



University of Maryland

**Hazardous and Regulated Waste
Procedures Manual**

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Review and Approval Authority

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PART I GENERAL INFORMATION

I. INTRODUCTION - This procedures manual has been prepared by the Department of Environmental Safety (DES). Its purpose is to provide the University of Maryland community with information to enable department chairs, faculty, and staff to comply with federal, State, local and University requirements for managing hazardous and other regulated wastes (controlled waste). Each University facility that generates controlled waste and each individual generator can receive a copy of this manual by printing this document.

The information, practices, and procedures discussed in this manual shall be implemented by all generators of controlled waste as required by University policy.

DES has provided detailed information regarding controlled waste management and disposal practices, and asks each member of the campus community to consult appropriate sections of this manual for information concerning the proper management of these materials.

II. REGULATORY REQUIREMENTS - Over 15,000 pages of federal, State, and local regulations have been published specifying the manner in which the University of Maryland must handle its waste materials. Locally, Prince George's County limits what may be placed in landfills and the Washington Suburban Sanitary Commission (WSSC) places restrictions on the University's discharges to the sanitary sewer system. The Maryland Department of the Environment (MDE) dictates what can be discharged into the atmosphere, water, and land. MDE is the prime regulator of the University's hazardous, radioactive, and biological, pathological, or medical wastes.

The Environmental Protection Agency (EPA) regulates controlled waste through six major regulatory programs: RCRA, CERCLA, TSCA, FIFRA, CWA, and CAA. The Department of Transportation (DOT) regulates the transportation of Hazardous Materials and Hazardous Substances. The Occupational Safety and Health Administration (OSHA) develops and enforces safety standards for response to hazardous chemical emergencies, employee awareness and right-to-know chemical information, as well as laboratory safety standards. These standards have been adopted and are enforced by Maryland Occupational Safety and Health (MOSH).

Listed below are brief explanations of the regulations, acts, and programs that are relevant to our understanding of environmental regulations, and that may have a direct impact on hazardous waste generators.

Environmental Protection Agency

RCRA (1976)

Resource Conservation and Recovery Act. Defined and regulated solid and hazardous wastes. (Regulations directly impact the hazardous waste generator.)

HSWA (1984)

Hazardous and Solid Waste Amendments. Made RCRA more stringent. (Regulations directly impact the hazardous waste generator.)

CERCLA (1980)

Comprehensive Environmental Response, Compensation and Liability Act (Superfund). Provides mechanisms to assign liability to corporations and individuals. (May impact the hazardous waste generator).

SARA (1988)

Superfund Amendments and Reauthorization Act. Created Community Right-To-Know for hazardous and toxic chemical reporting.

TSCA (1976)

Toxic Substances Control Act. Regulates chemical usage, including PCB usage, storage, and disposal.

FIFRA (1988)

Federal Insecticide, Fungicide, and Rodenticide Act. Controls the manufacture and use of pesticides intended to kill, repel, or control living organisms.

CAA (1963)

Clean Air Act. Regulates discharges to air. (Regulations directly impact the hazardous waste generator.)

CAAA (1990)

Clean Air Act Amendments.

CWA (1977)

Clean Water Act. Regulates discharges to water. (Regulations directly impact the hazardous waste generator.)

Department of Transportation

HMTA (1991)

Hazardous Materials Transportation Act. Regulates packaging and transport of hazardous materials.

Occupational Safety and Health Administration

HAZWOPER (1989)

Hazardous Waste Operations and Emergency Response. Sets standards for employee safety. At University of Maryland, only DES Emergency Response Teams must train beyond the awareness level.

HAZCOM (1983)

Hazard Communication (Right-To-Know). Employers must inform employees of chemical hazards. (Regulations directly impact the hazardous waste generator.)

LSS (1991)

Laboratory Safety Standard (Occupational Exposure to Hazardous Chemicals in Laboratories). Laboratories must develop Chemical Hygiene Plans, etc. (Regulations directly impact the hazardous waste generator.)

III. RESPONSIBILITY AND LIABILITY - University personnel generating or disposing of controlled wastes are responsible for compliance with federal, State, and local laws and regulations, as well as with University policies and procedures.

EPA has authorized MDE to regulate the management of controlled wastes within the state of Maryland. The regulations were developed to control industrial waste streams and are strictly enforced by the regulatory agencies. Although academic institutions generate less than one percent of the national waste stream and are not "industrial" in nature, no exemptions exist for academic institutions or their employees.

MDE considers a hazardous waste generator to be "...any person, by site, whose action or process produces hazardous waste identified or listed in the Code of Maryland Regulations..."

Although it is the University of Maryland that is identified as the waste generator, each Department, individual, laboratory, research center, maintenance facility, etc., that generates or disposes of materials regulated as controlled waste is considered a generator. Each generator is required to comply with applicable regulatory standards and may be liable for civil or criminal penalties for regulatory infractions.

DES is the University's liaison to the regulatory agencies. Its mission, in part, is to assist University employees to comply with these regulations. This manual provides procedures to enable campus waste generators to handle and dispose of controlled wastes in accordance with existing regulations.

Department chairs/directors, faculty, managers, supervisors, and staff have the following responsibilities regarding safe waste management:

1. Become familiar with chemical selection and usage by peers and subordinates;
2. Identify, segregate, collect, and properly store controlled wastes;
3. Develop and implement an active waste minimization program by investigating material substitution, scale reduction, chemical exchange, and purchase control within each department;
4. Encourage personnel to seek waste handling guidance from DES;
5. Accurately identify and properly label all waste material;
6. Insure that no chemicals are abandoned in place due to personnel retirement, termination of employment, graduation, etc.; and,
7. Provide staff and student training and information as required by regulation and outlined by the University Chemical Hygiene Plan and Laboratory Safety Guide.

IV. REQUIREMENTS FOR PERSONNEL LEAVING THE UNIVERSITY - The abandonment of controlled wastes without proper disposal or identification is a regulatory violation and also creates both a dangerous storage situation and an expensive disposal problem. DES recommends that all researchers planning to leave campus, properly identify all waste material and arrange for their disposal before departing the University. DES also recommends that department chairs and principal investigators take responsibility for insuring that laboratory personnel properly identify all waste material and arrange for waste disposal before leaving the campus.

DES has created a checklist to assist departing or relocating faculty and researchers. The checklist is located at: <http://www.essr.umd.edu/compliance/forms/checklist.pdf>

PART II HAZARDOUS WASTE MANAGEMENT

I. PURPOSE - University of Maryland faculty, staff, and students generate hazardous waste through teaching, research, and support activities. DES operates a storage facility that allows for the consolidation of hazardous wastes prior to off-site shipment. These procedures are to be used by University personnel in the identification, short-term storage, and removal of hazardous waste.

II. REGULATORY AUTHORITY

COMAR 26.13.01-.10

Hazardous Waste

40 CFR PARTS 260-273

Hazardous Waste

III. RESPONSIBILITY - All University personnel generating hazardous waste shall comply with the procedures set forth in this document.

IV. DEFINITIONS

- A. **Hazardous Waste** - Any solid waste that is specifically listed by EPA or MDE as a hazardous waste (see Appendix A), or meets one or more of the hazardous waste characteristics, or is a regulated mixture of hazardous and non-hazardous waste.
- B. **Acute Hazardous Waste** - Hazardous wastes that are considered exceptionally toxic as listed under 40 CFR Part 261.33 (listed wastes having codes beginning with "P").
- C. **Corrosivity** - An aqueous waste having a pH less than or equal to 2, or greater than or equal to 12.5; or a liquid that corrodes steel as described under 40 CFR Part 261.22.
- D. **Flammability** - A liquid (other than an aqueous solution containing less than 24 percent alcohol by volume) with a flashpoint of less than 60°C (140° F) as determined by a Pensky-Martens closed cup tester using ASTM method D-93-70 or D-93-80; or it is not a liquid and is capable under standard temperature and pressure of causing a fire; or it is an ignitable compressed gas; or is an oxidizer.
- E. **Reactivity** - A waste that is normally unstable and readily undergoes violent change without detonating; or reacts violently with water; or forms potentially explosive mixtures with water; or when mixed with water generates toxic gases, vapors, or fumes; or a cyanide or sulfide bearing waste that generates toxic gases, vapors, or fumes when exposed to pH conditions between 2 and 12.5; or is capable of detonation or explosive reaction.

- F. **Toxicity** - A waste whose extract under the test procedure specified under 40 CFR Part 261.24 contains one or more constituents at concentrations greater than those specified in Table I of the above referenced part.
- G. **Hazardous Waste Label** - A DES specified label that must be attached to each container of chemical waste. The label has the words "Hazardous Waste" displayed and requires the name of the waste components in standard English nomenclature.
- H. **Satellite Accumulation Area** - An area where a generator may accumulate up to 55 gallons of non-acutely hazardous waste or one quart of acutely hazardous waste in containers at or near any point of generation where wastes initially accumulate that is under the control of the generator.

V. GENERATOR'S REQUIREMENTS AND RESPONSIBILITIES - The University of Maryland is classified as a "Large Quantity Generator." The campus as a whole must meet several regulatory requirements, but each laboratory or workspace is classified as a Satellite Accumulation Area (SAA), unless your department is informed by DES personnel of a different regulatory status. As a SAA, each laboratory or workspace must adhere to the following federal and State requirements:

- A. May accumulate up to 55 gallons of non-acute hazardous waste or up to one quart of an acute hazardous waste (P List) in containers, without time constraints, at or near its point of generation;
- B. Must be under the direct control of the operator of the process that generated the hazardous waste;
- C. Mark each University of Maryland Hazardous Waste "Green" tag with the date when more than 55 gallons of non-acute hazardous waste or one quart of acute hazardous waste has accumulated; and,
- D. Submit an electronic pick-up request, via the University of Maryland Waste Management Tracking System, to DES so the waste can be removed within 72 hours.

VI. CONTAINER MANAGEMENT AND CHEMICAL SEGREGATION - All generators of hazardous waste whether they are a SAA or not, must properly manage containers and segregate waste based on chemical compatibility. The following practices must be used at all times:

A. Container Management

1. All containers must be compatible with the waste stored in them.
2. The container must be in good condition. If the container is leaking or damaged, transfer the waste to a compatible container in good condition.
3. All containers must be kept closed at all times except when adding waste to the container. Leaving a funnel in a container is not acceptable.
4. Containers storing hazardous waste must be labeled with its contents. DES specified hazardous waste labels are available from Chemistry Store. The label must be attached to the container and must have chemical names (written in English) with the percentage of each chemical listed. Trade names, abbreviations, and chemical formulas are not acceptable.
5. If a manufacturer's container is used to accumulate hazardous waste, deface the original label and attach the DES specified hazardous waste label. (Waste will not be removed from the laboratory or workspace unless it has the specified hazardous waste label.)

B. Management of Waste Steams

1. Store incompatible chemical waste away from each other. DES provides secondary containment in case of spillage.
2. Do not mix chemicals into one container. The chemicals may be chemically compatible, but the mixture could result in a higher disposal costs.
3. Heavy metal solutions must not be mixed with any organic solvent or solution.
4. Halogenated and non-halogenated organic solvents should be segregated into separate containers.
5. Do not mix solid and liquid waste. Liquids should be strained of all solids.
6. Large volumes of liquid waste should be accumulated in a 5 gallon carboy. Carboys can be obtained from DES by calling (40)5-3990.
7. Do not fill liquid containers to the top. Leave space in the container to allow for the expansion of the liquid.
8. Items with sharp edges (syringes, razor blades) must be put in a puncture proof container, available in the Chemistry Store. Placing these items in a cardboard box or plastic bag is unacceptable.

VII. PROCEDURE FOR HAZARDOUS WASTE REMOVAL

DES has developed a tracking program that allows the waste generators to enter and submit, via the Internet, all hazardous and chemical waste information to DES for disposal. By using this tracking program and the Internet, DES can provide a faster pick-up time for waste generators and more time to serve the environmental concerns of the campus community.

The following procedures have been developed to meet all federal and State regulations. Any questions concerning these procedures should be directed to the Environmental Affairs Section of DES at (40)5-3990.

- A. Before a person may submit a waste pick-up request, they are required to take the Online Hazardous Waste Generator Training. The training is approximately 30 minutes in length and can be taken at any time.
- B. After completing the Online Hazardous Waste Generator Training, a generator may submit an electronic pick-up request to DES via the University of Maryland Regulated Waste Pick-up Request System.

The instructions for logging into the system are available on the system's welcome page.

Each waste container must be submitted separately for tracking purposes. Fill in the form for each individual waste container and click on the "Request" button. The Pick-up Request system will assign and display a unique tracking number for that container. Write the tracking number on the University of Maryland Hazardous Waste Tag. Each waste container must have a University of Maryland Hazardous Waste Tag attached to it. More information about the University of Maryland Hazardous Waste Tags can be found at:

<http://www.essr.umd.edu/hw/pickup/green.html>

NOTE: A feature of the University of Maryland Regulated Waste Pick-up Request System will allow waste generators to check the status of their waste that they have submitted.

VIII. MATERIALS WITH SPECIAL REQUIREMENTS - The following categories of wastes require special containment or handling by the generator before DES personnel can remove the material. Unless otherwise noted, containers of the following wastes should be managed as described under sections VI and VII.

- A. **Asbestos** - Asbestos is not considered a hazardous waste but it still must be managed as a hazardous material. Double bag and seal all asbestos containing material for disposal, including a chemical compound known as "Ascarite." Mark the container with the words "Asbestos Waste" and "University of Maryland."

- B. **Batteries** - Spent batteries may be considered a hazardous material. Separate lead acid, nickel cadmium, alkaline, and any other batteries into separate containers. Lead acid batteries should be kept indoors or in a container. Departments are encouraged to make arrangements with qualified vendors for recycling batteries, but DES will dispose of them if requested.
- C. **Gas Cylinders** - Gas cylinders have a high disposal cost. DES recommends that cylinders not be used when possible. Cylinders should be purchased from manufacturers who will accept them back after use. If a cylinder cannot be returned to the manufacturer, please submit a pick-up request through the University of Maryland Regulated Waste Pick-up Request System for disposal by DES personnel.
- D. **Aerosol Cans** - DES can dispose of aerosol cans. Indicate in the University of Maryland Regulated Waste Pick-up Request System and label whether the aerosol can contains chlorofluorocarbons (CFCs), flammable material, pesticides, or is an inert material. If the aerosol can does not contain CFCs, a flammable warning, or a listing of pesticides, the aerosol can is considered inert.
- E. **Empty Containers/Glassware** - After removing or defacing labels, empty containers and glassware should be placed in the trash. Empty containers that held acute hazardous waste (P-listed) must be triple rinsed before discarding into the trash. The rinsate will then be handled as a hazardous waste.
- F. **Mercury Compounds** - Mercury compounds and mercury solutions will be disposed of by DES as a hazardous waste. Do not mix mercury with other types of waste.
- G. **Elemental Mercury** - Elemental mercury will be recycled when possible. Place the elemental mercury in a sturdy leak-proof container that has a screw-on cap.
- H. **Mercury Thermometers and Mercury Containing Devices** - Broken mercury thermometers or mercury-containing devices should be placed in a leak-proof container. Broken glass from the mercury thermometer or mercury containing devices should be placed in the same container. DES encourages all university personnel using mercury containing devices, including but not limited to thermometers and manometers, to switch to a non-mercury device when possible.
- I. **Polychlorinated Biphenyls (PCB) Waste** - PCB waste should not be mixed with other waste. Separate the PCB waste into a container. PCB-contaminated trash should be placed in a separate container as well. Indicate the type of PCB and concentration of the PCBs.
- J. **Osmium Waste** - Osmium waste is highly toxic. All liquid waste must be in a container with a screw-on cap. All solid waste must be double-bagged.

- K. **Ethidium Bromide Waste** - Ethidium bromide is not considered a hazardous waste, but still must be managed as a hazardous material. Ethidium bromide solutions must be in a container with a screw-on cap. All solid waste, including ethidium bromide gels, must be double-bagged. Do not place Ethidium bromide gels or ethidium bromide debris in a "biohazardous bag" for disposal; place the Ethidium bromide and debris in a 6 mil plastic bag.

- L. **Fluorescent Light Tubes** - The fluorescent light tubes that provide light to your workspace may be hazardous waste. DO NOT THROW THE FLUORESCENT LIGHT TUBES INTO THE TRASH. Place the used fluorescent light tube in its original box for proper disposal. The boxes should be sealed, marked with the words "Used Lamps" and the number of tubes marked on the top of the box. Call Facilities Management's Work Control (52222) to dispose of the boxes of fluorescent light tubes.

- M. **Picric Acid** - Picric acid with water is a mixture that requires no special handling. However, when picric acid is dry, it may be HIGHLY EXPLOSIVE. DES should be notified immediately whenever dry picric acid is in a lab or workspace. DES will examine the picric acid and determine if it poses a threat to human health, university property, or the environment.

- N. **Benzoyl Peroxide** - Benzoyl peroxide can be an unstable material in a dry state. Benzoyl peroxide is usually in a non-metallic container to prevent static electricity that could cause ignition.

- O. **Ethers** - Ethers, especially diethyl ether, form peroxides in the presence of light and oxygen. Special care will need to be taken for ethers that are more than one year old. DES will examine the ether container and determine if it poses a threat to human health, university property, or the environment.

IX. UNKNOWN WASTES - The generation and accumulation of unknown waste poses a health, safety, and environmental risk to faculty, staff, students, and property at the University of Maryland. The accumulation of such waste is a violation of federal and State regulations. It is the responsibility of each individual generator and department to properly label hazardous materials and identify containers of hazardous waste at the time accumulation begins.

DES will identify, remove, and dispose of unknown wastes for on-campus waste generators. However, the generator or generating department will incur a \$110.00 per bottle fee for all solid and liquid unknown wastes.

DES will also arrange for a contractor to sample, analyze, and dispose of any unknown cylinders. The generator or generating department will incur the full costs of the contractor's services, which can exceed \$2,000.00 per cylinder.

PART III

BIOLOGICAL, PATHOLOGICAL OR MEDICAL WASTE (BPMW) MANAGEMENT, INCLUDING SHARPS AND CONTAMINATED GLASSWARE

I. PURPOSE - University of Maryland faculty, staff and students may sometimes be at risk from exposure to materials that could be infectious to humans. Agents of disease (viruses, bacteria, etc.) may be utilized for certain research, cultured during medical diagnostic activities, or may be present in blood and certain other body fluids. This Standard Procedure is established to insure compliance with federal and State regulations governing the handling, treatment and disposal of potentially-infectious materials, and to protect the health and safety of the campus community by keeping these risks as low as reasonably achievable.

II. REGULATORY AUTHORITY

- A. COMAR 26.13.11
Special Medical Wastes
- B. COMAR 26.13.12
Standards Applicable to Generators of Special Medical Wastes
- C. 29 CFR 1910.1030
Occupational Exposure to Bloodborne Pathogens

III. DEFINITIONS

- A. Biological, Pathological and Medical Waste (BPMW) includes, but is not limited to the following materials:
 - 1. **Infectious Waste** - Cultures and stocks of infectious agents and associated biologicals from medical, pathological, research and teaching laboratories; wastes from the production of biologicals; discarded live and attenuated vaccines; isolation wastes; and contaminated culture dishes and devices used to transfer, inoculate and mix cultures.
 - 2. **Pathological Waste** - Human or animal tissues, organs, body parts or fluids that are removed during surgery, autopsy or other teaching or research procedures including specimens and their containers.
 - 3. **Sharps** - Any of the following used or unused, contaminated or uncontaminated items: hypodermic syringes with needles, syringe needles, pasteur pipettes, transfer pipette tips, dental wire, scalpel blades, razor blades, suture needles, or needles with attached tubing. Sharps also include broken or unbroken glassware and culture dishes that are contaminated with

blood, body fluids or infectious materials. Any object that is so contaminated, and is capable of penetrating the skin shall be considered a sharp.

4. **Animal Wastes** - Bedding of animals known to have been exposed to infectious agents during research or teaching activities; or contaminated or uncontaminated animal carcasses, tissues, or body parts.
 5. **Blood and Body Fluid Wastes** - Any blood, blood product or body fluid from a human or animal not known to be infectious. Any material contaminated with these materials shall also be considered a BPMW.
- B. **Biologicals** mean preparations made from living organisms and their products including but not limited to vaccines, cultures, etc.
- C. **Blood products** mean any product derived from human or animal blood, including but not limited to whole blood, blood plasma, platelets, red or white blood corpuscles, and other derived licensed products, such as interferon, etc.
- D. **Bloodborne pathogen** means any human pathogenic microorganism that may be present in human or animal blood (or body fluids) and can infect and cause disease in humans who are exposed to blood or body fluids containing the pathogen.
- E. **Body Fluids** mean liquid or solids emanating or derived from humans or animals including but not limited to blood, semen, vaginal secretions, dialysate, amniotic, pleural, peritoneal, cerebrospinal, synovial and pericardial fluids.
- F. **Chemical** means any chemical substance used by the generator that is considered by any regulatory authority or advisory group to be hazardous, toxic, mutagenic, teratogenic, carcinogenic or potentially carcinogenic.
- G. **Contamination** means objects or materials that are reasonably suspected to contain or have contacted known infectious agents, blood products, body fluids, biologicals, or isolation wastes.
- H. **Decontamination** means a process that assures the destruction of living infectious organisms.
- I. **Generator** means any person producing or packaging wastes containing or contaminated with materials as further defined below in the course of teaching, patient care, housekeeping, research, or other activities.
- J. **Infectious agent** means any organism, such as a virus, bacterium, or protozoa that is capable of infecting plants, animals or humans and causing disease or adverse effects in any species.

- K. **Isolation wastes** are biological wastes and discarded materials contaminated with blood, excretions, exudates, or secretions of humans or animals that are isolated to protect others from highly communicable diseases, or isolated animals infected with highly communicable diseases.

IV. BIOLOGICAL WASTE DISPOSAL PROCEDURES - Please read and follow the *Waste Disposal Guidelines Wall Chart*. Copies may be obtained by calling (40)5-3960.

A. Biological Waste

1. All biological waste from BL1, BL2, and BL3 laboratories must be decontaminated prior to disposal.
2. Decontamination and disposal are the responsibility of the person/laboratory generating the waste.
 - a. Collect disposable, solid materials contaminated by an infectious agent, excluding sharps, or broken or unbroken glass, into a clear, non-color autoclave bag (with no biohazardous symbols or wording) within a sturdy container. When full, these non-descriptive bags are to be autoclaved, cooled, and then placed in the building's dumpster.
 - b. Decontaminate liquids containing a biological agent by the addition of a chemical disinfectant such as sodium hypochlorite (household bleach) or an iodophor, or by autoclaving, then dispose of by pouring down the sink. It is not necessary to autoclave liquids that have been chemically disinfected. However, if a bleach solution has been used in the collection tray for labware that will later be autoclaved, sodium thiosulfate must be added to the bleach to prevent the release of chlorine gas during autoclaving.

B. Reusable Labware

Items such as culture flasks and centrifuge bottles are decontaminated by lab personnel before washing by one of two methods:

1. Autoclave items that have been collected in autoclavable containers; or,
2. Chemically disinfect items by soaking in diluted disinfectant for one hour before washing.

C. Disposal of Blood Products and Body Fluids

1. All blood and other potentially infectious materials should be handled using Universal Precautions. Blood and other body fluids must be solidified in a

container before disposal. Each container of solidified blood or body fluid must not exceed one (1) pound in weight.

2. Discard disposable items contaminated with human blood or body fluids (excluding sharps and glassware) into the incinerator boxes that are available from DES. Do not overfill boxes or use without the plastic liners provided with them. These boxes may be used for temporary storage and accumulation of waste. When full, close and seal the plastic liner and box.
3. For pick-up, submit a pick-up request, via the University of Maryland Regulated Waste Pick-up Request System, located at:

<https://des.umd.edu/apps/Waste/login.cfm>

DES will collect and dispose of all incinerator boxes.

D. Disposal of Sharps and Disposable Glassware

1. Discard all needles, needle and syringe units, scalpels, and razor blades, **whether contaminated or not**, directly into rigid, red, labeled sharps containers. Do not recap, bend, remove or clip needles. Sharps containers should not be overfilled. For pick-up, submit a pick-up request, via the University of Maryland Regulated Waste Pick-up Request System, located at:

<https://des.umd.edu/apps/Waste/login.cfm>

Alternatively, closed sharps containers may be packaged in incinerator boxes (Section III above). Sharps containers may be purchased from the Chemistry Store.

2. **Uncontaminated** pasteur pipets and broken or unbroken glassware are discarded into containers specifically designed for broken glass disposal, or into heavy-duty cardboard boxes that are closeable. When boxes are full, the laboratory personnel should tape the box closed and place it in the building's dumpster.
3. **Contaminated** pasteur pipets and broken or unbroken glassware may be treated in one of two ways:
 - i. Discarded into approved sharps containers, as in Section D above; or,
 - ii. Decontaminated by autoclaving or chemical disinfection, then discard into glass disposal boxes.
4. Sharps that are contaminated with radioactive materials or hazardous chemicals should be discarded into separate sharps containers. Specify chemical and/or isotope content when requesting pick-up by DES. For pick-

up, submit a pick-up request, via the University of Maryland Regulated Waste Pick-up Request System, located at:

<https://des.umd.edu/apps/Waste/login.cfm>

E. Mixed Waste

1. Avoid generating mixed waste if possible. Keep volume to minimum.
2. Do not autoclave mixed waste.
3. When discarding waste containing an infectious agent and radioactive material, inactivate the infectious agent first, and then dispose of as radioactive waste. Seek advice from the Radiation Safety Officer at (40)5-3985 before beginning inactivation procedures.
4. When discarding waste containing an infectious agent and a hazardous chemical, inactivate the infectious agent first, and then dispose of as chemical waste. Seek advice before beginning inactivation procedures. After the infectious agent has been deactivated, dispose of the waste as stated in the Hazardous Waste Management section in this manual.

F. Disposal of Animal Tissues, Carcasses, and Bedding

1. Disposal of animal carcasses/tissues is coordinated through the Central Animal Resource Facility.
 - a. Place animal carcasses/tissues into a plastic bag. Double-bag when carcass contains a zoonotic agent (transmissible from animals to humans).
 - b. Place the bag in freezer until pick-up.
 - c. Call Central Animal Resource Facility at (40)5-4921 for pick-up.
2. Disposal of animal carcasses/tissues that are contaminated with radioactive materials or hazardous chemicals is through DES. Instructions are available by calling (40)5-3960.

G. Disposal Containers

Each laboratory is responsible for purchasing containers for the disposal of biological waste, EXCEPT incinerator boxes (with liners) which will be provided by DES. The following types of containers are available:

1. **Sharps containers** may be purchased from local sources (including Chemistry Stores) as well as from laboratory product distributors. They are available in various sizes, and should be puncture resistant, red, labeled as "Sharps," and have a tightly closing lid. Do not purchase "needle-cutter" devices that may produce aerosols when used.
2. **Autoclave Bags** may be purchased from various laboratory product distributors, such as Fisher Scientific, VWR, and Baxter. Be sure to select polypropylene bags that are able to withstand autoclaving and are clear, non-color bags, with no biohazardous symbols or wording. They should be placed inside a rigid container with lid while waste is being collected.
3. **Incinerator Boxes** are provided by DES. A plastic liner (also provided by DES) must be used to prevent contamination of the box.
4. **Glass Disposal Boxes** may be purchased from Chemistry Stores and various laboratory product distributors. Alternatively, heavy-duty, closeable cardboard boxes may be used for disposal of broken glass.

H. What to do with Filled Waste Containers

1. **Sharps containers and incinerator boxes** - For pick-up, submit a pick-up request, via the University of Maryland Regulated Waste Pick-up Request System, located at:

<https://des.umd.edu/apps/Waste/login.cfm>

2. **Autoclave bags and glass disposal boxes** - close and autoclave bags, tape glass disposal boxes closed; put both in building dumpster. All material placed in the building's dumpster should be checked to ensure that no symbols or wording is on the bags or boxes to indicate that the container once held a biohazardous substance.

PART IV LOW-LEVEL RADIOACTIVE WASTE (LLRW) MANAGEMENT

- I. **PURPOSE** - The following procedure presents measures to safely control future disposal costs, minimize the amount of LLRW stored on-site, and minimize the amount of LLRW presently generated.
- II. **REGULATORY AUTHORITY** COMAR 26.12 Control of Ionizing Radiation (1994)
- III. **RESPONSIBILITY** - All UM personnel generating Low Level Radioactive Wastes shall comply with the guidelines set forth in this document.

IV. LOW LEVEL RADIOACTIVE WASTE DISPOSAL PROCEDURE - In order to attain the goals of controlling disposal costs and minimizing the amount of LLRW presently generated, each LLRW generator must insure that LLRW is strictly segregated by waste stream category, isotope, and chemical composition.

A. General Radioactive Waste Requirements

1. Complete the online Radioactive Waste Generator Training
2. Use only radioactive waste containers provided and/or authorized by DES. DES will not complete radioactive waste pickup requests if material is packaged in unauthorized waste containers.
3. Keep waste containers closed and properly labeled at all times.
4. Document the date and activity on the container content sheet each time waste is added.
5. Each container of radioactive waste is thoroughly inspected before disposal. Improperly packaged containers will be returned to the generator or PI for repackaging.

B. Separation and Segregation by Waste Stream Category

1. Dry Solid LLRW shall consist of paper, paper towels, absorbent paper, cardboard, gloves, and liquid-free pipettes contaminated with radioactive material.
 - a. ^{14}C Carbon and Tritium ^3H may be combined in the same container, but not mixed with other isotopes.
 - b. All other isotopes (^{32}P , ^{35}S , ^{125}I , etc.) must be stored alone and not mixed together.
 - c. Dry Solid LLRW contaminated by organic or other hazardous chemicals shall be considered to be Mixed LLRW (see 5., below) and shall be stored separately from other Dry Solid LLRW.
 - d. Needles, syringes and other sharps, free of contained liquids, and biological materials shall not be combined with Dry Solid LLRW. Waste generators shall supply their own sharps containers. When the sharps containers are full, they should be placed in the appropriate dry solid waste container.

- e. Radioactive warning signs, symbols, tags or labels shall be obliterated, by over-writing with a magic marker, or otherwise defaced prior to disposal. Neither municipal landfills nor private waste disposal companies will accept materials with radiation warnings although the material itself is not measurably radioactive.
 - f. Liquids, lead source containers, loose sharp objects, and biohazard bags/labels shall not be disposed in Dry Solid LLRW containers.
2. Needles, syringes and other sharps contaminated with radioactive material shall be placed in properly labeled "Sharps" containers and segregated by isotope. Radioactive waste generating departments or individuals shall supply their own sharps containers. When the sharps containers are full, they should be placed in the appropriate dry solid waste container.
 3. Radioactive contaminated biological materials, including animal bedding and animal wastes, must be double bagged, sealed with duct tape or similar material, and stored in a freezer while awaiting removal. The bag must be labeled with the contents, generator's name, department, building no., room no., date, isotope, and activity and a "caution radioactive material" tag.
 4. Radioactive contaminated etiological material (bacteria, viruses, etc.) must be sterilized prior to disposal or packaged by the generator in such a way that the possibility of microbiological contamination no longer exists. The labeling and packaging procedures are the same as for radioactive biological/pathological waste.
 5. Aqueous LLRW consists of mixtures of water, isotope(s), and non-hazardous chemical material:
 - a. Aqueous LLRW shall not be mixed with any organic material.
 - b. The pH of aqueous LLRW shall be adjusted, by the user, to between 6.0 and 10.0 pH units prior to disposal.
 - c. Isotopes may be combined in the same container.
 - d. To prevent spills or leaks, store liquids containers in secondary containment tubs provided by DES.

- e. Do not fill liquid containers to the top. Always leave 3-4 inches of head space in the container for safe sampling and handling.
6. Mixed LLRW consists of mixtures of organic chemicals, isotope(s), and other hazardous or non-hazardous materials. Mixed LLRW shall be stored in its own container and not mixed with other LLRW. Do not mix isotopes. Contact DES at extension 53990 before generating a mixed waste.
7. Sealed and Unsealed Sources
- a. Sealed sources consist of radioactive material either encapsulated by a solid material or permanently plated on metal. Unsealed sources are usually liquids or other material not meeting the definition of a sealed source.
 - b. Shielding requirements for sealed and unsealed sources are normally met with the original shipping container. If additional shielding is required, it must be commensurate with the radiation emitted.
 - c. Sealed and unsealed sources shall not be mixed with any other LLRW. Keep separate and present them to DES personnel for disposal as required.
8. Scintillation Solutions, Cocktails and Vials
- a. In all possible instances, use biodegradable scintillation fluid in place of organic/hazardous based material.
 - b. Do not combine vials containing biodegradable scintillation fluid with vials containing organic/hazardous scintillation fluid in the same container.
 - c. Segregate vials by isotope, similar to the dry solid waste procedures.
 - d. Remove vials from the "egg crate" cartons and ensure the caps are on tight before placing the loose vials in the appropriate container. Dispose of the "egg crate" as domestic trash if they are not contaminated or as dry solid LLRW if contaminated.
 - e. Write the brand name of the scintillation fluid on the container contents sheet.

The following cocktails are approved for use:

Scintillation Cocktails	Manufactures
Biosafe II	RPI
Cytoscint	ICN
Ecolite (+)	Ecolite (+)
Ecolume	ICN
Ecoscint A	National Diagnostics
Ecoscint O	National Diagnostics
Optiflor	Packard
Optiscint "Hisafe"	LKB
Ready Safe	Beckman
Universol	ICN

C. LLRW Disposal Paperwork

1. Each LLRW container/bag shall be labeled/tagged with the following information: Generator Name, Department, Building, Room, Telephone, Isotope(s), Waste Percentage Composition, Activity, and Date.
2. Requests for LLRW removal shall be submitted to DES; submit a pick-up request, via the University of Maryland Regulated Waste Pick-up Request System, located at:

<https://des.umd.edu/apps/Waste/login.cfm>

D. LLRW Reduction Methods

1. LLRW shall be managed to ensure that Mixed Wastes are not accidentally produced.
2. The introduction of an organic (hazardous) chemical, even at low concentrations, could cause a radioactive waste to be classified as a mixed waste. Mixed waste disposal options are very limited and could potentially cost \$2,000-\$3,000 per gallon.
3. Principal Investigators, their staff and students, when preparing or engaged in research protocols, need to consider alternatives that will eliminate the use of hazardous chemicals.
4. To minimize the disposal of non-radioactive waste as radioactive waste, monitor the waste material and only dispose of the contaminated parts as radioactive.

5. Using short-lived radioactive isotopes whenever possible will drastically reduce the University's disposal costs and overall management responsibilities.

E. Unknowns

Unknown or unidentified LLRW and Mixed Waste will not be removed by DES personnel. The identification of such waste, and the related expense, are the responsibility of the waste generator.

PART V EMERGENCY PROCEDURES

- I. **PURPOSE** - An environmental emergency is a release of a chemical to the environment, including air, soil, groundwater, or surface water. Spillage of hazardous materials in the lab is not considered an environmental emergency as the spillage is contained by the building in which it occurs, but still may present a danger to personnel from toxic fumes, explosive vapors, etc., requiring building evacuation by activating the fire alarm system. Qualified personnel in the laboratory may only remediate very small spills without DES assistance. Residues of spill clean-up shall be handled as hazardous waste.
- II. **RESPONSIBILITY** - All University of Maryland personnel involved in an emergency involving a spill of hazardous material or waste shall comply with the guidelines set forth in this document.
- III. **EMERGENCY PREPAREDNESS AND EQUIPMENT** - To prepare for potential emergencies involving hazardous materials or waste, generators are required to maintain emergency procedures and equipment.
 - A. Individuals who handle chemicals shall be aware of the hazards associated with the materials they work with and how to manage any spills of these materials. Information can be found in the Material Safety Data Sheets (MSDS) that accompany the chemicals purchased. MSDS's shall be kept in a central location in the laboratory or other work area. If you need a MSDS, access the DES web site at <http://www.essr.umd.edu/>, or contact DES at (40)5-3960.
 - B. Individuals shall ensure that each laboratory is equipped with a chemical spill kit specified by DES. The kits may be obtained from Chemistry Stores. It is the responsibility of the investigator to maintain the spill kit if replacement materials are needed.
 - C. Individuals will familiarize themselves with the locations and use of emergency equipment such as emergency showers, eyewash stations,

fire extinguishers, and telephones and be able to operate such equipment in case of emergencies.

- D. As applicable, individuals and supervisors having responsibility for hazardous materials in an area should develop and communicate specific written procedures for immediate shut-down of all research and teaching operations in the event of an emergency, such as a spill of hazardous material or waste.
- E. Individuals and supervisors shall train students and employees on the procedures for safely working with chemicals, including responding to chemical spills.
- F. DES has been working with laboratory personnel to display a sign outside the primary door of a laboratory that indicates the potential hazards within the laboratory. These signs also contain laboratory personnel names as well as telephone number in case of emergencies. Visitors to the laboratory are encouraged to observe the warning labels placed on the sign and be aware of the hazards.
- G. Personal Protective Equipment for Spill Clean-Up
 - 1. Eye Protection - Safety glasses are the absolute minimum for working in a laboratory or cleaning up spills of hazardous materials; for corrosive and/or reactive materials, goggles or a face shield are also necessary.
 - 2. Skin Protection - All personnel in laboratories should wear a lab coat. If splashing is a possibility, an apron should be worn. Gloves that are compatible with the chemical spilled must be worn.

IV. EMERGENCY PROCEDURES - MDE regulations require waste generators to have knowledge of, and implement as necessary, emergency procedures. Whenever there is a spill or other emergency involving materials or hazardous wastes that present a danger to human health or the environment, the following instructions must be followed:

- A. The area of the spill must be evacuated and secured. Depending on the nature and quantity of the material involved, evacuation may range from the area immediately adjacent to the spill, laboratory, floor, or building.
- B. Where highly flammable liquids or gases are released, follow the campus fire emergency procedures:

1. Evacuate area and building;
 2. Activate alarm; and,
 3. Call 9-1-1 or (301) 405-3333.
- C. Report all environmental emergency spills to the campus emergency number "9-1-1 or (301) 405-3333."
- D. Without jeopardizing personal safety, injured personnel should be removed from the site of the emergency.
- E. When there are properly trained and equipped laboratory or shop staff, small spills may be cleaned up. Clean-up materials shall be packaged as waste.
- F. Return to the work area only when permitted by the authorities in charge.
- V. Mercury Spills and Broken Thermometers - Mercury is the single most spilled chemical on campus. Mercury spills must be properly cleaned up because mercury can cause irreparable damage to the nervous system. Investigators shall adhere to the following prevention and spill response procedures:
- A. Trays shall be placed under equipment where a mercury spill is possible.
 - B. Spills must be isolated immediately to prevent foot traffic through the area.
 - C. If the mercury spill is larger than that from a broken thermometer, all personnel should be evacuated from the spill area. DES will respond with appropriate spill control equipment.
 - D. If a mercury spill occurs in a heated oven or an electrical device, turn off the device, evacuate the area and notify DES for further assistance.
 - E. In all cases of mercury spillage, **except for broken thermometers**, DES must be contacted.
 - F. Metallic mercury and metallic mercury contaminated waste must be stored in airtight containers to prevent the escape of toxic vapors. Do not place any liquid in the container to prevent the escape of toxic vapors. Plastic or glass bottles or a sealable plastic bag are adequate containers. Closed containers of waste must have a completed DES approved Hazardous Waste label.

- G. Always wear gloves and a respirator when conducting a mercury clean-up. Mercury is absorbed through intact skin.

PART VI WASTE MINIMIZATION PROGRAM

PURPOSE

The University of Maryland is required to develop, submit for approval, and implement a waste minimization program that will encourage employees to conscientiously strive to reduce waste.

The University of Maryland and its employees have a legal duty to minimize waste. The University must annually certify that it has a program in place to reduce the volume and toxicity of hazardous waste that it generates, to the degree determined by the University to be economically practicable; and the proposed method of treatment, storage or disposal is the practicable method currently available to the University that minimizes the present and future threat to human health and the environment.

The University of Maryland Waste Minimization Program can be located at:

<http://www.essr.umd.edu/hw/min/index.html>