
RADIOACTIVE WASTE MANAGEMENT AND DISPOSAL

1.0 **PURPOSE**

To describe the handling, storage, and disposal of radioactive waste and the documentation requirements of these activities.

2.0 **SCOPE**

This procedure applies to all radioactive waste generated at the Georgia Institute of Technology (Georgia Tech) from the use of radioactive sources, as well as radioactive sources to be disposed. The procedure covers the requirements of waste storage, waste management and inventory, and waste disposal for all physical forms of waste as well as waste containing short or long half-life isotopes.

3.0 **RESPONSIBILITIES**

3.1 The Authorized User (AU) shall ensure that waste produced is properly stored until removed from the lab by the Office of Radiological Safety, and that all documentation and forms are completed accurately. The AU shall keep copies of completed Form Es and maintain their inventory up-to-date. The AU shall ensure that waste volume is minimized to the extent possible.

3.2 The Office of Radiological Safety (ORS) shall be responsible for the collection, storage, inventory, and disposal of all radioactive waste and sources from Georgia Tech as specified in this procedure.

3.3 The radioactive waste broker utilized by Georgia Tech shall be appropriately licensed to accept radioactive waste in the form, activity, and quantity required. They shall label all containers and create the required manifests. The radioactive waste broker shall ensure that waste from Georgia Tech is transferred to an appropriately licensed facility for permanent disposal.

4.0 **REFERENCES/REQUIREMENTS**

4.1 Requirements and Specifications

4.1.1 OCGA 391-3-17-.03(13)

4.1.2 10 CFR 20, Appendix B, Table III

4.1.3 40 CFR 260, 266

4.2 Related Procedures

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- 4.2.1 Procedure 9510, Radioactive Material Shipment
- 4.2.2 Procedure 9501, Control and Accountability of Radioactive Material
- 4.2.3 Procedure 9317, Routine Surveys for Open Source Radioactive Material Labs
- 4.3 Required Forms
 - 4.3.1 RS-019e, “Radioactive Material Inventory Use and Waste Form” (Form E)
 - 4.3.2 RS-019g, “Radioactive Waste Disposal Form” (Form G)
 - 4.3.3 RS-150, “Decay In Storage Disposal Cover Sheet”
 - 4.3.4 RS-159, “ORS Hot Sink Disposal Log”
- 4.4 Other
 - 4.4.1 Method 71, Analysis of DIS Waste Prior to Disposal
- 5.0 **PROCEDURAL STEPS**
 - 5.1 STORAGE IN THE LAB
 - 5.1.1 Waste shall be separated by physical form and isotope to the extent possible.
 - 5.1.2 Waste shall be secured in the same manner as radioactive sources, such as in a locked lab or in a locked cabinet in a neighborhood lab.
 - 5.1.3 Mixed waste must be approved by the Radiation Safety Committee before generation. It refers to waste that is both radioactive and hazardous, to include:
 - 5.1.3.1 RCRA listed wastes (e.g., “F”, “K”, “P”, and “U” lists)
 - 5.1.3.2 RCRA wastes showing the characteristic of ignitability, corrosivity, reactivity, or toxicity (“D” wastes)
 - 5.1.3.3 Biological, pathogenic, or infectious waste
 - 5.1.4 Waste Storage Containers
 - 5.1.4.1 All radioactive waste storage containers shall be provided by ORS and labeled with a “Caution Radioactive Material” label.

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- 5.1.4.1.1 Prior to delivery to a lab for use, ORS shall follow the instructions under “Add In-Lab RAM Waste Container” in the online EHSA User Handbook at <https://www.ehs.gatech.edu/node/2723>.
- 5.1.4.2 Liquid waste shall be stored in plastic 1-gallon containers or an appropriate container if the liquid is not compatible with plastic. When waste is not being added, the cap shall be secured.
- 5.1.4.3 Solid waste shall be stored in black plastic 5-gallon buckets with plastic bag liners placed inside. When waste is not being added, the plastic lid shall be in place.
- 5.1.4.4 Liquid scintillation vials shall be stored in vial flats inside plastic storage tubs. Vials may be stored in plastic bag-lined black plastic 5-gallon buckets with plastic lids with approval of the RSO. When waste is not being added, the lid shall be in place.
- 5.1.4.5 Sharps shall be stored in red puncture-proof plastic containers.
- 5.1.5 Documentation
 - 5.1.5.1 As RAM Radiation Workers (end users) use radioactive material, they shall log the usage and disposal on a hardcopy "Form E Radioactive Material Use and Waste Log". These entries shall then be input by the end user into the EHSA database (EHSA) according to the instructions under “Enter Radioactive Source Use and Waste” in the online EHSA User Handbook at <https://www.ehs.gatech.edu/node/2722>.
 - 5.1.5.1.1 When waste added to a container has no source number, ORS shall follow the instructions under "Add a Waste Tag for Waste with no ORS Source Number" in the online EHSA User Handbook at <https://www.ehs.gatech.edu/node/2725>.
 - 5.1.5.2 When a lab is finished with an in-lab RAM waste container or it is full, the container shall be physically sealed and virtually sealed in EHSA, followed by a waste pickup request being generated, according to the instructions under “Seal In-Lab RAM Waste Container and Request Waste Pickup” in the online EHSA User Handbook at <https://www.ehs.gatech.edu/node/2728>.
 - 5.1.5.3 ORS shall physically pick up the waste container and process it according to “Process a RAM Waste Pickup” in the online EHSA at <https://www.ehs.gatech.edu/node/2724>. The steps for processing waste are:
 - 5.1.5.3.1 In EHSA, marking it as picked up and changing the container from in-lab RAM waste to ORS Waste Area,

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- 5.1.5.3.2 Filling in the waste information on the yellow waste tag, and placing the container in the ORS waste room,
- 5.1.5.3.3 Printing the Form G from EHSA for each waste container and saving a PDF copy in ORS Files/Waste/Form G. The hard copy shall be stored in the HP Tech file drawer in Boggs 3-60 until the waste has been finally disposed.
- 5.1.5.3.4 No radioactive waste shall be removed from the generating lab unless the Form E has been completed and its information has been entered in EHSA according to Procedure 9501.
- 5.1.5.3.5 The Form G shall contain at least the following: date, source number, radionuclide, activity disposed, description of waste disposed into the container, and physical form.
- 5.1.5.3.6 If a source or waste generated from a source is being disposed and the source is not currently listed on the inventory, the source number field of the Form G may be blank.
- 5.1.5.4 A PDF of the “Rad Source Usage History” report shall be saved in ORS Files/Isotope Receipts for each source when totally disposed using the “Rad Source Usage History” report in EHSA. Instructions for accessing this report are found under “Rad Source Usage History Report” in the online EHSA User Handbook at <https://www.ehs.gatech.edu/node/3503>.
- 5.1.5.4.1 The radioactive source usage history report shall contain at least the following: Authorized User, source number, isotope, original receipt date, activity, and volume/mass, storage location, compound, disposal date, activity removed, waste ID #, type of waste that was generated, and use volume/mass/activity.
- 5.2 DISPOSAL OPTIONS
- 5.2.1 Any isotope with a half-life of 120 days or less is considered a short half-life isotope. Any other isotope is considered a long half-life isotope.
- 5.2.2 Any waste container only containing a short half-life isotope may be stored for 10 half-lives to decay or may be shipped off in the same manner as waste containers containing long half-life isotopes.
- 5.2.3 **Decay In Storage (DIS)**
- 5.2.3.1 DIS is the process by which short half-life waste is held for decay until its radiation level is no longer distinguishable from background.

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- 5.2.3.2 Distinguishable from background means that the detectable concentration of a radionuclide is statistically different from the background concentration of that radionuclide.
- 5.2.3.3 A sample shall be considered distinguishable from background if the net count rate of the sample exceeds the critical level (L_C) determined for the instrument used. Refer to ORS Method 71 for a discussion of the critical level and guidance on applicable DIS waste survey methods.
- 5.2.3.4 After confirmation that waste is not distinguishable from background:
- 5.2.3.4.1 Attach the waste tag to the matching Form G. Attach these, as well as any sample printouts, to the RS-150.
- 5.2.3.4.2 Update the database to indicate the means and date of disposal of the waste container according to the online EHSA User Handbook at <https://www.ehs.gatech.edu/node/1882>.
- 5.2.3.5 Solid Waste DIS
- 5.2.3.5.1 Solid waste shall be surveyed thoroughly with an appropriate survey meter.
- 5.2.3.5.2 At least one smear shall be taken of the contents of each waste container and counted using an LSC.
- 5.2.3.5.3 Solid waste is considered non-radioactive if the survey meter readings are below the Georgia Tech contamination levels (as specified in Procedure 9317 for unrestricted areas), and the smear results are not distinguishable from background (as discussed in 5.2.3.3).
- 5.2.3.5.4 Non-radioactive solid waste may be discarded as regular trash after all labels and markings indicating the presence of radiation or radioactive materials have been removed or defaced.
- 5.2.3.6 Liquid Scintillation Vial Waste DIS
- 5.2.3.6.1 LSC vials shall be counted on an LSC. If they have liquid on the exterior, they shall be wiped clean prior to placement in the vial rack. This should take place on bench paper on a lab benchtop or in the fume hood.
- 5.2.3.6.2 LSC vials are considered non-radioactive if the results are not distinguishable from background.

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- 5.2.3.6.3 Non-radioactive LSC vials may be transferred to Georgia Tech Environmental Health and Safety (EHS) for disposal.
- 5.2.3.7 Liquid Waste DIS
- 5.2.3.7.1 A 1 mL sample of the liquid waste shall be combined with 10 mL of liquid scintillation cocktail and counted using a liquid scintillation counter (LSC).
- 5.2.3.7.2 Liquid is considered non-radioactive if the sample result is not distinguishable from background.
- 5.2.3.7.3 Before pouring non-radioactive liquid waste down the drain, verify the following:
- 5.2.3.7.3.1 Chemical and other properties are suitable for sewer disposal as verified by EHS
- 5.2.3.7.3.2 Any material is readily soluble in water or is readily dispersible biological material
- 5.2.3.7.4 If all of the above criteria are not met, the liquid waste will be transferred to EHS for disposal.
- 5.2.4 **Sewer Disposal of Radioactive Liquids**
- 5.2.4.1 Sewer disposal of radioactive liquids shall only be performed when the following specific conditions are met:
- 5.2.4.1.1 ORS disposes of the waste using its designated hot sink
- 5.2.4.1.2 Concentration limits from Table III of Appendix B of 10 CFR 20 will not be exceeded. If multiple isotopes are released, the sum of the fractions will not exceed 1.
- 5.2.4.1.3 Annual limits of 5 Ci of H-3, 1 Ci of C-14, and 1 Ci of all other isotopes will not be exceeded
- 5.2.4.1.4 Chemical and other properties are suitable for sewer disposal as verified by EHS
- 5.2.4.1.5 Any material is readily soluble in water or is readily dispersible biological material
- 5.2.4.2 Pour the waste slowly to minimize splashing with the water running, to be sure that the material moves out of the sink and into the sewer system.

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- 5.2.4.3 After finished pouring, survey the sink and surrounding work surfaces to confirm that no residual material or contamination remains in the sink or on the surrounding work surfaces. If contamination is found, decontaminate as soon as possible.
- 5.2.4.4 Document sewer disposal on RS-159, waste tag, and Form G.
- 5.2.4.5 Update the database to indicate the means and date of disposal of the waste container.
- 5.2.5 **Release of Radioactive Material via Air Effluent**
- 5.2.5.1 Disposal of radioactive material via air effluents shall be implemented only with the approval of the RSO.
- 5.2.5.2 Prior to the disposal, calculations must be made and documented to ensure that the individual member of the public most likely to receive the highest dose will not be expected to receive a total effective dose equivalent in excess of 10 mrem per year from the air effluents.
- 5.2.5.3 Where deemed necessary by the RSO, filtration systems will be installed to prevent the emission of excessive levels of air effluents.
- 5.2.6 **Shipment to Permanent Waste Facility**
- 5.2.6.1 General Instructions
- 5.2.6.1.1 Waste shall be packaged in appropriate containers.
- 5.2.6.1.2 Waste shall be packaged as described in OCGA 391-3-17-.03(13)(g)1.
- 5.2.6.1.3 Determine class of waste (A/B/C/GTCC) based on OCGA 391-3-17-.03(13)(f) and label container as such.
- 5.2.6.2 Additional Instructions by Physical Form
- 5.2.6.2.1 Any LSC vial with counts that are not distinguishable from background may be considered non-radioactive.
- 5.2.6.2.2 LSC vials containing H-3, C-14, or I-125 are considered non-radioactive if the activity of does not exceed 0.05 $\mu\text{Ci}/\text{gram}$ of liquid scintillation counting media.
- 5.2.6.2.3 A Uniform Hazardous Waste Manifest shall be completed for shipments of LSC vials, as needed, or mixed waste, and a copy sent to EHS.

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- 5.2.6.2.4 Animal carcasses are considered not radioactive if the activity of H-3, C-14, and I-125 does not exceed 0.05 $\mu\text{Ci}/\text{gram}$ averaged over the weight of the entire animal.
- 5.2.6.3 Documentation for Shipment
- 5.2.6.3.1 Each waste container to be shipped shall be given a unique identification number comprised of the type of waste (D – dry solid, A – aqueous liquid, V – scintillation vials, R – resin, etc.), the year it was packed, and the sequential number of that type of container for that year.
- 5.2.6.3.2 NRC Forms 540 and 541 (and 542 if applicable) shall be completed according to OCGA 391-3-17-.03(13)(g)2.(i).
- 5.2.6.3.3 Procedure 9510 for a DOT regulated ground shipment shall be followed.
- 5.2.6.3.4 Update the database to indicate the means and date of disposal of the waste container.
- 5.2.7 **Return to Vendor or Transfer to Other Licensee**
- 5.2.7.1 This disposal mechanism includes the transfer of discrete sources to the original vendor when the source is no longer needed by Georgia Tech, or transfer of discrete sources to another licensee that has use for the source no longer needed by Georgia Tech.
- 5.2.7.2 Ship the source according to Procedure 9510 to the vendor or other licensee.
- 5.2.7.3 Update the database to indicate the means and date of disposal of the source.

6.0 **RECORDS**

All records generated by the implementation of this procedure shall be maintained as permanent records of Georgia Tech. Rule .01(2)(o)3. and 4.