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| <b>Purpose</b>   | <ul style="list-style-type: none"> <li>To ensure the safety of those individuals who handle radioactive waste</li> <li>To comply with University, New York State and Federal requirements</li> <li>To be proactive when working on special or mixed waste projects</li> </ul> |
| <b>When</b>      | <ul style="list-style-type: none"> <li>Conducting work under a radioactive materials permit</li> <li>Waste removals that occur every Tuesday morning</li> </ul>   |
| <b>Materials</b> | <ul style="list-style-type: none"> <li>Radioactive materials permit</li> <li>Special Procedure #13 (decay excel sheet)</li> <li>Radioactive waste tag</li> </ul>  |
| <b>Resources</b> | <ul style="list-style-type: none"> <li>Radiation Safety Manual</li> <li>New York State Sanitary Code 10 NYCRR Part 16 – Ionizing Radiation</li> <li>Department of Environmental Conservation 6 NYCRR Part 380</li> </ul>  |

**CORNELL UNIVERSITY**

**PROCEDURE for DISPOSAL of RADIOACTIVE MATERIALS**

This procedure has been developed to ensure the safety of those individuals who handle radioactive waste and to comply with University, New York State and Federal requirements. The importance of strict adherence to this procedure cannot be overemphasized.

The generation of radioactive material with biohazard agents, EPA identified hazardous waste, or other unusual issues require special consideration. Contact the Department of Environmental Health & Safety (EH&S) **prior** to beginning projects that generate this type of waste. Failure to pre-evaluate potential waste may result in extreme disposal costs or generation of waste for which a disposal option does not exist.

The disposition of all forms of radioactive material is performed by EH&S. Solid radioactive materials may **not** be placed in the standard waste containers (collected by building care personnel). Radioactive carcasses may **not** be digested. Laboratory personnel may **not** discharge radioactive liquids into the sewer system. All radiation safety rules and procedures apply. Accounting for waste removal is a critical part of the inventory record.

Radioactive materials not prepared according to this procedure or by the scheduled pickup time will not be removed by EH&S staff.

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## Radioactive Waste Disposal

### 1. MINIMIZATION

Continued access for New York State waste generators to a low-level radioactive waste burial site is uncertain. Cornell is committed to minimizing the volume of radioactive waste generated. Utilizing the waste minimization practices presented below and complying with the waste procedures will keep volumes and costs at their minimum.

- 1.1 Order only the amount of radionuclide necessary for the research.
- 1.2 Use radioisotopes with half-lives less than 90 days wherever possible. Waste with half-lives less than 90 days is processed on site by decay.
- 1.3 Separate waste with a half-life of less than 90 days by individual radioisotopes. See section 3.1.5 for further instruction.
- 1.4 When working with readily detectable radionuclides, monitor potentially contaminated items and dispose of non-contaminated materials (less than 2 times background) as regular trash.
- 1.5 Consolidate waste of the same type and radioisotope category. Combine small dry waste items into larger waste bags with one Radioactive Waste Tag.
- 1.6 Use approved Biosafe liquid scintillation cocktails. Samples with counts of less than 2 times background or wipes less than 100 dpm are considered non-radioactive. (See section 3.9 for approved listings.)
- 1.7 Dispose of packaging (**excluding** stock vials and lead pigs) used for shipping radioactive products as regular trash. All packages must be free of contamination, radiation symbols and markings, and other DOT markings.
- 1.8 Contact EH&S for removal of all full or closed radioactive waste containers in a timely manner.
- 1.9 Removal of radioactive waste is recommended to occur at least every 6 months for isotopes with a half-life of 14 days or less, and once a year for isotopes with a half-life of greater than 14 days.

### 2. CONTAINERS

Waste types (dry, sharps, regulated medical waste, liquids, and scintillation vials) must be kept separate. Laboratories where radioactive waste is generated must be equipped with at least one container for each type of waste generated. All containers must be conspicuously labeled with the radiation symbol, isotope and for liquids chemical constituents. Separate containers are required for **each** radioisotope having a half-life of less than 90 days. Radioisotopes with a half-life of greater than 90 days may be combined with like types. Exceptions must receive prior approval from EH&S.

#### 2.1 Containers for Dry Materials

- 2.1.1 EH&S provides containers and labels.
- 2.1.2 Dry materials must be double bagged using **two clear**, 3 mil. bags (supplied by EH&S) as a liner for the container. **Biohazard bags** must not be used.
- 2.1.3 Containers must have radiation labels on two opposite sides and the lid. Containers must also be labeled with isotope. Labels can be obtained through EH&S.

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### 2.2 Containers for Sharps

- 2.2.1 “Regulated Medical Waste, Sharps”, must be collected in a red sharps container and have the word biohazard or be labeled with the universal biohazard symbol. These containers must be labeled with the radiation symbol and isotope. Separate these sharps from other non-radioactive sharps in the lab. See section 3.2.1 for description of Regulated Medical Waste Sharps.
- 2.2.2 “Other Sharps” must be collected in a puncture resistant, leak proof container and may be placed in dry waste container. See section 3.2.2 for description of Other Sharps.

### 2.3 Containers for Liquid/Secondary Containment

- 2.3.1 Use 1 gallon bottles or sturdy Nalgene carboys with a volume of 20 liters or less. For isotopes with a half-life of greater than 90 days, use only 1 gallon containers (plastic preferred). Inappropriate containers are not acceptable and will not be removed from the lab. Caps to all vessels must seal completely in order to prevent leakage during transport.
- 2.3.2 Recycled containers are available on a limited basis through EH&S. Please make request in the notes section of the on-line waste removal form.
- 2.3.3 To facilitate the return of empty carboys, use a permanent marker to indicate on the outside of the carboy the permit holder name, laboratory room number and building name. Carboys still in good condition will be returned to the lab after a 10 half-life decay period.
- 2.3.4 When using recycled bottles, deface or remove all markings, triple rinse and label with radioactive marking tape, isotope and chemical constituents. Bottles will not be returned.
- 2.3.5 Keep liquid vessels in secondary containment:
- (i) Secondary containment for bottles can be a pail, bucket, or basin large enough to hold the entire contents if the bottle were to crack or break.
  - (ii) Secondary containment for carboys can be a basin or tray, which is large enough to contain any liquid that might spill during transfers. Once a carboy is filled, capped, and wipe tested and the completed Radioactive Waste Tag attached, it may be stored on plastic-backed, absorbent paper until removal by EH&S.

### 2.4 Containers for Scintillation Vials

- 2.4.1 Use original trays. Place trays upright in a suitably sized, closable box. Place a small radioactive label on side of box identifying isotope and scintillation fluid.
- 2.4.2 If trays are not available, vials must be double-bagged with paper absorbent material between the bottom of the inner and outer bags. Bags must then be placed in a suitably sized, closable box. Place a small radioactive label on side of box identifying isotope and scintillation fluid.

### 2.5 Containers for Carcasses

- 2.5.1 Double bag carcasses with isotope of 90 day half-life or less in clear plastic bags and attach a completed Radioactive Waste Tag.

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- 2.5.2 For carcasses with isotopes of greater than 90 day half-life, receive instruction from EH&S (255-8200) **prior** to generation.

### 3. PACKING PROCEDURES

#### 3.1 Dry Material

Dry material includes, but is not limited to, gloves, bench paper, tissues, paper towels, disposable pipette tips, empty stock vials, etc.

- 3.1.1 Materials may not contain standing liquid.
- 3.1.2 Materials may not contain lead. See section 3.10 for proper disposal of lead.
- 3.1.3 Materials may not contain biohazards. See section 3.11 for instruction.
- 3.1.4 Materials must be double bagged with clear plastic bags only (supplied by EH&S). Smaller bench top collection bags should also be clear plastic bags.
- 3.1.5 Treat dry materials with a half-life of 90 days or less as follows:
- (i) Separate by radioisotope.
  - (ii) **Remove or obliterate** all radioactive labels or markings.
  - (iii) Pack labels that are still legible or contaminated into a separate container, such as a box or zip lock bag. Clearly mark this container as "labels". Attach a note requesting removal of the item. A Radioactive Waste Tag is not required for labels.
- 3.1.6 Treat dry materials with a half-life of greater than 90 days as follows:
- (i) These radioisotopes may be combined.
  - (ii) Dry material may include radioactive labels.
  - (iii) Metals **must** be separated from dry material.
- 3.1.7 The exterior surfaces of the closed bag must be free of removable contamination, i.e. less than 100 dpm. Printout of wipe survey results must accompany items offered for removal. Calculated dpm must be noted on each Radioactive Waste Tag. Consult the Survey Guide found in the Radiation Safety Manual, divider Inspections & Surveys for guidance.
- 3.1.8 A wipe survey can be taken of the upper half of the closed bag, allowing it to stay in the container.
- 3.1.9 Surveyed bags with negative results may be tagged and placed on plastic-backed absorbent paper while awaiting removal. **Do not** stuff waste bags back into the waste container. Shield waste if necessary.
- 3.1.10 Attach a **completed** Radioactive Waste Tag to each item awaiting removal.

#### 3.2 Sharps

- 3.2.1 "Regulated Medical Waste Sharps", including hypodermic needles, syringes, pasteur pipettes, scalpel blades, and blood vials, shall be treated as follows:
- (i) No other type of biohazards materials may be included. See section 3.11 for instruction.
  - (ii) Place in appropriate containers. See section 2.2.1.
  - (iii) Container must be labeled "Biohazard" or have the universal Biohazard symbol along with a radioactive label.

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- 3.2.2 “Other Sharps” which includes razor blades, broken glass, serological pipettes etc. shall be treated as follows:
- (i) No other type of biohazards materials may be included. See section 3.11 for instruction.
  - (ii) Collect material in an appropriate radioactive-labeled container. See section 2.2.2
  - (iii) If incorporating this item into a dry container, remove radioactive labels if isotope has a half-life of 90 days or less.
- 3.2.3 All radioactive sharps must be segregated according to half-life:
- (i) Less than 90 days must be separated by radioisotope.
  - (ii) Greater than 90 days may be combined.
- 3.2.4 The exterior surfaces of all sharps containers offered separately from dry waste must be free of removable contamination, i.e. less than 100 dpm. Printout of wipe survey results must accompany sharps containers offered separately from dry waste. Calculated dpm must be noted on each Radioactive Waste Tag. Consult the Survey Guide found in the Radiation Safety Manual, divider Inspection & Surveys for guidance.
- 3.2.5 Attach a **completed** Radioactive Waste Tag to each waste item awaiting removal.
- 3.2.6 Shield sharps containers if necessary.

### 3.3 Liquid

- 3.3.1 Liquid categories include aqueous, and EPA identified (either listed or characteristic) hazardous waste. Consult with EH&S prior to creating an EPA identified hazardous waste (255-8200).
- 3.3.2 Liquids must be segregated according to half-life/activity categories:
- (i) Less than 90 days must be separated by radioisotope.
  - (ii) Greater than 90 days with H3 and C14 may be combined.
  - (iii) Greater than 90 days all others separated by radioisotope.
- 3.3.3 Do not overfill bottles or carboys. Vessels which are overfull are a transport hazard and will **not** be removed by EH&S staff.
- (i) Fill bottles to the beginning of the shoulder or to 3 inches from the top.
  - (ii) Fill carboys to below the shoulder of the container.
- 3.3.4 Liquid waste must have both a radioactive label and a chemical constituents label. Labels must be in place while the container is being filled.
- 3.3.5 Liquid waste must not contain solid materials such as vials, tubes, magnetic stirrers, filters, pipettes, particulate, precipitate, etc.
- 3.3.6 Liquids must have a pH of between 5.5 and 9.5. Record the pH value on the Radioactive Waste Tag.
- 3.3.7 The exterior surfaces of all containers must be free of removable contamination, i.e. less than 100 dpm. A printout of the wipe survey results must accompany items offered for removal. Calculated dpm must be noted on each Radioactive Waste Tag. Consult the Survey Guide found in the Radiation Safety Manual, divider Inspection & Survey for guidance.

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3.3.8 Attach a **completed** Radioactive Waste Tag to each waste vessel awaiting removal. Be sure to list the different chemicals placed in the waste vessel in the CHEMICAL NAME section of the Radioactive Waste Tag.

3.3.9 Shield if necessary.

### 3.4 Liquid Scintillation Counting Vials

3.4.1 Liquid scintillation vials must not contain lead (including Pb-210), mercury, or Uranium/Thorium Compounds.

3.4.2 Liquid scintillation vials must not contain isotopes with half-life > 109 days except H-3 and/or C-14.

3.4.3 Liquid scintillation vials **must be separated by isotopes**. DO NOT combine isotopes, as the disposal costs can be very expensive! Keep total activity equal to or less than 1.0 millicurie (mCi) per container.

3.4.4 Vials containing H-3 and/or C-14 may be packaged together. Keep total activity equal to or less than 1.0 millicurie (mCi) per container

3.4.5 Place vials in their original trays in the upright position.

- (i) Return trays, in the upright position, to the original shipping boxes.
- (ii) Label box with a small radioactive label.
- (iii) Tape box closed and clearly mark the "up" direction on the outside of the box.

3.4.6 If the original container is not available or vials were bought in bulk:

- (i) Choose a sturdy cardboard box of a size that will accommodate a maximum of 500 standard vials or 1,000 sub-mini vials.
- (ii) Line the box with a clear plastic bag available from EH&S.
- (iii) Place a layer of absorbent paper (diaper paper, paper towels, etc.) in the bag.
- (iv) Place another plastic bag on top of the absorbent paper.
- (v) Place vials inside the second plastic bag.
- (vi) Seal both plastic bags when full.
- (vii) Tape box closed.

3.4.7 Vials must be offered for removal on a regular basis to prevent leakage and potential external contamination of containers.

3.4.8 The exterior surfaces of all containers must be free of removable contamination, i.e. less than 100 dpm. Print-out of wipe results must accompany items offered for removal. Calculated dpm must be noted on each Radioactive Waste Tag. Consult the Survey Guide found in the Radiation Safety Manual, divider Inspection & Surveys for guidance

3.4.9 Attach a **completed** Radioactive Waste Tag to each box awaiting removal. Be sure to list the brand of liquid scintillation fluid used in the LSC Vials section of the Radioactive Waste Tag.

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### 3.5 Liquid Scintillation Cocktails

3.5.1 Scintillation vials with approved "Biosafe" cocktails containing samples with counts of less than 2 times background or wipe test less than 100 DPM are considered non-radioactive and may be disposed of into the sanitary sewer. The approved cocktails are:

| <b><u>Manufacturer</u></b> | <b><u>Product</u></b> |
|----------------------------|-----------------------|
| Amersham                   | NBCS 204              |
| Atlantic Nuclear           | Econo-Safe            |
| Beckman                    | Ready Safe            |
| DuPont                     | NEF-989               |
| Fisher                     | Scint-safe Econo 1    |
|                            | Scint-safe Econo 2    |
|                            | Ultima-Flo AP         |
| ICN                        | Ecolume               |
|                            | UniverSol ES          |
|                            | BetaMax ES            |
|                            | CytoScint ES          |
| Isolab, Inc.               | Solvent Free          |
| National Diagnostics       | Ecoscint              |
| Packard                    | Ultima Gold           |
|                            | Opti-Flour            |

To obtain approval for other scintillation cocktails, contact EH&S at 255-8200.

3.5.2 Scintillation vials with standard cocktails containing samples with counts of less than 2 times background or wipe test less than 100 DPM are considered non-radioactive and must be disposed of via the Hazardous Waste Manual.

### 3.6 Animal Materials

Animal Material generated from animal experiments include: bedding, dry material, blood/urine and carcasses. Each type must be segregated.

3.6.1 Bedding:  
Bedding material includes soiled bedding material only. Bedding is to be double bagged in clear plastic bags available from EH&S.

3.6.2 Dry Material:  
Dry material includes gloves, bench paper, paper towels, etc. See section 3.1 for packing instructions.

3.6.3 Blood/Urine:  
Collect blood/urine separately in 1 gallon containers. Prior to generating amounts greater than 1 gallon, contact EH&S for specific instruction (255-8200).

3.6.4 Carcasses:

- (i) Separate by half-lives if half-life is 90 days or less.
- (ii) Contact EH&S for specific disposal instructions **prior** to generating carcass waste containing radioisotopes with half-lives greater than 90 days.
- (iii) Double-bag in clear plastic bags available from EH&S.
- (iv) Bags may not contain gloves, paper, absorbent pads or other non-carcass material
- (v) Remove as much air as possible before sealing.
- (vi) Keep the "bagged" carcasses frozen until removal by EH&S.
- (vii) Treat animal parts as carcass material.

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- (viii) Treat containers in which tissues were stored or analyzed as dry waste. See section 3.1 for packing instructions.

3.6.5 No animal materials will be removed prior to suitable deactivation of infectious agents.

3.6.6 The exterior surfaces of all containers must be free of removable contamination, i.e. less than 100 dpm. Print-out of wipe results must accompany items offered for removal. Calculated dpm must be noted on each Radioactive Waste Tag. Consult the Survey Guide found in the Radiation Safety Manual, divider Inspection & Surveys for guidance.

3.6.7 Attach a **completed** Radioactive Waste Tag to each item awaiting removal.

### 3.7 Digestion of Carcass Material

To qualify for digestion carcass material must contain less than 0.05 microcuries (uCi) per gram of H-3 and/or C-14. Digestion of carcass material **must** be authorized in writing by the RSO and will become part of the permit holder's Radioactive Materials Permit.

### 3.8 Sanitary Sewer

Discharge of radioactive liquid waste via sink or other modes into the sanitary sewer is **not permitted** unless authorized in writing by the RSO as a special condition of the permit holder's Radioactive Materials Permit.

### 3.9 Atmosphere

Discharge of any airborne radioactive materials is **not permitted** unless authorized in writing by the RSO as a special condition of the permit holder's Radioactive Materials Permit.

### 3.10 Lead

Lead once used for shielding or from plastic lead lined secondary containers from vendors must be separated from other material. Lead **cannot** be disposed of as either radioactive or regular waste. **LEAD IS AN INGESTION HAZARD, WEAR DISPOSABLE GLOVES WHEN HANDLING.** Additional information concerning the hazards of lead is available from the Occupational Health Section of EH&S (255-8200).

3.10.1 Survey lead to confirm it to be contamination free.

3.10.2 Decontaminate as necessary. Treat materials generated from the decontamination as any other contaminated material.

3.10.3 Place lead into a small box. Do not exceed 20 pounds.

3.10.4 Attach a note requesting removal of lead.

3.10.5 A Radioactive Waste Tag is not required.

### 3.11 Biohazards

Biohazards are any micro-organisms (bacteria, viruses, fungi, etc.) capable of causing illness or disease.

3.11.1 No radioactive biohazard material will be removed from any laboratory prior to suitable deactivation of infectious agents.



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3.11.2 Consult the Radiation Safety Officer for further clarification **prior** to generation.

### 3.12 Other Unusual Radioactive Material Disposal

From time to time the disposal of radioactive material other than the categories described in this procedure may be necessary. This may include, but is not limited to, the disposal of sources, standards, and/or uranium and thorium compounds. Disposal options for unusual waste types are always changing. Phone EH&S at 255-8200 for information and instruction.

Proposals involving other unusual disposal problems or exceptions to this procedure will be considered individually by the Radiation Safety Officer and the University Radiation Safety Committee.

## 4. **WASTE REMOVAL**

Waste Removal is performed every Tuesday morning except for when the University is closed. Preparation for removal must be completed prior to Tuesday. Waste material that is not prepared in accordance with this instruction will not be removed. **Ensure** that EH&S personnel have access to the lab upon arrival. If you expect to be unavailable, make prior arrangements and post instructions on the laboratory door.

To request a pickup go to the EH&S web site ([www.ehs.cornell.edu](http://www.ehs.cornell.edu)) under "Waste Pickups" in the lower right. Request must be received by 7:00 a.m. Tuesday morning. Be prepared to provide the building name, lab number, permit holder name, your name, phone number, e-mail address, and the type and volume of material to be removed.

## 5. WASTE REMOVAL CHECKLIST

### Paperwork

- ❑ Calculate activity for waste items using your inventory sheets, decay correct to the date of pick-up and record isotope and activity on waste tag. There should be one waste tag for each item to be removed.
- ❑ Complete all other information on waste tag including chemical constituents and pH (5.5-9.5) for liquids, scintillation fluid type for vials and lab information at the top of the waste tag.
- ❑ Perform wipe test on outer surface of all items to be picked up (i.e. outside of dry bag, surface of bottle/carboy, or box of vials). Record results on waste tag and leave only one copy of the printout for waste personnel.
- ❑ Attach completed waste tag to each item being removed and remove the yellow copy of the waste tag for your records.
- ❑ Provide inventory sheets from which waste is being disposed of to waste personnel. Originals are needed for all closed out sheets (zeroed out) and copies of all partial sheets (material remaining in lab). Ensure inventory sheets reflect the waste pick-up, date, activities and decay as appropriate.

### Packaging

- ❑ Dry waste must be double bagged. Dry waste with a half-life less than 90 days **cannot** contain radioactive labels. Labels must be removed or taped over, removed labels can be placed in a small bag for removal by EH&S, though no tag is needed. Dry waste maybe removed from its storage container, tagged and placed on plastic backed absorbent paper or pads.
- ❑ Liquid waste containers should only be filled to the shoulder of the carboy or bottle. They must be in good condition with tight fitting caps. Only use 1 gallon (plastic preferred) containers for H-3 and C-14 liquids.
- ❑ Scintillation Vials can be placed in trays and boxed with an arrow indicating up, or they may be bagged using double bags inside a box with absorbent paper or pads between the two bags. All boxes must be taped shut.
- ❑ Lead must be meter surveyed before removal by EH&S. Pack lead in small boxes and leave a note for EH&S to remove.

### Pick-ups

- ❑ Waste pick up is every Tuesday morning, to request a pick up contact EH&S on line at [www.ehs.cornell.edu](http://www.ehs.cornell.edu) under "Waste Pickups" in the lower right. You need not be present for pick-up, but the room must be open or a note should be left to locate someone who can open the room.