

Radioactive Disposal

The generation, regulation, and disposal of radioactive waste are among radiation workers' most important activities. Generation involves much more than simply creating contaminated material; it also involves controlling the composition and volume as well as paying attention to chemical, biological, and radiation safety and record keeping. Regulation involves complying with the evolving requirements of Lurie Children's Medical Center, governmental agencies, waste brokers, and waste-site operators. Disposal involves handling of the wastes by many individuals and businesses in the chain of custody from the generator to the disposal site.

The generator has cradle-to-grave responsibility for hazardous wastes, a responsibility that never can be relinquished. There are institutional, civil, and criminal penalties for failure to fulfill generator's obligations. So you must exercise control over what you place in radioactive waste containers and associated records. Disposal of any radioactive material except by the Safety Officer is prohibited without express prior consent of the Radiation Safety Officer or Radiation Safety Representative.

Waste

Radioactive waste containers may be significant sources of contamination and external dose. Authorized users must take appropriate steps to ensure that the collection and storage of radioactive waste is done safely and in accordance with all applicable policies and procedures. These guidelines will help reduce the hazards from your radioactive wastes:

- Use the strategies of time, distance, and shielding. Keep rad waste containers close to the radiation work area and away from desks and other frequently occupied areas. Shield waste just as you would shield your stock materials; use high-density shields for gamma emitters and plastic shields for beta emitters. Shield bench top waste collection apparatus.
- Control volatility. Airborne radioactive material may be a problem with radioiodine, sulfur-labeled amino acids, metabolic products in animal experiments, liquid scintillation media, and other wastes. Control volatility in liquid radioiodine wastes by adding a solution of 0.1 M sodium hydroxide, 0.1 M sodium iodide, and 0.1 M sodium thiosulfate. Collect dry wastes with volatile components in tightly sealed plastic bags before putting them into radioactive waste drums. Keep all containers tightly sealed. If wastes are stored in fume hoods, keep the waste in the rear of the hood, in small containers. Do not freeze sodium iodide, because the evolution of volatile components may increase when it is thawed. Do not store volatile wastes in laminar flow cabinets or biological safety cabinets or any other location where potentially contaminated air is re-circulated into the room. Store liquid scintillation media in a well-ventilated area.
- Control contamination. Protect work surfaces under waste containers. Do not invert lids on dry waste containers. Do not set equipment on top of waste containers. Securely bag dry waste being carried to the dry-waste container. Do not overfill containers. Use a funnel with liquid wastes. Use protective gloves every time containers are handled. Perform routine contamination checks. Use strong leak proof bags for animal carcasses.
- Needles and other sharps contaminated with radioactive material must be collected in puncture-resistant containers. Needles and needles attached to syringes (even if they are capped) must not be placed loose in radioactive waste containers. Any recapping or removal should be accomplished through the use of a mechanical device or a one-handed technique.

- Use protective clothing and equipment. Always wear lab coats, gloves, and eye protection when handling radioactive material.
- If you were issued a dosimeter, wear it.
- Report all spills and injuries that occur when handling radioactive waste.

Radioactive waste can only be disposed of by contacting the Radiation Safety Officer or Radiation Safety Representative. No radioactive waste is to be disposed of in the ordinary trash receptacles. No liquid waste may be disposed of in drains or other sewer openings by laboratory personnel.

Radioactive waste tags on the drums shall be completely filled out by the user. Provide the following information when you call:

- Authorized user's name.
- Caller's name.
- Caller's telephone number.
- Number and size of container.
- Nuclide(s) in each container.

Liquid Waste Disposal

This information is from the University of Illinois at Urbana-Champaign [Radiation Safety Manual](#).

There are two main types of liquid radioactive wastes generated by research laboratories. The most common liquid waste is aqueous, in which the waste materials are dissolved in water. Such waste may be disposed of by dispersal into the sewage system if concentration limits are low enough. Designate and label a sink for this purpose. The pH range of any aqueous waste shall be adjusted to between 6.8 and 8.0. Aqueous wastes shall not exceed the following concentrations:

Radionuclide	Concentration ($\mu\text{Ci/ml}$)
H-3	1×10^{-2}
C-14	3×10^{-4}
P-32	9×10^{-5}
P-33	8×10^{-4}
S-35	1×10^{-3}
I-125	2×10^{-5}
I-131	1×10^{-5}

Other radionuclide concentration limits can be found in Title 10, Code of Federal Regulations, Part 20, Appendix B, Table 3.

The other, less common form of liquid radioactive waste is composed of volatile, flammable, toxic or organic material that cannot be disposed of through the sewage system. Water insoluble organic solvents shall not be released into the sewage system under any circumstances (Toluene and xylene-based liquid scintillation cocktails and some HPLC fluids fall into this category. Users are advised to use water-soluble fluids whenever possible). Non-aqueous waste shall be free of all filterable solids. For filtering liquid scintillation waste, a 60-mesh metal screen is recommended. Organic, water-insoluble liquid waste is then collected by DRS personnel for disposal. Non-aqueous waste shall be stored in spill-proof, unbreakable plastic containers of either six or ten liter capacities.

Liquid wastes that do not fit into the above categories must be treated on a case-by-case basis.

Dry Waste Disposal

- Acceptable radionuclide combinations can be determined by contacting the Radiation Safety Officer or Radiation Safety Representative.
- No liquids of any kind can be placed in dry-waste containers, with the exception of residual liquid in emptied vessels or equipment and very small quantities (such as one milliliter or less) in microfuge tubes and other small vessels.
- Remove lead pigs. All lead must be removed from dry waste and stored separately.
- Remove labels. All labels, tags, signs, and stickers must be removed or defaced before waste is put into the container. Needles and unprotected sharp objects must be collected in puncture-resistant containers.
- Treat waste to reduce non-radiological hazards. Waste potentially contaminated with pathogenic organisms must be treated by autoclaving or chemical disinfection. Carcinogens, teratogens, other highly toxic materials, and physical hazards must also be treated.
- Record keeping. Records of radionuclides and activity in waste must be maintained. A properly filled out radioactive waste tag must be attached to each container. Acceptable units of activity are uCi or mCi or their SI equivalents (becquerels).
- Dry waste must be collected in the standard metal drums provided by the Radiation Safety Office. Dry waste can also be collected in strong, tightly sealed plastic bags, which in turn are placed in 5 gallon buckets with lids. When standard containers are full, seal the plastic liner with a twist tie and seal the metal top. Do not overfill containers.

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