

RADIOACTIVE WASTE MANAGEMENT

PURPOSE

This procedure specifies how radioactive waste will be collected, stored, processed, packaged and disposed of by the Radiological Health Department.

POLICY

All users of radioactive materials shall be instructed in the requirements for segregation and labeling of radioactive wastes. They shall also be encouraged to prevent the unnecessary generation of all radioactive wastes, particularly mixed waste, and to minimize the quantities of those wastes that are unavoidable.

Radioactive wastes (radwastes) shall be collected, stored, packaged, shipped and disposed of in accordance with all pertinent state and federal regulations. The RSO shall prepare and maintain procedures for handling radwastes that will ensure the protection of the employees involved in such duties and keep all radiation exposures ALARA. Specifications for segregation and packaging of radwastes shall be based on specific regulations or regulatory guidance, and include a record-keeping system that will allow complete tracking and accounting for all radwastes shipped to a disposal site or disposed of locally.

DEFINITIONS

"Animal" waste means carcasses or parts of animals administered radioactive materials; it also includes collected excreta and combustible bedding materials, e.g. shavings or sawdust.

"Aqueous" means a liquid that is soluble or readily dispersible in water and which contains no chemicals classified as toxic or hazardous; except for limits on radioactivity, aqueous liquid wastes are those which could be discarded to the sewer.

"Compactible" waste means any non-putrescible, dry waste, e.g. paper, plastics, glassware and metals, that

does not contain any compressed gases, liquids, pyrophoric or other hazardous materials.

"LS media" means any mixture of solvents and fluors used for liquid scintillation counting. "LS media" must be segregated for disposal, based on the solvents and nuclides they contain:

1 **"NHNT"** refers to nonhazardous, nontoxic, non-flammable solvents.

2 Flammable or toxic solvents, e.g. toluene, xylene, dioxane, pseudocumene, etc. **shall not be used** except with special authorization from the RSO.

"Mixed waste" means any material listed by the U.S. Environmental Protection Agency as a hazardous waste that also contains licensed radioactive material (40 CFR 261).

"Radwaste Tech" means the technicians(s) designated to collect and package radioactive wastes.

"Regulated Medical Waste" means human tissues or blood products, animal wastes, sharps, etc., as defined by the Department of Transportation (49 CFR 173, Appendix G).

REQUIRED TRAINING AND QUALIFICATIONS

Radwaste Techs are required to complete 24 hours of classroom instruction as Hazardous Waste Operators and shall possess a current Utah Commercial Driver's License with the hazardous waste endorsement.

The required training for Radwaste Techs shall include specific instructions for operating the compactor, the vial crusher and drum-handling equipment, such as drum truck, pallet truck, pallet stacker and fork lift and shall satisfactorily demonstrate an understanding of proper procedures and safety precautions.

PICKUP REQUESTS AND SCHEDULING

Waste pickups for laboratories that generate significant quantities of wastes should be scheduled on a regular basis. If the wastes cannot be picked up at the scheduled time, notify the laboratory and inform the user as to when the pickup will be made. Requests for unscheduled waste pickups will be made by phone to the Radiological Health office. The individual taking the call is responsible for notifying the Radwaste Tech of the request, either through the e-mail system or by means of a waste pickup request form (RPR 54A).

PROTECTIVE CLOTHING AND DEVICES

The minimum protective clothing requirement for all phases of waste handling is the wearing of closed-toe shoes, a lab coat and plastic or rubber gloves. Lab coats and gloves shall not be worn to the cafeteria or other public areas on or off the campus.

A face shield shall be worn during shredding of LS vials and packaging or disposal of liquid wastes. Ear plugs or muffs shall be worn during operation of the vial shredder or compactor. Steel-toed safety shoes and canvas or leather gloves shall be worn when moving 55-gallon steel drums, steel storage bins, or other heavy objects. Check with the RSO if there are any questions regarding conditions that may require the use of additional protective devices.

TRANSPORT OF WASTES

The vehicle used for transporting wastes from on-site generators to the radwaste management facility must be placarded on all four sides with "RADIOACTIVE" placards whenever low-specific activity (LSA) radioactive materials are present in the vehicle. When no radioactive materials, or limited quantities of radioactive material, are in the vehicle, the placards should be switched to the "DRIVE SAFELY" or blank position.

A wheeled cart or drum is used to transport waste packages of all types to the waste transport vehicle. Liquid waste shall be in secondary containers in the vehicle for transportation; the transfer cart or drum

normally serves as the secondary container. Dry wastes and frozen animal wastes can be transported in plastic bags or fiberboard boxes. The transfer drum and cart(s) shall be securely anchored within the transport vehicle to prevent shifting during transport.

When unattended, the vehicle shall be kept locked at all times when it contains radioactive waste. All radioactive materials shall be removed from the vehicle at the end of each work day. If the vehicle is involved in an accident while transporting radioactive waste, Campus Police (585-2677) and the RSO (581-6141) shall be notified as soon as possible. The RSO or his designee will determine if there is any contamination problem and supervise cleanup if necessary.

COLLECTION AND ACCEPTANCE OF WASTE

Wastes shall be accepted only if they are segregated, contained and labeled as specified in "RADIOISOTOPE ACQUISITION AND DISPOSITION" (RPR 13). Before taking any waste package, make sure that a radioactive waste tag (RPR 13E) has been properly completed and signed by the user. A hazardous waste tag is also required for a package of mixed waste. **Do not accept any waste that has not been properly labeled!**

A thin-window GM survey meter will be taken on all waste pickup runs to check waste containers for contamination or excessive exposure levels.

Sharps

All sharp objects, e.g. needles, pipettes and glassware shall be accepted only if packaged in puncture-proof containers (e.g., Asharps containers or closed cardboard boxes).

Dry Waste

Remove the lid of the waste can and check the exposure rate over the bag; verify that it is reasonable for the contents listed on the tag. Visually check the contents to ensure that only dry waste is in the container. If the tag indicates that the bag contains only short-lived nuclides, look carefully for "RADIOACTIVE

MATERIAL" labels. Carefully remove the bag from the waste container; inspect for protruding hypodermic needles, pipettes or other objects that may rupture the bag or cause injuries; also, check for leakage. Make sure the dry waste contains no visible liquids and no liquid scintillation vials

If there are any discrepancies, e.g. sharps, liquids, labels in short-lived waste packages, inform the user immediately of the nature of the discrepancy. Do not accept any waste packaged in opaque bags which cannot be visually inspected. If the problem can be corrected without risk of personal contamination, insist that the user correct the problem before accepting the waste. If there is risk of personal contamination, place the bag into a second bag and take the waste, **but inform the user that wastes with similar problems will not be accepted in the future and notify the RSO.**

Securely close the bag and place it in the transfer drum or cart. Before leaving the lab, put a new bag (clear vinyl) in the waste container with top folded over the rim and replace the container lid. Check gloves and hands for contamination, Survey the transfer drum to determine the exposure rate.

Bulk Liquid Waste

Containers for collection of liquid wastes shall not exceed 2.5 gallons capacity unless prior approval has been received from the RSO. Check the exposure rate over the container and verify that it is reasonable for the contents listed on the tag. Lift the container out of its secondary containment and inspect for leakage and solid objects. If solid objects are observed in the container, return it to the secondary containment and inform lab personnel that the objects must be removed before waste will be picked up. If no solids are observed, place the bottle in a plastic bag and close the bag, tape or tie the waste tag to the bag and place the bag and bottle in transfer drum. Place an appropriate empty waste bottle into the secondary container. Check gloves and hands for contamination.

Liquid Scintillation Vials

Liquid scintillation vials may be picked up and transported in plastic bags or the original cardboard trays.

Verify that they are properly segregated and labeled according to the nuclides and fluors present. Inspect each package or tray carefully for leakage; place trays into a bag before placing them in the transfer cart. Check gloves and hands for contamination.

Animal Waste

Before accepting animal carcasses, ascertain that they have been frozen in packages not exceeding 10 kg. Procedures are the same as for dry waste except that frozen animals should not be allowed to thaw. Provisions can be made in advance to pick up animals that have not been frozen if they are to be immediately placed into a freezer or taken to the animal resources crematory.

Lead Containers and Shielding

Lead shields and containers are not to be placed in the dry waste, but they will be picked up separately for salvage. After they have been surveyed to assure that they are free from contamination, they will be stored until the accumulated quantity is sufficient to justify transfer to a metals reclaimer.

Styrofoam Containers

Styrofoam inserts from packages of radioisotopes will be collected if a recycling program is available, either through vendors or through the University. The styrofoam shall be kept separate from radioactive wastes, but will be picked up and taken to the waste management facility. After being surveyed to assure the absence of contamination, the styrofoam will be sent for recycling. In the absence of any recycling opportunities, styrofoam packages shall be surveyed and discarded by the users, just as is done for any uncontaminated packaging materials.

RECORDS

The front copy of the waste tag (RPR 13E) will be removed from each waste package at the time that the waste is picked up and the copy given to the lab (after entering the date of pickup and initialing).

No package of radioactive waste shall be disposed of

in any manner before it is entered into the computer database and the entry data have been verified.

At the time of packaging or processing, e.g. compaction, the container identification number and processing date shall be entered and initialed. The second copy of the tag will be removed and the updated information entered into the RADSAFE database.

Prior to release of packages of dry wastes or sharps that have been stored for decay, the package shall be surveyed and the exposure rate entered on the waste tag and initialed.

The last copy of the waste tag will remain with the waste package if it is packaged in a drum for shipment. The last copy of the waste tags for cremated materials will be retained and packaged with the package of ash. The last copy of the waste tags from released liquids or released solids will be removed at the time of disposal.

SEGREGATION, PACKAGING AND DISPOSAL OF RADWASTE

Short-lived Dry Waste

Packages of dry waste or sharps that contain nothing but short-lived nuclides ($T_2 < 120$ days) and no "Radioactive Material" labels shall first be weighed, and the weight recorded on the tag. They shall then be segregated by half-life into storage containers for radioactive decay. Packages should be separated into the following groups for decay in storage:

$T_2 < 3$ days; store for 1 month:

Ga-67, Mo-99, Tl-201, In-111, Au-198, Pb-203, Hg-195m, Tc-99m, Na-24, I-123

$T_2 < 15$ days; store for 5 months:

P-32, I-131

$T_2 < 60$ days; store for 20 months:

I-125, Hg-203, Fe-59, Ru-103, Nb-95, Cr-51, P-33, Rb-86

$T_2 < 90$ days; store for 30 months:

S-35, Sc-46, Ir-192, Sr-85

$T_2 < 120$ days; store for 40 months:

Sn-113

Once a month, a computer listing will be generated that identifies those packages that have been held for at least the minimum required storage period. When enough such packages are identified to comprise a truck load, they shall be retrieved from storage and surveyed. If the maximum exposure rate from a package is indistinguishable from background when surveyed with a sensitive survey instrument, e.g. a scintillation detector, the exposure rate shall be recorded on the waste tag and the package should be disposed of as non-radioactive regulated medical waste.

Regulated medical wastes are accepted at the infectious waste section of the county landfill. Prior to disposing of decayed wastes, remove the last copy of the waste tag from each package and enter and initial the final disposal date. All other "RADIOACTIVE MATERIAL" labels shall be removed or obliterated before such disposal. Place an "INFECTIOUS SUBSTANCE" label on each sharps container (49 CFR 172.101).

Decayed short-lived wastes shall either be placed in a designated infectious waste dumpster or transported in a University vehicle to the landfill. Although DOT regulations do not require placarding of this waste (49 CFR 172.504, Table 2), the county landfill requires that the vehicle be placarded. (Use the generic "DANGEROUS" placard.)

Long-lived Dry Waste Compaction

Packages containing dry, solid waste, e.g. mixed paper, plastics, pipettes, glassware, etc. and nuclides with half-lives of more than 120 days will be placed where it will be convenient to retrieve them for compaction. Remove the second copy of the waste tag and enter the data into the RADSAFE database. **Inspect all long-lived waste packages for prohibited items before placing into the compactor.**

The maximum activity that can be placed in a single 55-gallon drum is defined by the Class A waste limits (10 CFR 61.55) unless otherwise restricted by the receiving site's license:

| | |
|---|-------------|
| H-3 | 8,400 mCi |
| C-14 | 168 mCi |
| Co-60 | 147,000 mCi |
| Ni-63 | 730 mCi |
| Sr-90 | 8 mCi |
| Tc-99 | 63 mCi |
| I-129 | 100 mCi |
| Cs-137 | 210 mCi |
| Total of all nuclides with half-lives less than 5 years | 147,000 mCi |

Ra-226 and transuranic alpha emitters with half-lives > 5 years
 10 nCi/g
 = 4.5 mCi/lb = 450 mCi/100 lb

For any wastes containing mixtures of the nuclides listed in the preceding paragraph, the limit for Class A waste is generally determined by the sum of fractions rule; however, 10 CFR 61.55 and the receiving site license should be reviewed carefully if the concentration of any of the listed nuclides is near the limit.

For compaction of dry wastes, use DOT Specification 17C (or equivalent) drums that are new or in excellent condition. Put a layer of 2-3 inches of absorbent into the drum. Place the drum in the compactor and make sure that the exhaust fan is turned on. Place dry waste packages and the last copy of their tags in the drum and compact in accordance with manufacturer's instructions; repeat until the drum is full. Maximum compaction can be obtained by leaving the compactor ram in the full down position periodically; this reduces "spring-back" of the compacted wastes.

When the drum is full, seal the drum and secure the lid with lock ring. Follow the posted instructions on closing drums. Survey and weigh the drum and mark in accordance with procedures in "TRANSPORTATION OF RADIOACTIVE MATERIALS" (RPR 55).

Liquid Scintillation Vials

Liquid scintillation vials are accepted for disposal only if they contain no hazardous constituents, i.e. they are "NHNT". Laboratories that use hazardous scintillation fluors shall empty and rinse the vials into a bulk liquid waste container; the empty vials can then be placed in a dry waste container for disposal. Packages of NHNT

vials should be placed in a storage location convenient to the vial crusher. After the data from the waste tag have been entered into the database and verified, vials are disposed of by crushing. The liquid extracted from the vials shall be collected in cans or jugs for disposal to the sewer system *via* the disposal sink in the waste management facility. The crushed vials shall be rinsed and then disposed of as non-radioactive trash.

Bulk Aqueous Liquid Waste

Aqueous liquid wastes in bulk containers (jugs) shall be stored in a location convenient to the disposal sink in the radwaste management facility. After the data from the waste tags have been entered into the database and verified, most will be disposed of to the sanitary sewer.

Aqueous liquid wastes containing radioiodines or transuranic or nuclides shall be segregated for storage will be held for decay as long as practical, with the time to be determined by storage space available. The activity of all nuclides to be discarded to the sanitary sewer shall be determined, and the monthly average concentrations and cumulative annual activity calculated, prior to each sewer disposal. If the quantities are within the current limitations, the aqueous wastes will then be discarded to the sewer. All other liquid wastes will be segregated for packaging.

Bulk Liquid Mixed Wastes

As soon as a container of mixed waste is received, a HAZARDOUS WASTE label (RPR 54B) shall be affixed with the receiving date entered as the "accumulation date." Before placing the waste container into a flammable liquid storage cabinet, the weight shall be entered on the Radwaste tag. After the tag data have been entered in the database and verified, liquid scintillation media containing only H-3 and/or C-14 in concentrations of less than 50 nCi/g should be disposed of as non-radioactive hazardous waste. Remove all RADIOACTIVE MATERIAL labels before transfer the waste.

Other liquid mixed wastes, i.e. organic solvents or other hazardous chemicals containing radionuclides, are to be labeled as hazardous wastes (RPR 54B) and stored in the flammable liquid storage cabinets until shipment has been scheduled and approved.

After the shipment of bulk liquids has been approved by the receiving facility, they shall be packaged as limited quantity or as low specific activity (LSA) wastes as required by the Department of Transportation (DOT). A Specification 17C steel drum shall normally be used for liquid LSA wastes.

Place a 4-mil plastic liner in the drum and add 4-6 inches of absorbent material. e.g. Ultrasorb 248™. Place a second plastic liner inside the first liner, and the place the bottles, cans or jugs of bulk liquids right side up within the inner liner with enough absorbent material to completely absorb twice the actual volume of liquid contained in the drum (typically 15-16 gallons of liquid in 1-gallon jugs, with all interstices filled with absorbent). Both liners shall be tightly closed and the drum lid shall be closed in accordance with the posted instructions for closing drums. The drum shall be weighed and labeled in accordance with "TRANSPORTATION OF RADIOACTIVE MATERIALS" (RPR 55).

Shipments of mixed wastes shall be scheduled as often as necessary to assure that no package of mixed waste is held for more than 90 days.

Animal Wastes

Each package of animal waste shall be weighed upon receipt and placed in a freezer for storage. After the tag data have been entered into the database and verified, animal wastes containing only H-3 and C-14 at concentrations of less than 50 nCi/g should have radioactive labels removed and be transferred to the Animal Resources Center for cremation as non-radioactive wastes. All animal wastes containing other nuclides will be stored for radioactive decay as long as practical prior to cremation. The activity of each nuclide present in the waste will be compared with the radionuclide air release limits prior to transporting wastes to the Animal Resources Center for cremation. If an animal waste package contains too much activity to be cremation it will be set aside for packaging.

Animal wastes will be cremated at the Animal Resources Center provided that they are within the activity limits established to assure compliance with concentration limits in the crematory stack effluent. Compliance with the crematory effluent limits is verified by running the computer program for that purpose that is in the RADS SAFE database. The program calculates the fraction of the regulatory concentration limit for each nuclide and then sums the fractions for all nuclides. The calculated fractions are based on annual average release rates and on the assumption that all nuclides are volatile and are released in the exhaust gas. **The inventory of animal wastes to be cremated must be approved by the RSO before a cremation is scheduled.**

Prior to the cremation of radioactive animals, the ash from previous non-radioactive animals shall be removed. The morning after the cremation all ash will be removed and the fire box of the cremation will be vacuum cleaned. During recovery of the ash, personnel will wear a lab coat, gloves and a dust mask. All ash shall be disposed of as compactible dry waste. All of the activity initially in the wastes is conservatively assumed to be in the ash.

All animal waste containing nuclides that have air effluent concentration limits so low that cremation is not desirable, shall be packaged in conformance with

the waste acceptance criteria of the US Ecology license.

STORAGE OF PACKAGED RADWASTE

Drums in storage awaiting shipment for disposal should be marked with all labels and markings required for shipment. The Radwaste Container Data form (RPR 54C) is to be completed for every container (drum) of radioactive waste at the time it is packaged. The container data shall be entered into the RADSAFE database promptly. Sealed drums should be placed on wooden pallets for convenient moving with a fork lift. Waste shipments should be scheduled often enough to prevent excessive accumulation of filled drums.

ANNUAL DATA SUMMARIES

Summaries of all radioactive waste disposals will be generated at least annually from the RADSAFE database. These summaries will be filed with the annual reports prepared for the records of the Radiation Safety Committee. The computer database will also be used to summarize information required for waste shipment manifests, as described in "TRANSPORTATION OF RADIOACTIVE MATERIALS" (RPR 55).

REFERENCES

U.S. Nuclear Regulatory Commission: 10 CFR 20.301-311 and 10 CFR 61; 10 CFR 71.

Utah Department of Health, *Utah Radiation Control Rules, Requirements of General Applicability to Licensing of Radioactive Material*, R313-19.

State of Washington, Radioactive Materials License No. WN-I019-2 issued to US Ecology, Inc.

Utah radioactive material license UT1800001.

RPR 54A. RADWASTE PICKUP REQUEST

This form is used to record requests for radioactive waste pickup.

| | | | | | |
|---|--------------------------------|-----------------------|-------|-----------|--------------|
| RPR54A | RADWASTE PICKUP REQUEST | (1/2000) | | | |
| Responsible User: | _____ | | | | |
| Caller/Contact : | _____ | | | | |
| Phone: | _____ | Waste Location: _____ | | | |
| WASTE TAG #: _____ REQUIRED FOR PICKUP! | | | | | |
| Isotope: | _____ | | | | |
| Circle waste type: | Sharps | Dry | Vials | Animal | _____lbs |
| Liquid (container size) | _____ | 1 Gal. | _____ | 2-1/2 Gal | _____ Iodine |
| Comments on back? _____ | Date: _____ | By: _____ | | | |
| Are you aware that you can request a waste pickup on the web now? | | | | | |
| http://www.rso.utah.edu/wformp.htm | | | | | |

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