&S promptly. While the disposal of waste is expensive, it is safe to assume that the cost will increase in the future.

I. Waste Minimization

UB is committed to minimizing the volume of radioactive waste generated and consequently has developed a Radioactive Waste Minimization Plan. This plan consists of the following:

1. Evaluating Principal Investigator (PI) permits and protocols to encourage waste reduction.
2. Training Associate Investigators (AI) in waste minimization practices.

Using the waste minimization practices presented below and complying with the waste procedures will keep volumes and costs at their minimum:

1. Order only the minimum amount of radioactive material necessary for the experiment.
2. Maintain and follow **up-to-date written experimental protocols** (approved by EH&S) that describe all the steps necessary to safely perform the research.
3. Whenever possible, use radioisotopes with half-lives less than 90 days. Waste contaminated with short half-life nuclides are stored for decay by EH&S and disposed of as regular waste after sufficient time has elapsed.
4. Survey potentially contaminated items in a low background area and dispose of non-contaminated materials (those less than two times the background) as regular trash. Remove or completely deface all radiation symbols before disposal. If only a small area of an item (lab bench soaker, for example) is found to be radioactive, dispose of only the contaminated portion in a radioactive waste container. However, **gloves used when handling contaminated or potentially contaminated items should always be placed in the appropriate radioactive waste container.**

5. Modify protocols to reduce the amount of waste generated, or use alternative non-radioactive methods.
6. Whenever possible, clean and reuse items instead of disposing to radioactive waste containers. Work on easily decontaminated items (i.e., stainless steel trays) so that removable surface contamination can be cleaned.
7. Empty shipping containers (excluding stock vials) used for radioactive products may be disposed of as regular trash. Shipping containers must be free of contamination and all radioactive markings must be completely removed or defaced.

II. Waste Categories and Container Types

Laboratories where radioactive waste is generated must be equipped with at least one container provided by EH&S for each type of waste generated. Some important points to remember:

- All radioactive waste storage areas should be managed with close attention to cleanliness.
- Any radioactive waste that is placed into the wrong type of waste container could mean unnecessary costs to the PI.
- **Absolutely no sink disposal of radioactive material or liquid scintillation fluid is allowed in the labs.**
- **Absolutely no evaporation of waste is allowed.**

A. Deregulated or Exempt Quantity Waste

Waste material meeting the following conditions are exempt from radioactive disposal regulations and can be disposed of according to the following procedures:

1. Dry radioactive waste contaminated with liquid scintillation fluid (such as used contamination survey wipes and empty vials) containing 0.05 $\mu\text{Ci}/\text{gram}$ or less of H-3 and/or C-14 can be disposed of as regular waste.
2. Liquid scintillation fluid containing 0.05 $\mu\text{Ci}/\text{ml}$ or less of H-3 and/or C-14 can be disposed of as **chemical waste**. The fluid can be either bulked into an **Exempt Quantity (EQ)** container or the entire vial and contents can be disposed of in a **Vial Drum (VD)** (See **Section F. Liquid Scintillation Fluid Waste** for more information on VD containers). For **EQ** disposal, vials should be uncapped and the fluid collected into the **EQ** container. This should be done in a hood or well-ventilated area. After all of the fluid is removed from the vials, dispose of the vials and wipes as regular waste.
3. All animal tissues containing 0.05 $\mu\text{Ci}/\text{gram}$ or less of H-3 and/or C-14, when averaged over the entire animal, may be incinerated as non-radioactive in an approved pathogenic incinerator. *Contact Lab Animal Facilities for the approved incineration procedures.* Record such disposals (in pounds) on the "Radioactive Material Package Receipt and Disposal Record."
4. Animal excreta and bedding is **NOT** considered deregulated. It must be disposed of as radioactive biological waste.

B. Dry Waste

Dry radioactive waste is separated into two categories determined by half-life:

- Waste with radioisotopes having a half-life less than 90 days.
 - Waste with radioisotopes having a half-life greater than 90 days.
1. Isotopes with a half-life of **less than 90 days** include P-32, P-33, Fe-59, I-124, I-125, S-35, Sc-46, Cu-64, Sr-85, Nb-95, Ru-103, In-144m, Hg-203, Rb-86, and Cr-51. Separate **Decay Storage (DS)** boxes are to be used for dry waste of each radioactive isotope with a half-life of less than 90 days.
 - a. There are three decay storage box sizes available: small (**DS-SM**) (14.5 x 9.5 x 8 inches), medium (**DS-MD**) (11.5 x 15 x 18 inches), and large (**DS-LG**) (14 x 25 x 16 inches).
 - b. The maximum activity allowed in any decay storage box is 5 mCi.
 - c. Record the activity placed into each box on the "Statement of Radioactive Waste Container Contents" form.
 - d. Decay Storage boxes with I-125 must be shielded with lead foil.
 - e. Decay Storage boxes with P-32 must be shielded with plexiglass. Special instructions will be given to the PI to any box exceeding 0.5 mR/hr. on the outside of the box.
 - f. **Before an item is placed in a decay storage box ALL radioactive symbols must be removed or completely defaced.**
 - g. **No liquids** (see stock vial exemption in Section C), **lead, or biological materials** are allowed in any decay storage box.
 - h. Each decay storage box must have a cover on at all times when waste is not being placed into the container.
 - i. Refer to the Radioactive Regulated Medical Waste Section for the proper disposal of these types of short half-life materials. Biohazard bags are not allowed in any radioactive waste container without the permission of EH&S.
 2. Isotopes having a half-life of **greater than 90 days** include H-3, C-14, Na-22, Cl-36, Ca-45, Co-57, Fe-55, Mn-54, Ni-63, Cd-109, Sn-113, Cs-137, Gd-153, and Zn-65. This type of waste must be disposed of into a **Yellow Dry (YD)** container or a **Special (S1)** box. Yellow Dry containers are used for large volumes of waste (2.5 cubic feet) and S1 boxes for smaller amounts of waste generated (0.64 cubic feet). This waste is expensive to dispose of and therefore volume minimization is important.
 - a. Long-lived isotopes may be combined in Yellow Dry containers and S1 boxes.
 - b. Note that H-3 and C-14 that have not been contaminated with scintillation cocktail, regardless of activity, must be placed into one of these containers.
 - c. Record the isotope and activity placed in these containers on the "Statement of Radioactive Waste Container Contents" form.
 - d. Covers must be in place at all times when waste is not being placed into the container.
 - e. Refer to the Radioactive Regulated Medical Waste Section for the proper disposal of radioactive regulated medical waste with isotopes having a long half-life.
 - f. Since the contents of these containers are removed and placed into another container, special attention must be given to the waste so that it can be handled without undue hazard to EH&S personnel:
 - Sharp objects must be packaged to prevent them from puncturing the inner bag.
 - Powders or other waste that could become airborne during handling require special handling. Contact EH&S for the proper packaging instructions.

C. Stock Vials and Secondary Containers

Radioactive material is typically obtained in small containers referred to as **stock vials**. The vial may be shipped by the manufacturer, often for shielding purposes, in an outer, **secondary container**.

1. Stock vials containing small amounts of unused liquid should be treated as dry waste according to isotope.
 - a. List the activity on the "Statement of Radioactive Waste Container Contents" form for the appropriate waste container.
 - b. Always deface any radioactive labels on stock vials placed into decay storage boxes.
 - c. **Never place stock vial contents into liquid waste containers**, this will increase the total activity of the container and make it difficult to dispose of.
2. Empty outer secondary containers are to be disposed of based on the material that they are constructed of and the level of contamination.
 - a. Plastic secondary containers can be placed into normal trash if they are surveyed and no contamination is found greater than twice the normal background *and* all radioactive markings are removed or completely defaced.
 - b. Plastic secondary containers from short half-life (less than 90 days) radioactive material shipments do not need to be surveyed if they are defaced and placed in a decay storage waste container for the appropriate isotope.
 - c. Lead or lead-lined secondary containers cannot be disposed of as radioactive material or as normal trash. EH&S will collect any lead shielding containers if they are surveyed inside and outside, and defaced of all radioactive markings. Refer to the Lead Section for more information.

D. Radioactive Regulated Medical Waste

Radioactive Regulated Medical Waste is any of the following waste, which is generated in the diagnosis, treatment, or immunization of human beings or animals, in research pertaining thereto, or in the production and testing of biological material ***and is contaminated with radioactive material***. This includes:

- Sharps (see below).
- Cultures and stocks of agents infectious to humans that are associated with biological material.
- Human pathological wastes.
- Human blood and blood products.
- Animal waste contaminated with infectious agents.

1. Sharps include the following items:

- Hypodermic and other medical needles.
- Syringes with attached needles.
- Glass **Pasteur pipettes**.
- Scalpel blades.
- Razor blades.
- Broken glass.

All sharps must be treated as Regulated Medical Waste regardless of use. If a sharp is in contact with radioactive material, it must also be handled as radioactive waste. Pointed objects, not meeting the definition of a sharp (such as plastic pipette tips) should be packaged so that they do not puncture the waste container liner.

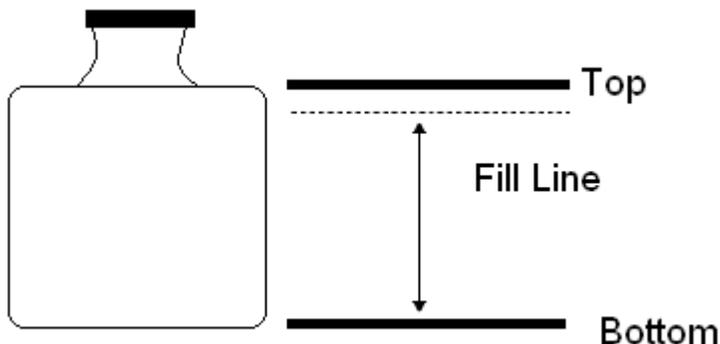
- a. Place contaminated sharps into an appropriate **sharps container**, available from a lab supply vendor.
 - b. Place a "Radioactive Materials" label on all sharps containers used for contaminated sharps.
 - c. If the half-life of the contamination is less than 90 days, segregate the sharps into separate containers by nuclide (same as any decay stored radioactive waste). If the half-life is greater than 90 days, the sharps can be placed into the same container.
 - d. Place full sharps containers in the appropriate radioactive waste container (decay storage box, yellow dry, or S1 box).
 - e. Write "SHARPS" on any decay storage box containing a sharps container. EH&S will dispose of the sharps container as regulated medical waste after the waste container has decayed and has been surveyed.
2. The generation of radioactive infectious waste should be prevented whenever possible. If you are using radioactive infectious material, or are unsure if you generate radioactive regulated medical waste, please contact EH&S for more information.
- a. Biohazard bags are not allowed in any radioactive waste container without the permission of EH&S.
 - b. When possible, arrangements should be made to treat the waste for the biohazard **before** being placed in radioactive waste containers. It is important the treatment does not spread the radioactive contamination. Obtain permission from EH&S prior to autoclaving radioactive waste.
 - c. All radioactive regulated medical waste handling must comply with both Radioactive Waste **and** Regulated Medical Waste Procedures. Refer to the EH&S website (www.ehs.buffalo.edu) for more information on Regulated Medical Waste.

E. Aqueous Waste

Contaminated water must be stored in containers (1.0 or 2.5 gallon sizes).

1. All radioactive aqueous waste must be **separated from liquid scintillation and hazardous chemical wastes (such as acids and alcohols)**. Only drain disposable materials (such as detergent, nontoxic salts, and some buffers) combined with radioactivity in water must be placed in the container.
2. All isotopes, regardless of half-life, may be mixed into an **Aqueous Liquid (AL)** container and must be identified on the "Statement of Radioactive Waste Container Contents" form.
3. Never place solid materials such as vials, tubes, filters, pipettes, pH paper, etc., into liquid waste. If necessary, filter the radioactive water waste prior to pouring in container and treat the dried filter as radioactive dry waste according to isotope.
4. Place absorbent paper around the neck of and on the floor under each AL waste container to minimize the spread of contamination.
5. Disposal of radioactive liquid waste via sink or other modes of entry into the sewer in laboratories is **not permitted**.
6. Water used for the final wash of glassware used to contain radioactive material can be disposed of to the sink as long as it can be demonstrated to contain no radioactivity.

7. **Never place stock vial contents into AL waste containers** (see the Stock Vials and Secondary Containers Section).
8. The waste container's cover must be secured when the container is not being used. Evaporation of waste is not permitted.
9. Non-infectious biological material that is readily dispersible in water may be placed into an AL container.
10. Radioactive blood may be placed into an AL container. Bleach (~5.25% Sodium Hypochlorite solution) must be added to the blood sample prior to adding to the waste container. Use a 1:10 dilution ratio, for every 10 ml of blood 1 ml of bleach must be added.
11. Aqueous waste containers must not be filled above the bottom of the neck of the container.



F. Liquid Scintillation Fluid Waste

Contaminated liquid scintillation fluid (cocktail) waste must be kept separate from other wastes and disposed of as radioactive waste. Uncontaminated liquid scintillation fluid must be disposed of as chemical waste. Scintillation fluid waste may be disposed of either **bulked or in vials**.

1. Exempt quantity or deregulated material is less than 0.05 $\mu\text{Ci/ml}$ of H-3 and/or C-14 in liquid scintillation media. Vials with exempt quantity material **OR** non-radioactive liquid scintillation can be emptied into a 1 gallon **Exempt Quantity (EQ)** container. Empty vials can be disposed of as regular trash.
2. Liquid scintillation waste contaminated with isotopes with half-lives of less than 90 days can be separated by isotope and placed into a 1 gallon **Organic Decay (OD)** container. This waste is decay stored by EH&S and disposed of as chemical waste. For example, liquid scintillation counting vials, which contain P-32, may be emptied into an **OD** container and placed into a decay storage box for P-32. Use the same procedure for other short half-life isotopes, placing the emptied vials into a decay storage box for that isotope.
3. Bulk liquid scintillation fluid waste containers must not be filled above the bottom of the neck of the container.
4. Liquid scintillation waste contaminated with non-exempt quantities of H-3 and C-14, or isotopes with half-lives greater than 90 days, cannot be bulked. Instead the entire vial must be placed into a designated **Vial Drum (VD)**, see **VD below**.
5. **Vial Drum (VD)** waste containers are plastic or steel pails used for collection of non-radioactive counting vials and/or vials containing contaminated scintillation fluid. The vials are to be placed in the container intact, without any emptying.
6. **Disposal of any type of liquid scintillation fluid via sink or other modes of entry into the sewer is not permitted.**

7. The waste container's cover must be secured when the container is not being used. Evaporation of waste is not permitted.
8. Record the manufacturer and brand name of the liquid scintillation fluid used on the EH&S waste container label found on the lid of the container.
9. Record the activity placed into the container on the designated "Statement of Radioactive Waste Container Contents" form.

G. Animal Waste

Radioactive animal waste is categorized into three types:

- Exempt Quantity (deregulated) animals.
 - Animals containing isotopes with less than a 90 day half-life.
 - Animals containing isotopes with greater than 90 day half-lives.
1. Exempt quantity animal waste contains less than 0.05 μCi /gram of H-3 and/or C-14 when averaged over the weight of the entire animal.
 - a. This waste may be incinerated as non-radioactive by the Laboratory Animal Facility.
 - b. Records must be kept of disposal methods on the "Radioactive Material Package Receipt and Disposal Record" forms.
 - c. Animal excreta and bedding is not considered deregulated. Contaminated excreta and bedding are disposed of as radioactive biological waste. Litter/Bedding can be disposed of in a **Special Animal Decay (AD-S1 or AD-YD)** with EH&S approval.
 2. Animals and associated biological debris contaminated with isotopes with half-lives less than 90 days can be placed into an **Animal Decay (AD)** Box. Animals will be stored for decay by EH&S and eventually incinerated as non-radioactive. **Carcasses, tissue samples/vials, and litter/bedding must be segregated.** When ordering an **AD**, be sure to indicate which one of the three waste types it will contain.
 3. Animals and associated biological debris contaminated with isotopes with half-lives less than 90 days can be decay stored in the lab **if** the following criteria are met:
 - a. Prior approval from EH&S is required to decay store animals in the lab.
 - b. Proper storage facilities must be available and posted as a radioactive materials area.
 - c. Tissue samples must be analyzed by EH&S to certify that the material has decayed to background levels.
 - d. The lab must make arrangements for incineration of the waste.
 4. Protocols using animals injected with isotopes with half-lives greater than 90 days (other than H-3 or C-14) must be approved by EH&S prior to the experiment. Disposal of these animals and associated waste is very expensive.
 5. No animal waste will be picked up for disposal prior to suitable deactivation of infectious agents.

H. Mixed Waste

Mixed waste is defined as waste that is classified as radioactive **and** contains chemicals that are either listed as hazardous in Subpart D of 40 CFR Part 261 or causes the radioactive waste to exhibit any characteristics identified in Subpart C of 40 CFR Part 261. This may include ignitability, corrosivity, reactivity, and toxicity characteristics. **The specific mixed waste must be identified in an EH&S approved protocol prior to generation.**

1. Place liquid mixed waste in the specific **Mixed Waste (MX) Container** for the type of waste generated. Only waste that corresponds exactly to the waste description listed on the container label may be placed in the container. **Mixed waste must never be placed into an Aqueous (AL) or Organic Decay (OD) container. Notify EH&S of any potential new mixed waste streams prior to generation.**
2. EH&S will decay store the mixed waste containing nuclides with a half-life less than 90 days and then dispose of the material as hazardous chemical waste.
3. The waste container's cover must be secured when the container is not being used. Evaporation of waste is not permitted.
4. Record the activity placed into the container on the designated "Statement of Radioactive Waste Container Contents" form.

I. Lead Waste

Lead must **not** be disposed in regular trash. EH&S will collect lead that is no longer required for shielding.

1. Survey the lead and provide a copy of the printout to EH&S at the time of the collection.
2. Prevent the contamination of lead. Contaminated lead is not easily disposed of.
3. Prior to surplusing a liquid scintillation counter, the internal lead must be removed (after the internal source is removed). See the Source Waste Section for more information.
4. Prior to surplusing a gamma counter, the internal lead must be removed.
5. Contact EH&S if additional lead shielding is needed in the lab.

J. Source Waste

Radioactive sources include the following:

- Calibration and check sources.
- Sealed sources.
- Electroplated sources.
- Liquid scintillation counter quench sources.

These types of radioactive materials are often used as standards and designed so the radioactivity is not meant to be removed from the device.

1. Contact EH&S to arrange for the disposal of any calibration sources, check sources, or electroplated sources. EH&S will obtain a quote from a radioactive waste broker for the disposal of the source.
2. The lab or the department is responsible for arranging, with the manufacturer, the removal of the internal source from liquid scintillation counters no longer operable. Notify EH&S of the source removal.

III. Documentation of Waste Disposal

Documentation of waste disposal is required to insure your laboratory does not exceed possession limits.

1. Each time a sample is taken from a stock vial, the method of disposal must be indicated on the "Radioactive Material Package Receipt and Disposal Record," which is provided by EH&S with each isotope received.
2. Each waste stream must be identified by indicating any items placed into a waste container. For exempt quantity animal waste, indicate the number of grams that are incinerated. For decay storage animals, indicate the number of pounds in the appropriate column.

IV. Waste Container Pick-up and Delivery

All pick-up and deliveries are done **Wednesday mornings between 9:00 and 11:30** unless other arrangements are made with EH&S. To arrange to have your waste picked up and/or empty containers delivered:

1. Complete the "Statement of Radioactive Waste Container Contents" form associated with each container.
2. Do not fill liquid containers above the bottom of the neck of the container.
3. Seal the inner bag and top flaps of Decay Storage, Animal Decay, and S1 boxes with strong durable tape.
4. Other containers must have the inner bags sealed and lids securely closed with the provided rings (if appropriate).
5. Complete a "Request for Radioactive Waste Disposal" form (RW-50).
6. Fax the form to EH&S at 829-2029 **by 2:00 p.m. on Monday for a Wednesday run.**
7. Remove and properly dispose of the absorbent paper from the neck of liquid waste containers.
8. **Perform a wipe survey** on the outside surfaces of all waste containers to be picked up by EH&S and attach the printout directly to the container. The survey must show that the surfaces of the containers are less than twice the background of the counting instrument.

V. Unusual Waste Disposal Problems

For any unusual waste disposal problems contact EH&S at 829-3281.

For example:

1. Waste involving infectious agents, highly toxic or hazardous substances or other special considerations early in the design stages of the experiment.
2. Proposed procedures involving unusual waste disposal problems or exceptions to these procedures will be considered individually by EH&S or the Radiation Safety Committee.
3. If gaseous or airborne particulate waste is suspected, contact EH&S so the area can be monitored with an air sampler to determine if airborne material is present.
4. Occasionally, the disposal of radioactive material other than that mentioned in the above procedures may be necessary. This may include disposal of sources, LSC standards, and Uranium and Thorium compounds. Please contact EH&S for information and instruction.

Attached is a "Request for Radioactive Waste Disposal" form (RW-50)

Fax Form to: Radiation Safety Division
 Environment, Health and Safety Services
 Fax: 829-2029

REQUEST FOR RADIOACTIVE WASTE DISPOSAL

(Use also for lead and liquid scintillation fluid waste)

Name of Principal Investigator:		Name of Person Preparing Form:	
Date of Request:	Phone Number:	Location of Waste (Building and Room Number):	

Container Delivery				Container Pickup				
Quantity	Type (use code)	Mixed Waste Chemical Description (for Type = MX)	Isotope(s) to be used	Type (use code)	Mixed Waste Chemical Description (for Type = MX)	Container Number	Isotope(s) used	Activity (mCi)

Special Notes or Handling Instructions:	
<p>Certification: I hereby declare that the identification and activity of the waste is accurate and complete to the best of my knowledge and that I have made every effort to minimize our waste streams. Note: Incomplete forms will be returned. Wipe test results must be attached to container at time of pickup.</p>	
Signature:	Date:

See Reverse Side for Container Type Codes

Summary of Radioactive Waste Container Types

Container Code	Container Description	Waste Type	Sizes Available
DS	Decay Storage Box	Short half-life dry waste	SM = 0.64 ft ³ MD = 1.77 ft ³ LG = 3.28 ft ³
YD	Yellow Dry Barrel	Long half-life dry waste	2.5 ft ³
S1	Special Dry Box	Long half-life dry waste	0.64 ft ³
AL	Aqueous Liquid Jar	Water with non-hazardous sink disposable chemicals only	1 or 2.5 gallon
EQ	Exempt Quantity Jar	Scintillation Cocktail with less than 0.05 μ Ci/ml of H-3 and/or C-14	1 gallon
OD	Organic Decay Jar	Short half-life isotopes in Scintillation Cocktail	1 gallon
MX	Mixed Waste Liquid Jar	Radioactive Material Mixed with Hazardous Chemical	1 or 2.5 gallon
VD	Vial Drum	Scintillation Cocktail Vials	5 gallons
AD	Animal Decay Storage Box	Animal Carcasses, Animal Litter/Bedding, or Tissue Vials/Samples	SM = 0.64 ft ³ MD = 1.77 ft ³

Refer to “Guide to Radioactive Waste Management” or call EH&S Radiation Safety at 829-3281 for further information.