University of Hawai‘i
Biohazardous Waste Disposal Guidelines

A. PURPOSE

The University of Hawai‘i (UH) is committed to providing a safe and healthy work environment for those who work in research and academic laboratory settings. In general, UH follows the appropriate State and Federal guidelines and regulations for the management of biological / biohazardous waste on the various campuses. The management of the various wastes generated within each facility requires a dedicated and informed effort in order to maintain proper segregation, handling, and disposal. Risk of personnel contamination and environmental release is a concern for any biological/biohazardous waste that is not properly handled prior to leaving the University facilities. This document provides guidance in the explanation of the various types and categories of biological/biohazardous waste materials that might be encountered and “…establishes minimum requirements for their management, segregation, handling, treatment, transport, storage, and disposal in order to ensure practices that will protect the health and safety of persons living in Hawaii.” (Hawaii Administrative Rules, Title 11, Department of Health, Chapter 104.1, Management and Disposal of Infectious Wastes).

B. DEFINITIONS / ABBREVIATIONS

Biological waste. ALL wastes at the University of Hawaii that have come into contact with any biological commodity are considered as a biological waste.

Biohazardous / Infectious waste. Any wastes that may contain infectious agents of sufficient virulence and quantity that present a risk or potential risk to the health of humans, other animals, or plants, either directly through infections or indirectly through disruption to the environment (EPA chapter 2.1)

Decontamination. A process that reduces or eliminates the microorganisms on an area, object or material, thus reducing the risk of exposure to harmful pathogens. (BMBL 5th edition pg 329)

Disinfection. A procedure or process that “eliminates nearly all recognized pathogenic microorganisms but not necessarily all microbial forms (e.g. bacterial spores) on inanimate objects.” (BMBL 5th edition, pg. 327)

Sharps. Any material or object that can puncture or cut skin and cause injury. These include but are not limited to: needles, syringes, glass slides, broken glass, plastic pipettes, pipette tips, Pasteur pipettes, lancets, capillary tubes, etc.

Sterilization. A procedure or process “that kills ALL microorganisms, including high numbers of bacterial endospores.” (BMBL,5th edition pg. 327)

ASHP - American Society of Health System Pharmacists
CLSI - Clinical and Laboratory Standards Institute
CDC - Centers for Disease Control and Prevention
C. RESPONSIBILITIES

All laboratories that generate biological/biohazardous wastes must comply with these UH Biohazardous Waste Management Guidelines and appropriate City and County, State and Federal rules and regulations. It is the responsibility of the principal investigator / supervisor of each lab to make sure that all employees are familiar with these guidelines and have received the proper training in the management of the specific biohazardous materials that they generate. The proper segregation, processing and disposal of biological / biohazardous wastes generated in any UH laboratory are the responsibility of the person or persons who have generated the waste.

D. TYPES OF WASTES (HAR §11-104.1-4 & EPA chapter 2.2)

1. Cultures and Stock of Biohazardous/Infectious agents and associated biologicals, including recombinant or genetically engineered products.
   a. These wastes have potentially high concentrations of pathogenic organisms. Included in this category are specimen cultures, stocks of biohazardous/infectious agents, and wastes from the production or use of these biologicals. (EPA chapter 2.2.2)
   b. Steam sterilization (autoclaving) is the preferred method of treatment for these types of waste prior to disposal.

   a. These include: serum, plasma, seminal fluids, vaginal fluids, cerebrospinal fluid, synovial fluid, pleural fluid, peritoneal fluid, amniotic fluid, and other potential infectious materials. Does not include: nasal secretions, sputum, tears, urine, feces, sweat, and vomitus, unless they contain visible blood or known to contain infectious agents (however, dispose of as biological wastes). These types of waste are considered biohazardous because of their potential for bloodborne pathogens and zoonotic diseases.
b. Two recommended treatment methods are autoclaving and incineration (EPA chapter 5.4). In addition, chemical treatment may be used for small volumes (less than 100 mls) of these products which may be then discharged into the sanitary sewer.

3. **Human Pathological and Tissue Cultures**

   a. Human pathological waste composed of tissues, organs, and body parts are considered biohazardous waste due to their possibilities of unknown pathogens in the patients, cadaver or diagnostic samples.

   b. For aesthetic purposes, *recognizable body parts* must NOT be disposed of in the normal biohazardous waste stream. These types of wastes must be incinerated. Please contact the *Department of Anatomy, Biochemistry, Physiology and Reproductive Biology*, John A. Burns School of Medicine at 692-1446 for more information on proper disposal of these wastes.

   c. Human or animal cells or tissue cultures whether infected or not, must be autoclaved or chemically treated before disposal into a sanitary sewer.

   **General Procedure for chemical treatment of cell cultures**
   
   - Pour spent tissue culture(s) (medium and cells) whether infectious or not, into a beaker or other containment vessel for decontamination.
   - Add enough sodium hypochlorite (bleach) so volume of bleach is 10% of total volume.
   - Mix well and hold overnight. Label container as Biohazardous Waste, 10% Bleach and Date.
   - Carefully pour (decant) supernatant down sink with copious amounts of water to flush.
   - Any particulates/precipitant must be deposited into a biohazard bag and processed as regular biohazardous waste.
   - Containment beaker or other vessels should be autoclaved before reuse or disposal.

   Contact UH LAS on proper procedures for disposal of animal carcasses, body parts, organs tissues and contaminated bedding.

4. **Contaminated Agriculture and Plant Wastes**
   (Miscellaneous Contaminated Waste –EPA 1986, NIH rDNA guidelines 2009)

   a. A contaminated agriculture or plant waste that is infected with plant diseases, insects, other biological agents, or has been genetically modified. Please follow "Use Permit" conditions as required by Federal or State Department of Agriculture and/or State Department of Land and Natural Resources.

   b. Steam sterilization can also be considered as an acceptable method of decontamination for infected/contaminated plant materials.

   c. See your conditions of your "Use Permit" for either the federal agencies (USDA, EPA, and DOT) or state (HDOA or HDOH) for any additional treatments or restrictions on disposal.

5. **Contaminated Biological Sharps**

   a. Discarding of biologically contaminated sharps, including but not limited to hypodermic needles, syringes, Pasteur pipettes, broken glassware, broken plastic
ware, lancets, glass slides, cover slips, plastic pipettes, pipette tips or any other material that is able to puncture a plastic trash bag, must be placed into impervious, rigid, puncture-resistant, and leak proof containers to avoid injury. These sharps containers must be located as close to the usage site as possible. Clipping, recapping, bending, manipulating, and breaking of needles is prohibited since this may result in the production of potentially infectious aerosols and personal injury. Containers should be labeled with the originating Lab number and contact phone number.

b. **Metal Sharps:** All metal biologically contaminated sharps (needle with syringe, lancets, scalpel, razor blades, dissecting needles, etc.) must be disposed of directly into a dedicated Red colored sharps containers.

c. Metal sharps must be treated to eliminate the biohazardous potential. Both steam sterilization and/or incineration provide effective treatment for contaminated sharps. Chemical decontamination may also be used, with the approval of the Biological Safety Officer/Compliance Office. Contact the Biosafety Program 956-3197 for pickup of full, treated red metal sharps containers for disposal.

d. Sharps containers for non metal sharps (i.e. plastic pipette tips) can be recycled laundry detergent bottles (plastic) or sturdy corrugated boxes doubled line with heavy gauged plastic bags which are able to withstand autoclaving and remain intact.

6. **Mixed Wastes (Biohazardous-Radioactive, Biohazardous-Chemical, Biohazardous-Chemotoxic, etc.)**

**DO NOT AUTOCLAVE or chemically treat BIOLOGICAL MIXED WASTES** without first doing an assessment of the types of mixed waste! Autoclaving mixed waste could cause the potential release of volatile radionuclides and/or toxic chemicals!

a. Mixed wastes consist of materials that exhibit multiple hazardous properties: biological, radioactive, chemical, carcinogenic, pharmaceutical, etc.

b. Radioactive → Biological → Chemical is the order from high to low hazard, with the exception of a toxin or carcinogen which is either equal to or higher than the biological depending on the Risk group of the biological. This ranking will determine the best method for decontamination before discard.

c. Radioactive mixed wastes should be managed through the Radiation Safety Office at 956-6475 (EHSO). Contact them for proper handling and disposal.

d. For more information regarding chemically contaminated mixed wastes contact the Hazardous Materials Management Office at 956-3198 (EHSO).

E. **SIGNS, LABELS, AND MARKINGS**

1. A **Universal Biological Hazard Symbol** (UBHS) (see Fig. 1) is used to indicate the actual or potential presence of a Biohazard and to identify equipment, containers, rooms, materials, experimental animals, or combinations thereof that contain, could contain, or are contaminated with viable biological commodities (Laboratory Safety Monograph, A Supplement to the NIH Guidelines for Recombinant DNA Research 1-2-1979).

2. Proper identification of biohazardous agents is necessary to alert support personnel who may enter the lab area, to take precautions and to restrict traffic to hazardous areas. It is the primary responsibility of the principal investigator to properly identify all biohazards in their labs.
3. The UBHS must be placed so that it can be easily seen and displayed only for the purposes of signifying the presence of or the potential for biological hazards.

4. The UBHS is usually **fluorescent orange** or an **orange-red** in color. There is no requirement for the background color as long as there is sufficient contrast to permit the symbol to be clearly defined. The symbol must be as prominent as practical, of a size consistent with the size of the equipment or material to which it is affixed, and easily seen from as many directions as possible.

   ![BIOHAZARD Symbol](image)

5. Appropriate wording may be used in association with the symbol to indicate the nature or identity of the hazard, name of the individual responsible for its control, precautionary information, etc., but this information should never be superimposed directly on the symbol.

**F. BIOHAZARD WASTE CONTAINMENT**

1. **Non-sharps, non-liquid waste containers**

   a. Biohazardous waste containers must be made to ensure containment of the waste, to protect the waste handlers, other personnel, and the public from injury and diseases that could be potentially caused by contact with the wastes.

   b. Containers should be: (OSHA 1910.1030(d)(4)(iii)(B)
      - Closable.
      - Lined with non-soluble autoclavable bags which are red in color or clearly labeled with the UBHS.
      - Constructed in such a way as to contain all contents and prevent leakage of fluids during handling, storage, transport, or shipping. (OSHA 1910.1030(d)(4)(iii)(B))
      - Closed prior to removal to prevent spillage or protrusion of contents during handling, storage, and transport.

2. **Plastic Bags (polyethylene or polypropylene)**

   a. All biohazardous waste should be deposited/colllected into a **biohazard autoclave bag** (red or clear only, three ml thickness). These bags must be used for **NON-SHARPS, NON-LIQUID WASTES**. All biohazardous bags must be tear-resistant, leak proof, able to contain the waste completely from its point of generation, through movement, and treatment. All bags must be properly labeled with the UBHS at the point of generation. (HAR 11-104.1-11)

3. **Sharps containers** (OSHA 1910.1030(d)(4)(iii)(A)(1))
a. **Sharps waste** must be deposited at the usage site (point of generation) or as soon as feasible into a special closable, rigid, leak proof, puncture resistant, autoclavable, container with a lockable lid which is unable to be re-opened once locked in place, which is red in color and/or clearly marked with the UBHS. Containers should be labeled with the originating **Lab number** and contact **phone number**. Sharps waste must never be deposited into plastic biohazard bags alone. (OSHA 1910.1030(d)(4)(iii)(A)(1))

b. All metal sharp waste containers should be steam sterilized. For metal **red sharps containers** once they have been sterilized call the Biosafety Program at 956-3197 for pickup and disposal. Non-metal sharps containers once sterilized can be placed in a dark plastic trash bag, sealed and disposed of in regular trash.

4. **Alternate Types of Containers**

a. In selection of alternate containers, consideration must take into account the type of treatment that will be used - metal, rigid plastics, corrugated cardboard, fiberglass, and glass are generally suitable materials for biohazardous wastes containers. They have an advantage of greater rigidity and strength than plastic bags alone. The disadvantages include: glass containers are breakable; corrugated cardboard and fiberboard containers are not leak proof and must be used only with double plastic bag liners.

b. All alternate containers must be lined with plastic bags listed above in section F, 2a. Sharps containers for **non metal sharps** (i.e. plastic pipette tips) can be recycled laundry detergent bottles (plastic) or sturdy corrugated boxes double lined with heavy gauged plastic bags.

5. **Containers for Liquid Waste**

a. Liquids must be placed within leak proof containers for movement to the site of treatment. The size of the containers should be large enough in order to minimize and control spills and use of a covered leak proof secondary container are essential for transport and autoclaving. The use of an absorbent packing material between the primary container and the secondary container should also be considered.

G. **HANDLING AND TRANSPORTING BIOHAZARDOUS MATERIALS**

1. Untreated biohazardous waste being transported to another location within a facility for any reason must be placed in autoclavable plastic bags, sealed, labeled with the UBHS, and placed in a **rigid, sealable and leak proof secondary container** for transport. (HAR §11-104.1-12)

2. Terminal disposition of biological agents and of all materials contaminated or suspected of being contaminated with biological/biohazardous material, including dead animals, tissues, and equipment must be preceded by autoclaving or inactivation by other approved methods for agents involved before disposal or cleaning.

H. **TREATMENT**

These are general guidelines and information on various types of treatment processes. Your individual situations may vary and require adjustment to meet the needs and intent of these guidelines.
1. Steam sterilization
   a. Steam sterilization of biological/biohazardous waste utilizes saturated (live) steam within a pressure vessel at temperatures sufficient to kill ALL biological/biohazardous agents present in the wastes (usually pressurized steam at 15 psi and 250 to 270°F / 121 to 132°C).
   
b. There are two general types of steam sterilizers. In both, the air is replaced with pressurized steam, the temperature increases to a level within the waste load which is sufficient to sterilize any biological/biohazardous agents. The gravity displacement type, in which the displaced air flows out the drain through a steam activated exhaust valve. The pre-vacuum type, in which a vacuum is pulled to remove the air before steam is introduced into the chamber. Most modern autoclaves are a hybrid of both these types.

There are three basic autoclave cycles:
   - Fast Exhaust cycle. Is usually used to decontaminate or sterilize dry goods, glassware etc. This cycle charges the chamber with steam and holds it at a set temperature for a set time. When finished the chamber returns quickly to atmospheric pressure.
   - Pre-Vacuum cycle. This cycle is typically used for decontaminating porous material, animal bedding etc. In this cycle the chamber is evacuated of air before the steam is introduced, which allows the steam to better penetrate throughout the load.
   - Slow Exhaust cycle. Also known as the “liquid cycle”, steam is exhausted after completion of decontamination “slowly” in order to prevent sterilized liquids from boiling over.

c. Treatment by steam sterilization is TIME and TEMPERATURE dependent; therefore, it is essential that the entire waste load is exposed to the necessary temperature for the defined period of time.

d. The principle factors that must be considered when treating biological/biohazardous waste by steam sterilization are:
   - Type of waste: solids, liquids, equipment, animal bedding etc.
   - Packaging and containment: bags, box, metal container etc.
   - Volume of waste load.
   - Configuration and arrangement in the treatment chamber.

2. Preparing items for autoclaving
   a. When bags or containers are approximately 3/4 FULL they should be prepped for autoclaving. DO NOT pack down or compress contents as this will prevent and/or hinder stream penetration. Add 100-250ml of water to each bag prior to processing, amount of added water will vary and be determined by the size and contents of bag or container. Bags should be loosely closed to allow steam access.

   b. Materials that are waiting to be autoclaves should be properly stored and contained in a secondary leak proof container. Never store untreated waste directly on the floor.

   c. All waste being prepared for autoclaving should be properly labeled in order to be able to track waste back to the generating laboratory if necessary. Each autoclave
location should have a labeling system and log in place that provides this documentation.

d. Autoclaves must be packed loosely to allow air to escape and steam to enter. Open mouth containers must not be inverted and should be placed on their sides especially in a gravity displacement autoclave to prevent trapping air.

e. Select a suitable sterilization cycle. Cycle times are usually double when used for decontamination of waste. General suggested guidelines for Temperatures, Times and Pressures for decontaminating/sterilizing various waste materials.

- Trash: 250°F(121°C) for 1 hour, 15 psi.
- Liquids: 250°F(121°C) for 1 hour for each gallon, at 15 psi.
- Glass: 250°F(121°C) for 1 hour, 15 psi.
- Tissue: 250°F(121°C) for 1 hour for each pound, 15 psi.
- Laundry: 250°F(121°C) for 30 minutes, 15 psi.

f. Always follow manufacturer's specific instructions for proper use of the particular autoclave you are using. Training on its proper use and operation should always be completed and documented by the PI or EHSO before using any autoclave in the University of Hawai‘i system. Written operating instructions should be available at each autoclave location.

g. General routine autoclave maintenance:

- Remove and clean drain strainer daily
- Gauges, temperature recorders, timers’ etc. should be routinely checked/monitored and calibrated periodically to assure accuracy.
- Wash chamber periodically with trisodium phosphate or a mild detergent. Never use a strong abrasive or steel wool.
- Rinse chamber with tap water and dry.
- Wash, rinse, and dry loading carts/carriages as indicated or needed
- Periodically flush and clean chamber discharge drain.

h. Again remember that biohazardous wastes that have multiple/mixed hazards MUST NOT be steam sterilized because of the potential for exposure of equipment and equipment operators to toxic, radioactive, anti-neoplastic drugs, or other hazardous or toxic chemicals that could be volatilized by the temperatures utilized in steam sterilization.

3. Loading and Unloading the Autoclave

Persons involved in steam sterilizing biohazardous/infectious wastes must be educated and trained in the proper techniques to minimize personal exposure to hazards posed by these wastes and the autoclaving process. Proper personal protective equipment (PPE) should be worn when preparing, loading and unloading the autoclave. This includes the use of at minimum, safety glasses or face shield, lab coat with long sleeves and heat resistant gloves. When loading and unloading the autoclave, personnel should be dutiful in order to, minimize formation of aerosols, prevent the spillage of waste during the loading and unloading process and be aware of possible vapor inhalation and burn hazards especially when opening and unloading the autoclave.

4. Autoclave Monitoring, Performance evaluation and documentation

All autoclaves, steam sterilizers, and pressure vessels operating on the UH campus’ must be routinely inspected, serviced and certified. This is to verify that the autoclave is functioning properly. NOTE: Certification for autoclaves that are hard plumbed to a
buildings steam lines is required by the State of Hawai‘i and is preformed by the Hawai‘i State Department of Labor and Industrial Relations, Division of Occupational Health and Safety, Boiler and Elevator Inspection Bureau.

- **Biological indicators**: It is highly recommended that a biological indicator (BI) utilizing *Geobacillus stearothermophilus* spores be used on a regular scheduled basis to determine and document that the autoclave is functioning properly and within desired parameters. They should be run at regular intervals, weekly, monthly or quarterly, to verify functionality and logged.

- **Class 5 - Integrating Indicators**: Class 5 Integrating integrators or chemical indicators (CI’s) are devices designed to respond to the various physical conditions within the autoclave with a chemical or physical change. Class 5 CI’s have been approved by the FDA as equivalent in performance to a biological indicator. They use multiple parameters to give an indication of how well the autoclave is functioning and can serve as a valuable tool for immediate load monitoring and compliance more economically and quickly than standard biological indicators. Class 5 CI’s however **DO NOT** replace the use of spore BI’s which should continue to be used periodically and logged for each autoclave.

**Documentation.** All waste being prepared for autoclaving should be properly labeled in order to be able to track waste back to the generating laboratory if necessary. Each autoclave location should have a labeling system and log in place that provides this documentation.
BIOHAZARDOUS / INFECTIOUS WASTE MANAGEMENT PLAN

Laboratory Specific - Biohazardous Waste Management Plan

Each research or instructional laboratory at the UH that utilizes any form of biological/biohazardous materials is required to have a written Biohazardous Waste Management Plan as part of the laboratories Biosafety manual. It should be specific and designed for each individual laboratory and delineate the procedures for the labs management of their particular biohazardous/infectious waste stream.

According to HAR §11-104.1-33, EPA 1986 each infectious waste generator and transporter of untreated infectious waste shall have a written plan that contains policies and detailed procedures that:

1) Outline the handling, safety and effective management, and disposal of infectious waste in accordance with these rules (HAR §11-104.1). Suggested sections for waste plan (EPA 1986):
   - Designation
   - Segregation
   - Packaging
   - Storage
   - Transport
   - Treatment
   - Disposal
   - Contingency Planning
   - Staff training

2) Ensure the health and safety of persons living in Hawaii and the environment in accordance with applicable federal, state, and local regulations, which include, but are not limited to, those regulations issued by the NIH, CDC, OSHA, EPA, and CLSI, as well as HRS §11-58.1 (Solid Waste Management Control), HAR §11-62 (Waste Water).

A copy of this plan shall be kept in the laboratory or administrative offices of the generator and the transporter.

The plan shall also provide for contingencies in emergency situations. At a minimum this shall include, but not be limited to, procedures to be used in the following circumstances:

1) **Spills of liquid infectious waste.** The plan shall include provisions for containment, protection of personnel, clean up procedures, disinfection and disposal of the spill residue and contaminated containers; See: UH Spill Plan – Safe Handling of Biohazardous Laboratory Spills.

2) **Rupture of plastic bags or other loss of containment.** The plan shall include provisions for containment, protection of personnel, clean up procedures, disinfection, and repackaging of waste; and

3) **Equipment failure.** The plan shall include contingent arrangements for waste storage, transportation, and treatment.
REFERENCES


OSHA Bloodborne Pathogens Standard. 29 CFR §1910.1030

Identification and Listing of Hazardous Waste. 40 CFR §261

State of Hawai‘i, Bloodborne Pathogens Standard. HAR §12-205.1


State of Hawai‘i, Solid Waste Management Control. HAR §11-58.1

State of Hawai‘i, Medical waste treatment and disposal facilities. HAR §11-58.1-52

State of Hawai‘i, Infectious wastes. HAR §11-58.1-63

Preventing Occupational Exposure to Antineoplastic and Other Hazardous Drugs in Health Care Settings. (DHHS) NIOSH Publication No. 2004-165, September 2004
