



Radiation Safety



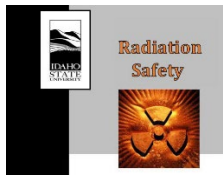
RADIATION PROCEDURES MANUAL

Procedure Cover Sheet

Procedure Title: Procedure for Radioactive Waste Management
Procedure Number: RS-09 Rev.2
Effective Date: 10/31/2025

Approved By: Radiation Safety Committee

Date: 10/29/2025



Procedure #: RS-09 Rev.1
Procedure Title: Radioactive Waste Management
Approval Date: 10/29/2025
Effective Date: 10/31/2025

Revision History

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RS 9.2	Mason Jaussi & Kishor Paudel	10/02/25	RSC-10/29/25

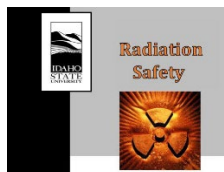
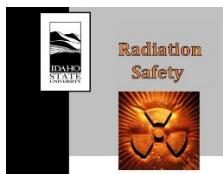


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1. INTRODUCTION

This procedure specifies instructions for managing radioactive waste generated from ISU research and academic operations. Instructions are provided for Authorized Users and Radiation Safety Department staff who perform waste management functions. In addition, this procedure specifies instructions for managing mixed waste consisting of radioactive waste combined with hazardous waste and for managing biological waste (e.g. animal carcasses and food products) that contain radioactive material.

2. PURPOSE

The purpose of this procedure is to ensure safe and compliant management of radioactive and mixed waste at ISU facilities.

3. SCOPE

This procedure addresses the following activities:

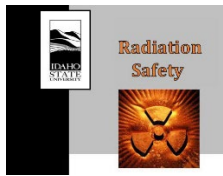
- Waste generation, segregation, and storage at individual laboratories and facilities.
- Characterization and documentation of waste for radioactive and chemical constituents.
- Pickup, storage and tracking of radioactive waste by the Radiation Safety Department.
- Disposal of waste using the designated waste broker.
- Disposal of waste by discharge to the sanitary sewer.
- Disposal of waste as ordinary trash after decay in storage.

4. ROLES AND RESPONSIBILITIES

Responsibility for radioactive waste management is shared by authorized users and the Radiation Safety Department.

Authorized users are responsible for the following activities.

- Segregating radioactive waste into appropriate waste streams.
- Characterizing the waste for radioactive material content (radionuclides and activities)
- Characterizing the waste for chemical content (pH, metals, solvents, etc.)
- Documenting waste characterization on a waste tag form with sufficient attachments to justify the radiological and chemical characterization.
- Storing radioactive waste in a safe manner.
- Generating and storing mixed waste in compliance with the Hazardous Waste Management Plan and the Radiation Safety Manual.



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- Requesting formal permission to generate mixed waste from the Radiation Safety Officer prior to generation.
- Contacting the Radiation Safety Department when radioactive waste is ready for pickup.

The Radiation Safety Department is responsible for the following activities.

- Picking up waste from generators and transferring it to the waste storage facility.
- Tracking the radioactive material content of waste materials in the HP Assist database.
- Storing radioactive waste materials in the waste storage facility.
- Transferring waste to the designated waste broker including the following actions.
 - Maintaining licenses and permits for disposal of waste at the Republic Services site in Richland, Washington.
 - Preparing waste profiles for the designated waste broker.
 - Reviewing and signing waste manifests and shipping documents.
- Discharging aqueous liquid waste to the sanitary sewer in accordance with NRC requirements and the City of Pocatello discharge permit.
- Storing waste for decay in accordance with NRC requirements.
- Assisting Authorized Users with waste characterization using gamma spectroscopy or sampling and analysis.

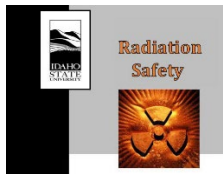
5. ACRONYMS/DEFINITIONS

ISU:	Idaho State University
NRC:	Nuclear Regulatory Commission
CFR:	Code of Federal Regulations
RSO:	Radiation Safety Officer
EHSS:	Environmental Health, Safety & Sustainability
PPE:	Personal Protective Equipment

6. REQUIRED MATERIAL(S)

The following materials are used by Authorized Users generating waste.

- White plastic radioactive waste containers issued by the Radiation Safety Department.
- Clear plastic liners provided by the Radiation Safety Department.
- Secondary containment trays for liquids.
- Waste tag forms or spreadsheets.
- Strong screw top containers for liquid waste.



The following materials are used by the Radiation Safety Department.

- 55-gallon drums (1A2 and Type A), 1H2 plastic buckets, 1H1 carboys.
- Clear plastic drum liners and waste can liners.
- Secondary containment trays for liquids.
- Scale for weighing containers.
- Drum handling equipment (hand trucks, pallet jacks, etc.)
- Labels (Caution Radioactive Material, Radioactive Waste Labels, etc.)

7. REQUIRED TRAINING(S)

- ISU Radiation Safety Training
- Radioactive Material Transportation Training designated by RSO for personnel signing low-level waste manifests.
- Mixed Waste Transportation Training designated by RSO for personnel signing mixed waste manifests or shipping radioactive wastes with DOT hazard class other than 7.

8. PROCEDURE

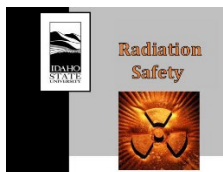
8.1. Waste Generation (Authorized Users)

Authorized Users must complete the following actions to properly generate radioactive waste. For routine PPE waste, if the material does not have detectable radioactive material by frisking with a GM detector and does not have known H-3 contamination, it may be disposed in the ordinary trash.

8.1.1. Segregate Radioactive Waste

Authorized Users shall segregate their radioactive waste into the following waste streams. Each waste stream will have a designated container.

- Dry active waste is general solid radioactive waste. Liquids, federal or state of Washington hazardous or dangerous waste, biological materials and sources greater than 100 μCi are prohibited from this waste stream. Ensure all sharps are contained in puncture proof containers to protect personnel handling the waste.
- Aqueous liquid waste is water-based liquid with radionuclides but no hazardous waste and pH greater than 2 and less than 12.5.
- Liquid scintillation waste with non-hazardous fluid containing only H-3 and C-14 with activity concentration less than or equal to 0.05 $\mu\text{Ci/g}$.
- Liquid scintillation waste with non-hazardous fluid and radionuclides other



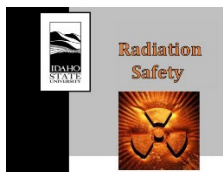
than H-3 or C-14 or H-3 and C-14 with activity concentration greater than 0.05 $\mu\text{Ci/g}$.

- Animal carcasses with only H-3 and C-14 with activity concentration less than or equal to 0.05 $\mu\text{Ci/g}$.
- Biological waste includes milk, food products, and carcasses not described above.
- Sources with activity greater than 100 μCi . If the source is tracked by mass the Authorized User will convert to activity to comply with this requirement. Specific activity values are available in 49 CFR 173.435. Sources greater than 100 μCi require stabilization at the waste disposal facility to meet waste classification requirements. These sources should be packaged separately to ship as UN2910 (limited quantity) or UN2915 (Type A package) as applicable.
- Radioactive waste containing only radionuclides with half-lives less than 120 days. Solids should be separated from liquids and these waste materials should be segregated from longer lived radioactive materials. Ensure no radioactive labels or markings are present in the waste. These wastes can be disposed by decay in storage by the Radiation Safety Department.
- Mixed waste is waste that contains radioactive material and hazardous or dangerous waste. Common materials that are often hazardous waste include toxic metals (As, Ba, Cd, Cr, Pb, Hg, Se, and Ag), acids and bases, certain organic solvents, flammable liquids, and water reactive materials. See more detailed information in 40 CFR 261. If waste contains unusual chemicals or you have questions regarding potentially hazardous or dangerous waste, contact the RSO.
- Other wastes by written permission from the RSO.
- Greater than Class C (10 CFR 61.55) wastes may not be generated in any circumstances.

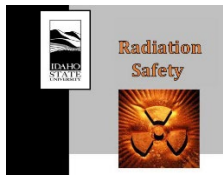
8.1.2. Waste Characterization and Documentation

Authorized users must determine and document the radioactive and chemical content of their waste.

- 8.1.2.1. Record all additions to waste containers on a Waste Addition Log Form (Available on Radiation Safety website <https://www.isu.edu/radiationsafety/>). For routine waste, the description can be generic (e.g. PPE, plastic, wipes, decon debris, etc). The Radiation Safety Department uses this information to verify the waste is in the proper waste stream and will meet the requirements of the disposal facilities.
- 8.1.2.2. Determine the radioactive content by knowledge of your operation and the material used. If the material does not have known activity, such as activated metals, contact the Radiation Safety Department for assistance with characterization.



- 8.1.2.3. Determine the chemical content of your waste by knowledge of the materials used in your operation. Common chemicals that may cause waste to be hazardous are listed below. See the Hazardous Waste Manual and 40 CFR 261 for more information.
- Toxic metals (As, Ba, Cd, Cr, Pb, Hg, Se, Ag)
 - Acids and bases ($\text{pH} < 2$ or > 12.5)
 - Flammable liquids
 - Reactive chemicals
 - Organic solvents
- 8.1.2.4. Once a waste item (e.g. bag of solid waste taped closed, carboy of liquid waste, group of sources, etc.) is complete, fill out the waste tag form to document the waste characterization. Attach supporting documents (source certificates, waste addition logs, etc.) as necessary to give complete information. Note all applicable HP Assist numbers on the waste tag or in the supporting information. The Radiation Safety Department will assign a waste tag number and enter the data in HP Assist as specified in Section 8.3.2.
- 8.1.3. Waste Storage
- 8.1.3.1. Store dry active waste in waste containers and clear plastic bags provided by the Radiation Safety Department. When bags are full, tape the bag closed, and contact the Radiation Safety Department for pick up as specified in Step 8.1.5 below.
- 8.1.3.2. For liquid wastes store in strong containers with screw top lids. Containers must be less than 4 liters for glass and less than 20 liters for plastic and metal. All liquid containers must be stored in secondary containment to capture the liquid if the primary container leaks.
- 8.1.3.3. Mixed waste must be stored and labeled in accordance with the ISU Hazardous Waste Management Plan. Requirements differ for main campus locations and very small quantity generator locations.
- 8.1.4. Permission to Generate Mixed Waste
- Contact the Radiation Safety Officer to obtain written approval prior to generating mixed waste. This is necessary to ensure no waste is generated unless a specific disposal pathway exists and is required in the ISU Broad Scope license 11-27380-01.



8.1.5. Schedule Pick Up of Waste

Once the waste item is ready for pickup, scan or electronically transfer the waste tag form and supporting information to the Radiation Safety Department. They will review the information and schedule a time to pick up the waste. For mixed waste, the waste may need to remain at the generator location until a shipment is scheduled because the Radiation Safety Department is not authorized to store hazardous waste for more than 90 days at their waste storage facility.

8.2. Waste Operations (Radiation Safety Department)

8.2.1. Picking Up Waste

- 8.2.1.1. Radiation Safety Department staff members will review the information submitted by the Authorized User to ensure it is complete and that characterization information is accurate. They also will determine if the waste is regulated for transportation and identify the appropriate storage location for the waste.
- 8.2.1.2. Radiation Safety Department staff members will enter the waste tag in HP Assist and virtually dispose of all HP Assist items associated with the waste tag. See Section 8.3.2 and procedure RS-16, Radioactive Material Inventory.
- 8.2.1.3. Radiation Safety Department technicians will collect the waste from the authorized user laboratory and move it to the radioactive waste storage facility. This may involve hand carrying the waste or moving it in a state vehicle as directed by the staff member. In some cases, waste may be stored at the Authorized User facility.
- 8.2.1.4. The technician will record their name, the acceptance date, and the storage location (TAA 1 or TAA 2) or container number on the bottom of the waste tag. If the waste is placed in a container, the technician will add the waste tag number to the Waste Addition Log for the container.

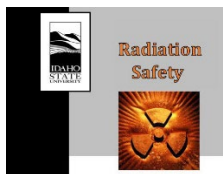
8.2.2. Evaporation of Certain Radioactive Liquid Wastes

Evaporation of certain radioactive liquid wastes may be performed in consultation with the RSO.

- 8.2.2.1. Certain process liquids containing radioactive materials may be evaporated in a designated container using appropriate engineering controls (e.g., evaporation cabinet, fume hood) provided that all of the following conditions are met:

Conditions for Evaporation:

- RSO approval
- Appropriate engineering controls are in-place
- The liquids do not contain hazardous materials*.



- The constituents are non-volatile.
- The pH is greater than 2 and less than 12.5 (as close to neutral as practicable).
- Documented Air Monitoring Evaluation

* Elementary neutralization of radioactive liquids is acceptable if corrosivity is the only hazardous characteristic. Neutralization must be performed in a suitable container.

8.2.2.2. The RSD staff will conduct an immediate post-job survey after the liquid is transferred into a container within the appropriate controlled environment and post-job survey at the conclusion of the evaporation.

8.2.2.3. All evaporations will be documented in the Evaporations Log workbook

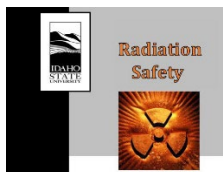
8.2.3. Disposing Waste Using the Waste Broker

8.2.3.1. Radiation Safety Department staff members will complete paperwork necessary to obtain the State of Washington Use Permit, to pay the Republic Services site use fee, and to complete the Republic Services annual volume projection each year.

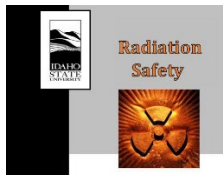
8.2.3.2. Radiation Safety Department staff members will contact the waste broker several months prior to the desired shipment date and submit the necessary waste profile information to schedule the waste shipment. This will allow sufficient time to ensure that the proper waste designation is assigned in compliance with federal, local, and Washington state hazardous waste regulations.

8.2.3.3. Radiation Safety Department personnel will package waste into appropriate containers based upon characterization information. Some containers may already be packaged at Authorized User facilities. See packaging instructions for certain waste streams in Appendix I. The hierarchy of packaging for solid radioactive materials is listed below.

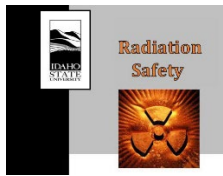
- Non-regulated in general design package 49 CFR 173.410 or higher.
- Excepted package (UN2910, UN2911, etc.) in general design package or higher.
- LSA-I exclusive use in a general design package or higher.
- LSA-II exclusive use in a general design package or higher.
- Type A package for non-LSA material (e.g. sources) in a DOT-7A Type A container.
- Non-Class 7 material in an appropriate lab pack (49 CFR 173.412(b)) or packaging for the applicable hazard class.



- 8.2.3.4. Radiation Safety Department staff members will complete the waste broker profile form and transfer it and any supporting information to the waste broker several months prior (whenever possible) to the proposed shipping date.
- 8.2.3.5. Radiation Safety Department staff members will review the waste manifest forms 540 and 541 and any Uniform Hazardous Waste Manifest forms generated by the waste broker and make a list of required markings and labels for each package.
- 8.2.3.6. On the day of shipment, a Radiation Safety staff member will verify all markings and labeling applied to containers by the waste broker based on the list from above and the waste manifest forms.
- 8.2.3.7. On the day of shipment, a Radiation Safety staff member with appropriate transportation training will sign all of the waste manifest forms and make copies for records. Note: the staff member must be trained for mixed waste shipment in order to sign a Uniform Hazardous Waste Manifest or a low-level waste manifest with subsidiary hazard classes.
- 8.2.4. Discharging Waste to the Sanitary Sewer
 - 8.2.4.1. Radiation Safety Department staff members will verify that the waste material is readily soluble and will complete the RPR 54J spreadsheet to evaluate the radioactive content against the NRC and Pocatello limits. If there have been more than three discharges in the calendar year, copy the latest discharge tab to a new tab and update the summation formulas in the Annual Discharge to Date (μCi) column. After entering the data, the staff member will sign the form as prepared by.
 - 8.2.4.2. A second Radiation Safety staff member will review the form to verify that all meets limits cells are Y and will sign the form as approved by.
 - 8.2.4.3. A Radiation Safety Department technician will discharge the material to the sewer typically in the fume hood sink in Room 102 of the Physical Sciences Building. The technician will sign as disposed by and will scan the final form into the box folder under Sewage Disposal (240).
 - 8.2.4.4. The technician will perform a daily use survey of the sink and immediate work area and document it in the lab logbook.
- 8.2.5. Disposing Waste by Decay in Storage
 - 8.2.5.1. A Radiation Safety Department staff member will evaluate the waste tag by entering the data in the Decay in Storage spreadsheet and will thus determine the date when the activity will have decayed to less than $0.1 \mu\text{Ci}$.
 - 8.2.5.2. On the date when the activity has decayed, a Radiation Safety Department technician will survey the waste item with the instrument recommended by the staff member on the lowest scale and will document the survey.



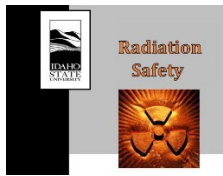
- 8.2.5.3. A radiation safety staff member will write a memo authorizing disposal of the material and will attach the spreadsheet and the waste survey. The memo will be saved in Box under Radioactive Waste Disposal (280) \ Radioactive Waste Decay in Storage.
- 8.2.5.4. A radiation safety technician will dispose the waste material as ordinary trash in a dumpster.
- 8.2.5.5. If the survey in step 8.2.4.2 indicates radioactive material is present, the technician will contact a radiation safety staff member to review and provide additional guidance.
- 8.2.6. Performing Waste Characterization Measurements
- The Radiation Safety Department can assist Authorized Users with waste characterization for materials that cannot be characterized by process knowledge such as activated materials or legacy materials. Characterization measurements performed by the Radiation Safety Department include gamma spectroscopy measurements, sampling of liquid materials for analysis by liquid scintillation, and sampling materials for analysis at off-site analytical laboratories.
- 8.2.6.1. Perform the following steps to collect a sample of aqueous liquids.
- For aqueous liquids, collect 5 ml of liquid and 15 ml of Ultima Gold LLT.
 - Create a background sample using 5 ml of tap water and 15 ml of Ultima Gold LLT.
 - Analyze the samples on the Radiation Safety Department liquid scintillation counter using protocol 6 (30-minute count time and two beta windows).
- 8.2.6.2. Perform the following steps to collect a sample of oils.
- For oils, collect 5 ml of liquid and 15 ml of Ultima Gold LLT.
 - Create a background sample using 5 ml of clean oil and 15 ml of Ultima Gold LLT.
 - Analyze the samples on the Radiation Safety Department liquid scintillation counter using protocol 6.
- 8.2.6.3. Perform the following steps to measure a waste item by gamma spectroscopy
- Tape Cs-137 source 124840 (or other appropriate source) on the top front of the portable HPGe detector with front edge at the bevel and lettering up.
 - Select Advanced/Calibrate from the main menu.
 - Adjust energy calibration as necessary and note the adjustment in the project log.



- Select Identify and let the instrument count for 600 seconds.
- Press pause and then save.
- If the EVA instrument is used for gamma spectrometry, perform an instrument check by following the steps described in the Operating Instructions for the EVA, which is saved on box.
- Record the source check count in the project log.
- Count the waste item as directed by the radiation safety staff member.
- For drums, standard counting conditions are two feet from the center of the side of the drum for one hour. Pause every 15 minutes and rotate the drum 90°.
- Record the waste count in the project log. Note count time and counting geometry.
- Move the waste item away from the detector. Count background for the same time as the waste item with the detector in the same position.
- Record the background count with count time in the project log.
- For carboys, the standard count distance is one foot from the center of the side of the carboy and the standard count time is 30 minutes.
- For other waste items, count as directed by the radiation safety staff member.

8.2.6.4. Perform the following steps to analyze the gamma spectroscopy measurement.

- Develop a MicroShield model for the count geometry and waste contents. Standard models are available for drums with compactable waste and carboys with liquids. Use standard energy points (60, 70, 80, 90, 100, 125, 150, 175, 200, 250, 300, 400, 500, 600, 700, 800, 900, 1000, 1200, 1400, 1600, 1800, 2000, 2400, 2800) and 1 Bq source term.
- Analyze the measurement control Cs-137 check and enter the data in the control chart spreadsheet. If the measurement is beyond three sigma, the measurements will have to be repeated.
- Analyze the gamma spectrum after subtracting the background spectrum live time normalized to determine net counts in peaks of interest.
- Enter the waste item, file name for the gamma spec measurement, the live time, and the MicroShield unattenuated fluence rate in the gamma spectroscopy spreadsheet. Enter the Nuclide, energy, yield (from decay data search), and net counts in the spreadsheet. Activity results will be given in the uniform source estimated activity (Ci) column.



- Save the spreadsheet file on Box under current radioactive waste for the container or waste tag.
- If the EVA instrument is used for gamma spectrometry, generate the efficiency curve for the desired geometry by using the vendor supplied efficiency generating software, namely, LabSOCS, and analyze the spectrum using the Gamma-ray Energy and Identification Evaluation (GENIE) software.

8.3. Data Management in HP Assist

The following sections describe basic data entry for waste management in HP Assist

8.3.1. Add a RAM Waste Container

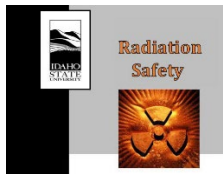
This is performed each time a new waste container is created. Container numbers are assigned as follows. Location_MM-DD-YY_X where X is a consecutive number if multiple containers are created at the same location on the same date.

- Select Waste
- Select RAM Waste Containers
- Select Add
- Under Container Info.
 - Enter starred fields (use RSO as generator for all), contents description, weight in pounds
- Under Container Dates
 - Enter opened date (first date).
- Under Storage Location
 - Enter building and location.

8.3.2. Add a Waste Tag to a Container

This is performed each time a waste tag is created and transferred to a waste container. Waste tag numbers are tracked in the spreadsheet on box. Assign the next number and enter it in the spreadsheet.

- Select Waste
- Select RAM Waste Container to see list of available containers.
 - Click on arrow (a triangular shape inside a square) adjacent to container number to view contained isotopes.
- Select Add



- Under Waste Content Details
 - Select isotope.
 - Enter Waste Tag # under Waste Card. Just numeric digits.
- Under Assay Detail
 - Enter amount for license unit under receipt activity
- Repeat for each isotope on each waste tag

8.3.3. Final Disposal of a Container

- Select Waste
- Select RAM Waste Containers
 - Double click on container to open
- Under Disposal
 - Enter Final Disposal Date, Final Disposal Method, Manifest number
 - Check Disposed.
- Under DOT Shipping
 - Enter the Manifest number.
- Repeat for each container disposed in the waste shipment.

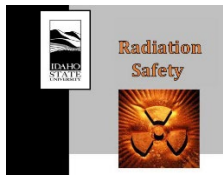
8.3.4. Enter RAM Waste Manifests

- Select Waste
- Select RAM Waste Manifests
 - Select Add
- Under Waste manifest
 - Enter Manifest # from TGA and Shipment Date

8.3.5. Waste Queries

Common waste queries, executed through mySQL Workbench, are available to the Radiation Safety Department to perform the following functions:

- Summarize disposal information by container number.
- Summarize disposal information by manifest number.
- Provide summed activity for a container for entry into waste profile.
- Perform insert and update queries to virtually dispose ship_codes when transferred to waste containers.



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9. LIST OF FORMS

Waste Addition Log (See Section 8.1.2.1)
Waste Tag (located on Box)
Sewer Discharge Spreadsheet (located on Box)
Decay in Storage Spreadsheet (located on Box)

10. REFERENCES

ISU Hazardous Waste Management Plan
Dangerous Waste Designation Publication 23-04-006
(<https://apps.ecology.wa.gov/publications/SummaryPages/2304006.html>)

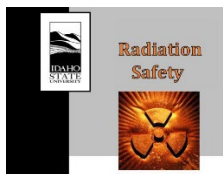
11. CHANGE HISTORY

Revision 1.0 – Section 8.3 was added to provide instructions for entering source terms for waste containers into the HPAssist database. Two websites were added for reference while executing this procedure. A few sentences were added/removed for the clarity of the existing procedure and to make the waste management program more efficient.

Revision 2.0- Section 8.2.2 was added regarding the evaporation of certain radioactive liquid wastes, which may only be performed with the approval of the RSO.

12. APPENDICES

Appendix I – Waste Packaging Instructions.



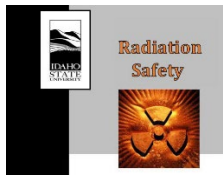
APPENDIX I - Waste Packaging Instructions

LSC Vial Waste

- Place a clear drum liner in the waste drum and tape the edge to the side of the drum.
- Place approximately four inches of vermiculite in the waste liner.
- Place a second liner in the drum and tape to the side of the drum.
- Place full LSC vials in the drum until full. Record waste tag numbers on the Waste Addition Log.
- When drum is full, tape the two liners closed and close the drum according to the manufacturer instructions.
- Scan the waste addition log into the container folder on Box under Current Radioactive Waste.

Lab Pack Containers

- Ensure the waste drum is rated for liquids. It will have a UN identifier line like UN1A2/X 1.5/ 400/ 19/ USA/ LM000 where 1.5 is the specific gravity and 400 is the maximum gross mass in kilograms. There will probably be a second line in the form UN1A2 /X 400/S/ 19/ USA/ LM000 where S indicates solids. If only one line is present and it contains S, the drum is not rated for liquids.
- Place a clear drum liner in the waste drum and tape the edge to the side of the drum.
- Place approximately four inches of vermiculite in the waste liner.
- Ensure all liquid waste materials are in strong containers with screw top lids and have volume less than 4 L for glass containers and less than 20 L for plastic and metal containers.
- Ensure all liquid waste containers are in the same hazard class and are compatible (e.g. Class 8 for corrosive acids)
- Tape each liquid waste container closed.
- Place a layer of liquid containers in the drum.
- Surround the liquid containers with vermiculite and cover with another four-inch layer.
- Repeat the process until the drum is full.
- Tape the liner closed and close the drum according to the manufacturer instructions.
- Scan the waste addition log into the container folder on Box under Current Radioactive Waste.



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Solid Radioactive Waste in Drums

- Place a clear drum liner in the waste drum and tape the edge to the side of the drum.
- Load solid waste until the drum is full. Record all items and waste tags on the waste addition log.
- When the drum is full, tape the liner closed and close the drum according to the manufacturer instructions.
- Scan the waste addition log into the container folder on Box under Current Radioactive Waste.

