Saint Louis University

RADIOACTIVE WASTE PACKAGING INSTRUCTIONS FOR LABORATORIES

(Applicable to <u>Radioactive Materials Use</u> Only)



INTRODUCTION

This section of the Radiation Safety Manual provides important information on how to prepare your radioactive waste for shipment over public roadways, in compliance with appropriate regulations. Please review and become familiar with the requirements contained in this section prior to packaging radioactive waste for transfer to Radiation Safety Office staff to assure that radioactive waste is securely and safely packaged for transport, and that documentation requirements are met. Your adherence to the details contained herein will help to keep you and the University in compliance with safety and transportation requirements for radioactive shipments.

If you have any questions regarding the technical details, contact the Radiation Safety Office.

(Updated August 2025)

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I. KEY WORDS & TERMS

animal carcass waste, biological waste, bulk liquid waste, bulk liquid waste - mixed hazard, bulk liquid waste - scintillation fluid, container (dry waste), container (liquid waste), deregulated waste, dry solid waste, liquid waste, mixed waste, scintillation vials, half-life, liquid scintillation vial, long-lived radionuclide, NRC, radioactive waste, short-lived radionuclide, stock vial, radioactive waste, stock vial, beta plate

II. GENERAL INSTRUCTIONS

(A) HOW TO OBTAIN RADIOACTIVE WASTE CONTAINERS:

- (1) Call, email, or submit a waste pickup request via the Radiation Safety website and specify delivery of waste container(s) on your next pickup date; or
- (2) Arrange for a pickup of waste containers(s) from the Radiation Safety Office.

(B) MAINTAINING YOUR WASTE CONTAINERS IN THE LAB:

- (1) Complete information on the container label prior to placing radioactive waste in the container.
 - (b) Permit Holder
 - (c) Department
 - (d) Radionuclide
 - (e) Date Started
 - (f) Waste Type
- (2) Keep container tightly closed at all times.
- (3) Survey and wipe test the container and the area where the container is stored regularly (at least weekly).
- (4) When the container is full, seal the liners and the container in accordance with the detailed instructions for that category of waste (provide elsewhere in this section).
- (5) After sealing the container, record "Date Sealed" and "Total Activity" on the container label.

(C) ARRANGING FOR PICK-UP OF YOUR RADIOACTIVE WASTE:

- (1) Call the Radiation Safety Office or submit a radioactive waste pickup request on the Radiation Safety website.
- (2) Have the following information available for each container prior to calling for a pickup:
 - (b) Permit Holder
 - (c) Department
 - (d) Building and Room
 - (e) Radionuclide
 - (f) Also report how many empty containers you would like to receive at the time of pick-up.

III. <u>INSTRUCTIONS FOR COMPETING THE RADIOACTIVE</u> WASTE TRANSFER FORMS

Refer to appendix 19 - A for examples of the radioactive waste transfer forms (These examples are for illustrative purposes only. Official Radioactive Waste Transfer forms must be requested from the Radiation Safety Office.)

- (A) Identify and indicate the appropriate waste category and waste transfer form based on the definitions given in the attached "Packaging Instructions".
- **(B)** Enter the radionuclide(s) contained in the waste in the "Radionuclide" column.
- (C) Determine the uCi content of the waste and enter it in the "uCi" column.
 - (1) For bulk liquid waste (Form A):

- (g) Take a 1 ml sample and assay it on a Liquid Scintillation Counter or Gamma Counter (whichever is appropriate) and determine the activity in dpm. <u>If you are assaying aqueous liquid waste use a 20ml vial with 10ml of scintillation fluid.</u>
- (h) Multiply the activity (dpm) by the number of gallons of liquid in the container and then multiply by the conversion factor 0.0017. This will give you the total uCi content of the container.

Activity (uCi)	=	dpm/ml :	·	gallons	Х	0.0017

- (i) Attach a copy of the assay system printout to the transfer form.
- (2) For liquid scintillation vials (Form B):
 - (a) Take 10 vials at random from your waste and assay them on a Liquid Scintillation Counter
 - (b) To get total dpm, multiply the <u>average</u> dpm of the ten vials by the number of vials (e.g., for 20 ml vials, 530 vials per cubic foot; for 6 ml vials, 1,470 vials per cubic foot).
 - (c) Divide the total dpm by 2.22E-6 (2,220,000) to determine the total uCi content of the 1 cu. ft. container.
 - (d) Attach a copy of the assay system printout to the transfer form.
 - (e) Important: Based on your experiment data/notes, confirm that the activity arrived at in step 1 is an accurate representation of activity.
- **(D)** Multiply the uCi content of the waste by 0.037 to get MBq and enter it in the "MBq" column. This is a D.O.T. requirement.
- (E) Enter the chemical content of the waste in the "Chemical Content" column (for Form B specify the scintillation fluid trade name, manufacturer and flash point).
- (F) If the flash point is ≤ 140 degrees Fahrenheit, check the "Hazardous" box. Otherwise check the "Non-Hazardous" box.
- **(G)** Enter the quantity or volume of the waste as appropriate.
- **(H)** Enter the name of the Permit Holder, the applicable department or division and the phone number of the laboratory in the upper section of the "Laboratory/Generator" column.
- (I) In the middle section of the column, enter the results of the meter readings and exterior wipe tests that must be performed on the container (meter readings are not required for H-3).
- (J) The individual who prepared the waste transfer form must sign it in the lower section of the column.
- **(K)** The Permit Holder must also sign the form in this section.
- (L) After properly packaging your radioactive waste and completing the waste transfer form, contact the Radiation Safety Office to request a waste pick-up.

IV. PACKAGING DRY SOLID RADIOACTIVE WASTE

Refer to appendix 19 - B for examples of approved radioactive waste containers

- (A) What does dry solid waste include? Dry solid waste includes absorbent pads, gloves, empty stock vials and other paper, plastic or glass products (if there are large amounts of glass please contact the Radiation Safety Office for instructions) which have been used during procedures involving radioactive materials and which are likely to have become contaminated. Stock vials must be wrapped in absorbent material (e.g., a bench pad) prior to being placed into the dry waste container.
- (B) What is prohibited? All biological and carcass radioactive waste is prohibited from disposal as dry solid radioactive waste (this includes syringe needles which must be removed from the syringes, placed in puncture proof containers and disposed of as biological radioactive waste). Absolutely no liquid scintillation vials, or vials containing any type of fluid aside from spent stock vials are to be disposed of in the dry solid radioactive waste receptacle.

(C) Packaging instructions:

- (1) Dry solid radioactive waste must be segregated by isotope (with the exception of H-3 and C-14, which may be packaged together).
- (2) Dry solid waste must be packaged in the dry solid radioactive waste container lined with the two plastic bags provided by the Radiation Safety Office (the heavier, clear plastic bag must be placed inside the thinner yellow bag).
- (3) Each bag must be tied, taped, or wired shut.
- (4) The containers must be taped shut to prevent loss of contents during transport.
- (5) A separate Waste Transfer Form must be completed for each properly packaged parcel of waste being transferred. Place the completed Radioactive Waste Transfer Form into the pouch located on the side of the dry solid radioactive waste container.

V. PACKAGING SCINTILLATION VIAL RADIOACTIVE WASTE

Refer to appendix 19 - B for examples of approved radioactive waste containers

- (A) What does scintillation vial waste include? Scintillation vial waste includes vials generated during the liquid scintillation counting process, that contain radioactive material and scintillation cocktail. The vials must be "scintillation vials" (vials used specifically for the purpose of scintillation counting).
- (B) What is prohibited? Absolutely no stock vials, dilution vials or any other type of non-scintillation vials are to be disposed of in the scintillation vial radioactive waste. Do not include pipet tips, gloves, absorbent pads, paper, paper products, etc. with your vials.

(C) Packaging instructions:

- (1) Scintillation vials must be segregated by radionuclide category into:
 - (a) "Category one Scintillation Vials; Deregulated" (those which contain only <u>H-3</u> and/or <u>C-14 in concentrations not exceeding 0.05 uCi/ml of scintillation fluid</u> and/or any amount of any radionuclide with a half-life less than 30 days).
 - (b) "Category two Scintillation Vials; Deregulated" (those which contain only <u>H-3</u> and/or <u>C-14</u> in concentrations not exceeding 0.05 uCi/ml of scintillation fluid and/or any amount of any radionuclide with a half-life more than 30 days but less than 109 days).
 - (c) "Category three Scintillation Vials; Radioactive/Regulated" (those which contain only H-3 and/or C-14 in concentrations not exceeding 0.05 uCi/ml of scintillation fluid and/or any amount of any radionuclide with a half-life more than 109 days).
- (2) The average concentration of H-3 and/or C-14 must never exceed the concentration limit specified above whether contained in category one, two or three scintillation vials.
- (3) Liquid scintillation vials must be further segregated by scintillation fluid category into:
 - (a) vials containing toluene/xylene-based scintillation fluid and
 - (b) Vials containing biodegradable scintillation fluid
- (4) Scintillation vial radioactive waste must be packaged in the scintillation vial radioactive waste container, lined with the two plastic bags provided by the Radiation Safety Office (the heavier, clear plastic bag must be placed inside the thinner yellow bag).
- (5) Each bag must be tied, taped, or wired shut.
- (6) The containers must be taped shut to prevent loss of contents during transport.
- (7) A separate Waste Transfer Form must be completed for each properly packaged parcel of waste being transferred. Place the completed Radioactive Waste Transfer Form into the pouch located on the side of the scintillation vial radioactive waste container.

VI. PACKAGING BULK LIQUID AQUEOUS RADIOACTIVE WASTE

Refer to appendix 19 - B for examples of approved radioactive waste containers

- (A) What does bulk liquid aqueous waste include? Bulk liquid aqueous radioactive waste includes only aqueous based liquid radioactive waste with a pH between 5.5 and 11.5 (i.e., buffer solutions, liquid media, wash solutions, labeling solutions, etc.).
- (B) What is prohibited? All mixed hazard bulk liquid waste is prohibited from disposal as bulk liquid aqueous radioactive waste (i.e., no radioactive and chemical hazard or radioactive and biological hazard). Absolutely no scintillation media may be mixed with bulk liquid aqueous radioactive waste. All acidic or basic bulk liquid aqueous radioactive waste must be neutralized in the laboratory prior to transfer. The pH must be adjusted to between 5.5 and 11.5.

(C) Packaging instructions:

- (1) Bulk liquid radioactive waste must be segregated by isotope (with the exception of H-3 and C-14, which may be packaged together).
- (2) Bulk liquid aqueous radioactive waste must be packaged in either the one-gallon or the five-gallon bulk liquid waste containers.
- (3) Each container must be tightly capped to prevent leakage during transport.
- (4) A separate Waste Transfer Form must be completed for each properly packaged container of waste being transferred. Place the completed Radioactive Waste Transfer Form into the pouch located on the side of the bulk liquid aqueous radioactive waste container.

<u>Note</u>: Since bulk liquid radioactive waste containers are very susceptible to external contamination, it is especially important to wipe test them and remove any contamination prior to transfer.

VII. PACKAGING BULK LIQUID SCINTILLATION FLUID RADIOACTIVE WASTE

Refer to appendix 19 - B for examples of approved radioactive waste containers

- **(A)** What does bulk liquid scintillation fluid radioactive waste include? Bulk liquid scintillation fluid radioactive waste includes <u>only</u> bulk liquid scintillation fluid generated through the use of HPLC (High Performance Liquid Chromatography).
- (B) What is prohibited? Absolutely no aqueous non-scintillation media may be mixed with bulk liquid scintillation fluid.

(C) Packaging instructions:

- (1) Bulk liquid scintillation fluid must be segregated into:
 - (a) "Category one Bulk Scintillation Fluid; Deregulated" (those which contain only <u>H-3</u> and/or <u>C-14</u> in concentrations not exceeding <u>0.05</u> uCi/ml of scintillation fluid and/or any amount of any radionuclide with a half-life less than 30 days).
 - (b) "Category two Bulk Scintillation Fluid; Deregulated" (those which contain only <u>H-3</u> and/or <u>C-14</u> in concentrations not exceeding <u>0.05</u> uCi/ml of scintillation fluid and/or any amount of any radionuclide with a half-life more than 30 days but less than 109 days)
 - (c) "Category three Bulk Scintillation Fluid; Radioactive/Regulated" (those which contain only H-3 and/or C-14 in concentrations not exceeding 0.05 uCi/ml of scintillation fluid and/or any amount of any radionuclide with a half-life more than 109 days).
- (2) The concentration of H-3 and/or C-14 must never exceed the concentration limit specified above whether contained in category one, two or three scintillation fluid.

- (3) Bulk liquid scintillation fluid must be further segregated into categories of:
 - (d) toluene/xylene based scintillation fluid and
 - (e) biodegradable scintillation fluid
- (4) Bulk liquid scintillation fluid radioactive waste must be packaged in either the one gallon or the five gallon bulk liquid waste containers.
- (5) Each container must be tightly capped to prevent leakage during transport.
- (6) A separate Waste Transfer Form must be completed for each properly packaged container of waste being transferred. Place the completed Radioactive Waste Transfer Form into the pouch located on the side of the bulk liquid scintillation fluid radioactive waste container.

<u>Note:</u> Since bulk liquid radioactive waste containers are very susceptible to external contamination, it is especially important to wipe test them and remove any contamination prior to transfer.

VIII. PACKAGING ANIMAL CARCASS RADIOACTIVE WASTE

Refer to appendix 19 - B for examples of approved radioactive waste containers

- (A) What does animal carcass radioactive waste include? Animal carcass waste includes animals or parts of animals that contain radioactivity.
- (B) What is prohibited? Anything other than animal carcasses (bedding and excreta can currently be packaged for disposal along with the carcasses)
- (C) Packaging instructions:
 - (1) Animal carcasses must be segregated into one of two categories. They are:
 - (a) "Animal Carcasses; Deregulated" (those which contain only H-3 and/or C-14 in concentrations not exceeding 0.05 uCi/gram of tissue) and
 - (b) "Animal Carcasses; Short Lived" (those which contain radionuclides with half lives less than 120 days).
 - (2) Animal carcass waste <u>must be frozen solid</u> and packaged in the animal carcass radioactive waste container, lined with the two plastic bags provided by the Radiation Safety Office (the heavier, clear plastic bag must be placed inside the thinner yellow bag).
 - (3) Each bag must be tied, taped, or wired shut. The animal carcass radioactive waste container must also be lined with absorbent pads to contain carcass fluids that may thaw during transport.
 - (4) The containers must be taped shut to prevent loss of contents during transport.
 - (5) A separate Waste Transfer Form must be completed for each properly packaged parcel of waste being transferred. Place the completed Radioactive Waste Transfer Form into the pouch located on the side of the animal carcass radioactive waste container.

Special arrangements must be made with the Radiation Safety Office prior to the transfer of animals which are too large to fit into the standard containers or which contain long-lived radioisotopes (those with half-lives greater than 120 days) in concentrations in excess of the deregulated concentration specified above.

IX. PACKAGING BIOLOGICAL RADIOACTIVE WASTE

Please contact the Radiation Safety Office for specific instructions regarding biological radioactive waste prior to generating it.

X. PACKAGING BETA PLATES

Refer to appendix 19 - B for examples of approved radioactive waste containers

- (A) What does beta plate waste include? Beta plate waste includes only beta plates generated from use of a beta plate system (e.g., Top Count) and the scintillation fluid contained in those plates.
- (B) What is prohibited? Absolutely anything other than beta plates. Do not include pipet tips, gloves, absorbent pads, paper, paper products, scintillation vials etc. with your beta plates.

(C) Packaging instructions:

- (1) Beta plates must be segregated by radionuclide category into:
 - (a) "Beta Plates; Deregulated" (those which contain only <u>H-3 and/or C-14 in concentrations not exceeding 0.05 uCi/ml of scintillation fluid and/or any amount of any radionuclide with a half-life less than 109 days).</u>
 - (b) "Beta Plates; Regulated" (those which contain only <u>H-3 and/or C-14 in concentrations not exceeding 0.05 uCi/ml of scintillation fluid and/or any amount of any radionuclide with a half-life more 109 days).</u>
- (2) The average concentration of H-3 and/or C-14 must never exceed the concentration limit specified above whether contained in Deregulated or Regulated beta plates.
- (3) Beta plates must be further segregated by scintillation fluid category into:
 - (a) Beta plates containing toluene/xylene-based scintillation fluid and
 - (b) Beta plates containing biodegradable scintillation fluid
- (4) Beta plate radioactive waste must be packaged in the Beta Plate radioactive waste container, lined with the two plastic bags provided by the Radiation Safety Office (the heavier, clear plastic bag must be placed inside the thinner yellow bag).
- (5) Each bag must be tied, taped, or wired shut.
- (6) The containers must be taped shut to prevent loss of contents during transport.
- (7) A separate Waste Transfer Form must be completed for each properly packaged parcel of waste being transferred. Place the completed Radioactive Waste Transfer Form into the pouch located on the side of the beta plate radioactive waste container.

APPENDIX 19 - A RADIOACTIVE WASTE TRANSFER FORMS

(See following inserts)

Nov. 2004 Revision

Saint Louis University - Radiation Safety Office

RADIOACTIVE WASTE TRANSFER FORM A (Use one form & attach copy of assay system printout for all bulk liquids)

CHEMICAL

 $uCi \times 0.037 = MBq$ ACTIVITY

RADIO-NUCLIDE

WASTE CATEGORY

ONLY

H-3 C-14 Ca-45

Dry Solid (Non-Biological); Long-Lived

Measured pH:

H-3 C-14

Bulk Liquid Aqueous; Long-Lived (contains H-3, and/or C-14; must be readily soluble in water and have a pH between 5.5 and 11.5)

Short-Lived (must have a half life ≤ 120 days) Dry Solid (Non-Biological); (for shipment to disposal site)

Bulk Liquid Aqueous; Short-

Lived

Measured pH:

(must be readily soluble in water and have a pH between 5.5 and 11.5; must have a half life \leq 120 days)

	@ 1 meter:	GENERATOR/PERMIT HOL CERTIFICATION	I certify that the identity, estimated activity, chemical content and other information pertaining to this wast	specified on this form. All waste has rendered non-infectious.	(Individual Who Prepared Waste &	(Signature of Permit Holder)		RSO USE ONLY	Date Received:	.67
(Parama)	Weight: Ibs.	(Snecies & Number)	(Species & Number)		Weight:lbs.	(Ou. ft.)				(A, A)
				22						
	//									
	Н-3	C-14			H-3 C-14	2 1				
	Animal Carcasses; Deregulated (any animal or portion thereof containing	 4.0.05 uCi/g of animal tissue; must be frozen) 	Animal carcasses; short-lived (radionuclide must have a half-life < 120 days; must be frozen)	Biological (Non-Carcass); Long- Lived	(contains biological, pathogenic, or infectious material e.g., syringes, test tubes, capillary tubes, animal bedding or proper the property of	infectious prior to packaging; must be frozen)	Biological (Non-Carcass); Short- Lived	(contains biological, pathogenic, or infectious material e.g., syringes, test	tubes, capillary tubes, animal bedding or excreta; radionuclide must have a half-	life < 120 days; must be frozen)

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Page:

RADIOACTIVE WASTE TRANSFER FORM B (SCINTILLATION MEDIA) (Use one form & attach copy of assay system printout for all beta plates, scintillation vials, and bulk liquids)

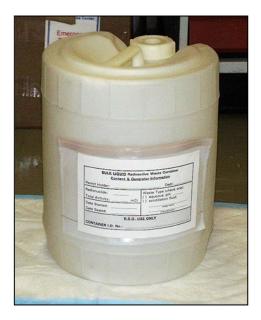
/ ONE	WASTE CATEGORY	CONTAINER SPECIFIC INFORMATION	LABORATORY/GENERATOR INFORMATION
	Category One Scintillation Vials; Deregulated <0.05 uCi/nl of ³ H and/or ¹⁴ C, and/or any amount of any radionalide with a half-life < 30 days (e.g. ³² P, ³³ P, ⁵¹ Cr)	RADIO- NUCLIDE(S) ACTIVITY	(Name of Permit Holder) (Department/Division)
	Category Two Scintillation Vials; Deregulated < 0.05 uC/ml of ³ H and/or ¹⁴ C, and/or any amount of any radionuclide with a half-life > 30 days and < 109 days (e.g. ¹² I, ³⁵ S)		CONTAINER SURVEYS (A) EXTERNAL WIPE TEST:
	Category <u>Three</u> Scintillation Vials; Radioactive/Regulated < 0.05 uCi/ml of ³ H and/or ¹⁴ C, and/or any amount of any radionuclide with a half-life > 109 days (e.g. ⁴⁵ Ca)	uCi x 0.037 =MBq	(B) METER SURVEY: Surface:
	Beta Plates; Deregulated < 0.05 uCi/ml of ³ H and/or ¹⁴ C, and/or any amount of any radionuclide with a half-life < 109 days Beta Plates; Regulated < 0.05 uCi/ml of ³ H and/or ¹⁴ C, and/or any amount of any radionuclide with a half-life > 109 days (e.g. ⁴⁶ Ca)	SCINTILLATION FLUID IDENTITY A: Fluid Manufacturer:	@ 1 meter
	Category One Bulk Scintillation Fluid; Deregulated < 0.05 uCi/ml of ³ H and/or ¹⁴ C, and/or any amount of any radiouncide with a half-life < 30 days (e.g. ² P ₂ - 3P ₂ - 3C ₂)	B: Fluid Trade Name: C: Flash Point:	pertaining to this waste is as specified on this form. All waste has been rendered non-infectious. (Individual Who Persared Waste & Exem)
	Category Two Bulk Scintillation Fluid; Deregulated < 0.05 uC/ml of ³ H and/or ¹⁴ C, and/or any amount of any radionuclide with a half-life > 30 days and < 109 days (e.g. ¹² I, ³ S ₃)	.0 °F) □ Hazardous (< OLUME	(Signature of Permit Holder)
	Category Three Bulk Scintillation Fluid; Radioactive/Regulated < 0.05 uCi/ml of ³ H and/or ¹⁴ C, and/or any amount of any radionuclide with a half-life > 109 days (e.g. ⁴⁵ Ca)	Cu. ft.	RSO USE ONLY Date Received: Received By:

APENDIX 19 - B

APPROVED RADIOACTIVE WASTE CONTAINERS

(See following insert)







1 cubic foot container for the following:

- 1. Dry Solid Radioactive Waste
- 2. Scintillation Vial Waste
- 3. Beta Plate Waste

None of these categories may be mixed in the same container

5-gallon container for the following:

- 1. Aqueous Radioactive Waste
- 2. Bulk Scintillation Fluid Radioactive Waste

None of these categories may be mixed in the same container

1-gallon container for the following:

- 1. Aqueous Radioactive Waste
- 2. Bulk Scintillation Fluid Radioactive Waste

None of these categories may be mixed in the same container