

UNCG Regulated Medical Waste Policy

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1. Policy

All persons at the University will handle Regulated Medical Waste and other biohazard waste so as to minimize hazardous exposure to themselves, other persons, and the environment. This may be accomplished by following the rules and regulations provided by the State of North Carolina (15A NCAC 13 B .1200), the Guilford County Health Department, and all City of Greensboro Department of Sanitation requirements. The UNCG Medical Waste Management Policy stipulates proper procedures for the collection, decontamination, and disposal of laboratory-generated biohazard waste. This policy has been developed in order to minimize the risk of exposure to those who may come into contact with biohazard waste generated on the UNCG campus, specifically:

- Laboratory workers generating, collecting, and treating biohazard waste during research
- Student Health Services treating our community
- Athletics research and treatment personnel
- Support staff retrieving, transferring, and autoclaving biohazardous waste
- Housekeeping staff responsible for transporting the autoclaved waste in buildings that house laboratories
- And anyone else who may generate or handle Regulated Medical Waste on campus

North Carolina Medical Waste Management regulations require that "Regulated Medical Waste" (RMW), defined as "blood and body fluids in individual containers greater than 20 ml, microbiological waste, and pathological waste," must be treated before disposal in order to render the waste nonhazardous. In addition to blood in volumes greater than 20 mL, some laboratory-generated biological waste falls under the category of "Microbiological Waste" as defined below, within 15A NCAC 13 B .1200. Biohazard waste generated and collected in UNCG laboratories, which qualify as RMW, must be treated by validated autoclave or formally approved chemical treatment prior to disposal to the normal waste stream. The process must change the biological character of the waste to reduce or eliminate its potential for causing disease. Laboratories with biohazard wastes which do not qualify as RMW (ie. BSL-1) should consult the UNCG Biosafety Manual for disposal procedures. Additionally, biological waste containing multiple hazards (ie. hazardous chemicals or radioactivity) should consult with the EH&S Department for appropriate treatment and disposal methods.

2. Definitions

Regulated Medical Waste - Regulated medical waste means blood and body fluids in individual containers in volumes greater than 20 ml, microbiological waste, and pathological waste that have not been treated. Regulated medical waste must be treated prior to disposal. After treatment these wastes may be handled as general solid waste.

Microbiological Waste - Microbiological waste means cultures and stocks of infectious agents (Risk Group or Biosafety Level ≥ 2), including but not limited to specimens from medical, pathological, pharmaceutical, research, commercial and industrial laboratories.

Pathological Waste - Pathological waste means human tissues, organs and body parts; and the carcasses and body parts of all animals that were known to have been exposed to pathogens that are potentially dangerous to humans during research, were used in the production of biologicals or in vivo testing of pharmaceuticals or that died of a known or suspected disease transmissible to humans.

Blood and Body Fluids - Blood and body fluids means liquid blood, serum, plasma, other blood products, emulsified human tissue, spinal fluids and pleural and peritoneal fluids. Dialysates are not blood or body fluids under this definition. Please note that the definition of regulated medical waste specifies blood and body fluids that are in a liquid state and in a container, such as a suction canister. This does not refer to blood absorbed by materials such as bandages and dressings. (Some waste items contaminated with blood may be subject to OSHA labeling requirements).

3. Responsibilities

- It is the responsibility of the Principal Investigator and department that waste material identified as regulated medical waste is properly labeled, stored, and treated according to this policy.
- It is the responsibility of the Principal Investigator that the decontamination cycle verification be performed and documented on a weekly basis.
- It is the responsibility of the autoclave user that all safety precautions are followed and personal protective equipment is used when operating the autoclave, including placing material inside and removing material from the autoclave.
- It is the responsibility of the Principal Investigator to maintain all required shipping documentation when shipping off campus for treatment.

4. Waste Collection Methods

Solid Waste

Includes items such as:

- Culture dishes, flasks
- Solid cultures/stocks
- Gloves, gowns, masks
- Other solid material potentially contaminated under the definition of biohazard waste

The outer collection container must be durable, leak proof, have a lid and be of such a design so as not to be mistaken by Housekeeping as regular trash. This container must be labeled with the universal biohazard symbol. Wire cages cannot be used as the outer container.

Line the outer container with an autoclavable biohazard bag. Waste bags with the universal biohazard symbols are only to be used for biohazard waste that will be autoclaved before disposal. Before lining the collection container with a biohazard bag, crisscross the bag's biohazard symbol and/or markings with heat sensitive autoclave tape. The biohazard collection container should be covered with its lid when not in use. Remove bags at 2/3 full and never place glass in these containers.

Liquid Waste

Includes items such as:

- Any liquid containing BSL-2 agents
- Animal blood or body fluid from animals infected with BSL-2 agents
- Human body fluids as defined above as regulated medical waste
- Human tissue culture, human cell lines
- Liquid growth media from human tissue cultures

Collection containers must be durable and compatible with the treatment method (autoclave or chemical). A lid must be secured when not in use and a biohazard label affixed. Glass containers should not be placed on the floor without secondary containment.

Storage

Regulated medical waste must be stored in such a way that does not degrade the integrity of the container, labels, or markings. Only authorized personnel shall have access to areas used to store Regulated medical waste. A plan shall be prepared, maintained and updated as necessary to ensure continued proper management of regulated medical waste at the facility.

All areas used to store regulated medical waste shall be kept clean. Vermin and insects shall be controlled. All floor drains shall discharge directly to an approved sanitary sewage system. Ventilation shall be provided and shall discharge so as not to create nuisance odors.

5. Treatment and Disposal

Autoclave Waste Decontamination

Autoclaving, or steam sterilization, is a dependable method for the destruction of all forms of microbial life and is therefore the preferred method of treatment for solid and liquid biological waste. Successful treatment is dependent upon adequate temperature, pressure, and time for steam to penetrate all parts of the waste. Therefore, the autoclave user must be mindful of the cycle parameters, as well as the volume and packaging of waste to prevent the entrapment of air. If all the air is not allowed to escape from the waste during the cycle, steam will not replace the air. Individual trials should be done to determine the proper loading and cycle parameters to for adequate sterilization. N. C. medical waste rules state that autoclaves are to be provided with a chart recorder which accurately records time and temperature for each cycle.

Parameters

The autoclave is to be operated at a minimum of 121°C (250°F) and 15 psi for a minimum of 45 minutes, or other combination of parameters shown to effectively treat the waste. Suggested parameters are shown in the table below. Some autoclaves are equipped to operate at higher temperatures, which may allow for shorter exposure times. The parameters used for each type of waste in the laboratory must be validated weekly using biological indicators to ensure effective sterilization (see procedure below).

Autoclaves may have settings for "LIQUIDS" or "DRY GOODS". "LIQUID" settings run for longer periods at lower temperatures to minimize liquid evaporation and spills. For solid materials, the "DRY GOODS WITH VACUUM" should be used for infectious waste as it is the most effective at moving steam and heat into the deepest parts of large bags producing the best conditions for killing persistent organisms. "DRY GOODS WITHOUT VACUUM" should only be used for clean items that need to be sterilized. Exhaust settings should also be appropriate for the type of waste being autoclaved. FAST exhaust should be used for solid items and SLOW exhaust should be used for liquids.

| Material | Temperature | Time |
|----------------------------------------------|----------------------------|-------------|
| Laundry | 121 C (250 F) | 30 minutes |
| Trash (biohazard bags with infectious waste) | 121 C (250 F) | 1 hour |
| Glassware | 121 C (250 F) | 1 hour |
| Liquids | 121 C (250 F), each gallon | 1 hour |
| Animals | 121 C (250 F) | 8 hours |

Solid waste

Place plastic bags inside a secondary container in the autoclave in case liquids leak out. Plastic or stainless steel containers are appropriate secondary containers. Make sure plastic bags and pans are autoclavable, to avoid having to clean up melted plastic. Do not overfill waste bags or the autoclave. This will interfere with steam penetration. Add about 50-100 ml of water to each bag of solid waste to facilitate steam penetration in the bag. If there is naturally occurring water in the load, adding additional water is not necessary. Keep the waste bags slightly open to allow for steam penetration. Bags must be placed into stainless steel or polypropylene trays prior to autoclaving.

Liquid waste

Use leak proof containers for items to be autoclaved. Wherever possible, all considerations should be given to non-glass containers. Plastics such as polypropylene, polypropylene copolymer or fluoropolymer products are capable of being autoclaved repeatedly. Place non-borosilicate glass bottles in a tray of water to help prevent heat shock. The containers should

not be filled to more than 75% capacity. The caps or stoppers on the containers should be loosened. Never autoclave sealed containers of liquid. This could result in an explosion of superheated liquid. Liquid containers should be placed in a stainless steel or polypropylene tray with 1/4 to 1/2 inch of water in the bottom of the tray. The tray should be placed on a shelf in the autoclave and not on the bottom of the chamber.

Autoclaved liquid wastes may be discharged directly to the sanitary sewer.

Liquid waste containing sodium hypochlorite (bleach) should not be autoclaved because of the potential to produce toxic gases and corrosion of autoclave equipment. Liquid waste treated chemically does not need to be autoclaved prior to disposal, see the **Treatment of Liquid Biohazardous Waste** section for more details on *Chemical Disinfection*.

Indicators

Tape indicators can only verify that the autoclave has reached normal operating temperatures for decontamination. Most chemical indicators change color after being exposed to 121°C but cannot measure the length of time spent at 121°C. Biological indicators (e.g., *Geobacillus stearothermophilus* spore strips or spore suspension) and certain chemical indicators (e.g., Sterigage) verify that the autoclave reached adequate temperature for a long enough time to kill microorganisms.

Use autoclave tape on all bags of biohazardous waste. Before autoclaving bags of biohazardous waste, place an “X” with autoclave indicator tape over the biohazard symbol. Autoclave tape can also be used to indicate if media or equipment has been autoclaved.

Once a week, use a biological indicator to verify the effectiveness of the autoclave cycle parameters (see procedures below).

Training

Owners and authorized users of autoclaves shall read and understand the manufacturer’s owner manual and be thoroughly familiar with the safe operation of their autoclave. It is the responsibility of the Principal Investigator that all users are familiar with the safe operation of the autoclaves.

Autoclave Precautions

The hazards associated with autoclaves include extreme heat and high pressure and large, heavy doors and loading carriage. When operating an autoclave the following safety procedures must be followed:

1. Become familiar with the autoclave's owner’s manual. Though the principle is the same for each, manufacturer recommendations for use can vary widely.

2. Firmly lock autoclave doors and gaskets in place before you run the autoclave to prevent a sudden release of high-pressure steam. Some autoclaves do not have safety interlocks that prevent the autoclave from running if the door isn't closed properly. If your autoclave does not have safety interlocks, you will need to take additional precautions to ensure that the doors are secured.
3. If you have an older autoclave that has little or no heat shielding around the outside, attach signs warning of "Hot Surfaces, Keep Away" on or next to the autoclave to remind people of the hazard. Do not stack or store combustible materials (cardboard, plastic, volatile or flammable liquids, compressed gas cylinders) next to an autoclave.
4. When a cycle is complete, wait until the pressure has normalized before opening the door of the autoclave.
5. Wait at least 30 seconds after opening the door before reaching or looking into the autoclave.
6. Open the door slowly, keeping head, face, and hands away from the opening.
7. Allow contents to cool before removing them from the autoclave.
8. Remove solutions from the autoclave slowly and gently; some solutions can boil over when moved or when exposed to room temperature. Thick, heat-resistant gloves, safety goggles or face shield and a rubber apron must be worn when removing hot liquids from the autoclave. Liquids should stand for over 1 hour before being handled without heat-resistant gloves.
9. Never put solvents, toxic, volatile or corrosive chemicals (e.g., phenol chloroform, bleach, formalin, fixed tissues, etc.), or radioactive materials in an autoclave. Call the EH&S Department at 334-4357 if you have questions about proper disposal of these materials.
10. Clean up any spills immediately.
11. Report any malfunctions or accidents immediately to your supervisor.

Autoclave Waste Decontamination Cycle Testing and Verification

The NC Regulated Waste Rules (15A NCAC 13 B .1200) state that autoclaves shall be monitored under conditions of full loading for effectiveness weekly by each user through the use of biological indicators. *Bacillus stearothermophilus* indicators must be used with average spore populations of 10⁴ to 10⁶ organisms. There are many commercially available biological indicators with a choice of spore ampules or spore strips with growth media. Follow the instructions provided by the manufacturer of the biological indicators. Most require refrigeration when kept in storage.

1. Place the indicator in the middle of the waste bag or material to be autoclaved. It is best to put the indicator in the waste bag before it is filled completely. To aid recovery of the indicator after sterilization, tape it to a brightly colored sheet of paper or to a long string allowed to protrude from the bag. Indicators can also be placed in test waste bags filled with materials that simulate full loading for the test.

2. Autoclave the waste following normal procedures. Once the cycle is complete and contents have cooled, remove the indicator from the waste bags wearing appropriate protective equipment which should include eye protection and temperature resistant gloves. Prepare and incubate the indicator and a control indicator that was not autoclaved as recommended by the manufacturer.
3. Check for signs of growth at regular intervals during the incubation period (8, 12, 24 and 48 hours). There should be signs of growth on the control indicator that was not autoclaved or the test is invalid. If there are signs of growth on the indicator placed in the waste, the waste was not sterilized properly. The time, temperature and autoclave procedures should be re-evaluated. If an autoclave problem is suspected, Facilities Services must be contacted immediately for repair.
4. A log of each test should be maintained, which includes the type of indicator used, date, time, and result of the test (Appendix A).
5. The waste does not have to be held until the results of the testing confirm effectiveness. If test results indicate that the autoclave is not sterilizing properly, the autoclave should not be used for waste until it has been repaired. The first load run in the autoclave should be tested with a biological indicator to ensure proper functioning of the autoclave.
6. N. C. medical waste rules state that autoclaves are to be provided with a chart recorder which accurately records time and temperature for each cycle.

Treatment of Liquid Biohazard Waste

Even though the rules and definitions for liquid biohazard waste vary somewhat from solid waste procedures, autoclaving is the method of choice for disinfection of the following:

- Liquid human blood
- Animal blood/body fluids
- Human tissue culture, human cell lines (primary or established)
- Human body fluids considered OPIM*
- Liquid growth media removed from human tissue cultures

NOTE: These items may not be regulated medical waste, if no infectious agents are known to be present. See the UNCG Biosafety Manual for disposal procedures for nonregulated biological waste.

* **OPIM** (Other Potentially Infectious Material), defined as human semen; vaginal secretions; cerebrospinal, synovial, pleural, pericardial, peritoneal, and amniotic fluids; and body fluids visibly contaminated with blood or in situations where it is difficult to differentiate between body fluids.

Chemical disinfection

Chemical disinfection, such as bleach treatment, may be an acceptable alternative to autoclaving nonregulated biological waste generated in research laboratories at UNCG. The NC Medical Waste Rules do not allow chemical disinfection of regulated liquids followed by disposal to the sanitary sewer unless approval has been obtained from the NC Division of Waste Management. Regulated liquids include the following:

- Liquid waste media from cells/tissue used for propagating risk group 2, or 3 **pathogens or toxins**, including those produced in recombinant DNA procedures.
- "Microbiological waste" as defined by the NC Regulated Waste rules: e.g. cultures and stocks of **infectious agents** (Risk Group or Biosafety Level ≥ 2)
- Fluids from animals known to contain infectious agents

If you are unable to autoclave liquid waste likely to be contaminated with any of the materials listed above, you will need to make application to the North Carolina Medical Waste Division for approval of the chemical disinfection method, prior to disposal of the chemically disinfected liquid waste to the sanitary sewer.

If you wish to obtain approval for chemical treatments of infectious liquids please contact the EH&S Department.

Choosing a Chemical Disinfectant

When choosing a disinfectant, keep the following considerations in mind:

- How effective is the disinfectant for the particular application?
- What is the organism requiring inactivation (Different disinfectants are more effective against different types of organisms.)?
- How many of the organisms are present (The more organisms present, the more disinfectant required and/or the longer the application time will be.)?
- Does organic matter inactivate the disinfectant (Proteins in organic matter can inactivate or slow down the activity of certain disinfectants, such as bleach.)?
- Is the disinfectant compatible with work surfaces and equipment (e.g., metal, tile, plastic, wood, concrete)
- Disposal of chemical waste
- What is the shelf life of the disinfectant?
- How hazardous is the disinfectant? Refer to the MSDS and the product label for this information.
 - Perform a risk assessment on the disinfectant to determine required PPE.
 - Is the disinfectant compatible with equipment or work surfaces?
 - Does the disinfectant leave a residue?

Types of Chemical Disinfectants

The following are outlines of the basic properties and examples of the most common categories of chemical disinfectants, including alcohols, chlorine compounds, liquid formaldehyde, glutaraldehyde, iodophors, peracetic acid, phenolic compounds, and quaternary ammonium compounds. Adequate contact time is very important to ensure complete disinfection. Contact time varies with the type of material being disinfected.

- Alcohols (e.g., ethanol, isopropanol)
 - Alcohols are the most effective against lipophilic viruses, less effective against non-lipid viruses, and ineffective against bacterial spores.
 - Optimal disinfection is attained by using 70% ethanol for 15 minutes.
 - These types of disinfectants evaporate quickly, so sufficient contact time may be difficult to achieve. Concentrations above 70% are less effective because of increased evaporation rate.
- Chlorine compounds (e.g., household bleach – 5.25% sodium hypochlorite)
 - Chlorine compounds are effective against vegetative bacteria and most viruses in solutions of 50 – 500 ppm of available chlorine. Bacterial spores require concentrations of 2,500 ppm with extended exposure time. Prions require 20,000 ppm with extended exposure time.
 - A 5,000 ppm available chlorine solution is preferred for general use because excess organic materials inactivate chlorine compounds. This concentration of solution is made by diluting household bleach 1:10 with water. Shelf life for diluted bleach is approximately 24 hours, if kept in a clear container.
 - Air and light inactivate diluted solutions, so solutions must be freshly made in order to maintain adequate available chlorine concentrations. These solutions should be stored in an airtight, opaque container out of the light. Shelf life is approximately seven days.
 - Strong oxidizers are very corrosive to metal surfaces, as well as to the skin, eyes, and the respiratory tract.
- Formalin – Requires initial monitoring prior to use. Contact the EH&S Department at 334-4357 to schedule monitoring.
 - Formalin is effective against vegetative bacteria, spores, and viruses.
 - Effective concentration is a 5 – 8% solution of formalin
 - (formaldehyde in water; made by diluting a 37% solution).
 - Formaldehyde is a suspected human carcinogen and can cause respiratory problems at very low concentrations. Inhalation limits are 2 ppm for 15 minutes, 0.75 ppm for 8 hours of exposure.
 - Formaldehyde has an irritating odor and is a sensitizer, so a potential exists for developing allergic reactions.
- Glutaraldehyde mixtures (e.g., Cidex, Sporicidin, and 3M Glutarex) – Requires initial monitoring prior to use. Contact the EH&S Department at 334-4357 to schedule monitoring.

- Glutaraldehyde mixtures are effective against vegetative bacteria, spores, and viruses (more so than formaldehyde).
- Effective concentration is 2%.
- Chemically related to formaldehyde, vapors are irritating to the eyes, nasal passages, and upper respiratory tract.
- Iodophors – organically bound iodine compounds (e.g., Wescodyne diluted 1:10 is a popular hand washing disinfectant)
 - Iodophors are effective against vegetative bacteria and viruses but not against bacterial spores.
 - Effective concentration is 75 – 150 ppm.
 - Iodophors are relatively nontoxic to humans, so they are often used as general disinfectants in antiseptics and surgical soaps.
 - These disinfectants have built-in indicators: if the solution is brown or yellow, it is active. Sodium thiosulfate solution can be used to readily inactivate iodophors and remove iodophor stains.
- Peracetic acid
 - Peracetic acid is used most commonly to sterilize gnotobiotic animal holding chambers and equipment.
 - Peracetic acid is effective against bacteria, viruses, fungi, and bacterial spores. It is very powerful and fast acting.
 - Effective concentration is 2% in water, or 0.08% solution in 10-20% ethanol. The ethanol solution has fewer adverse properties than the 2% solution in water.
 - Peracetic acid is received as a 40% concentrated solution, which can explode if contaminated with heavy metals or reducing agents or if rapidly heated. It is also flammable and must be refrigerated. It is a potent respiratory irritant and requires a respirator for use – Contact the EH&S Department prior to use.
 - Peracetic acid is corrosive to metal surfaces.
 - Diluted solution degrades rapidly, so it must be freshly prepared for use.
- Phenolic compounds (e.g., Amphyl, Vesphene II)
 - Phenolic compounds are commonly used for disinfecting contaminated walls, floors, and bench tops.
 - Phenolic compounds are effective against vegetative bacteria, including mycobacterium tuberculosis, fungi, and lipophilic viruses. They are not effective against spores and non-lipid viruses.
 - Effective concentrations are 0.5 – 2%.
 - Phenolic compounds produce an unpleasant odor and are toxic.
 - These are irritants to the eyes, skin, respiratory tract, and gastric tract.
- Quaternary Ammonium compounds – cationic detergent (surfactant) with strong surface activity, commonly referred to as “Quats”
 - Quats are effective against fungi, Gram-positive bacteria, and lipophilic viruses but less effective against Gram- negative bacteria. They are ineffective against

hydrophilic viruses or bacterial spores. Quats mixed with phenolics are very effective against disinfectants, as well as cleaners.

Usual effective concentration is 1:750.

- Quats are relatively nontoxic and acceptable as a general disinfectant, such as for decontaminating food equipment or for general cleaning.

Quats are easily inactivated by organic materials, anionic detergents (soaps), or salts of metals found in hard water.

Procedures for Inactivation and Safety Containment of Toxins

For more information on procedures for inactivation and safety containment of toxins, please refer to the current BMBL for Guidelines for Working with Toxins of Biological Origin.

Treatment Off-Site

UNCG uses Stericycle for all off-site disposal needs.

Contact Information:

Telephone: (866) 783-7422

Website: www.stericycle.com

Each package of RMW shall be marked on the outer surface with the following information:

- The generator's name, address, and telephone number
- The transporter's name, address, and telephone number
- Storage facility name, address, and telephone number, when applicable
- Treatment facility name, address, and telephone number
- The words "INFECTIOUS WASTE" or "MEDICAL WASTE"

6. Exemptions

Medical Waste

Medical waste such as dressings, bandages, sponges, used gloves, and tubing are not included in the definition of regulated medical waste and may be disposed of without treatment.

Blood and Bodily Fluids

Blood and body fluids not known to be infectious and in individual containers in volumes equal to or less than 20 ml are not required to be treated prior to disposal (.1202(c)). If not stored in a secured area, accessible only to authorized personnel, these containers must be packaged either in a container suitable for sharps or in a plastic bag in a rigid fiberboard box or drum.

Urine and Feces

Urine and feces should be disposed of through sanitary sewage or septic disposal practices. Soiled diapers are not regulated medical waste and may be disposed as general solid waste.

Sharps

North Carolina does not require treatment of sharps before disposal. They must be packaged in a container that is rigid, leak-proof when in an upright position and puncture resistant. The package then may be disposed of with general solid waste. (Generators should comply with any relevant OSHA requirements for labeling and packaging). Prepare for disposal when the container is 2/3 full.

Include items such as:

- Razor blades
- Scalpels
- Lancets
- Syringes with/without needles
- Slide covers
- Specimen tubes
- Any sharp object used to pierce skin

Sharps are collected in containers which must be red, rigid, leak-proof when in an upright position and puncture resistant, and must also have a universal biohazard label. This type of container is available from Lab Safety Supply in many different sizes and styles to meet any need.

Sharps cannot be processed in small compaction units inside the generating facility. The rule does not prohibit hauling sharps to the landfill on trucks that compact waste. Also, it does not prohibit processing sharps containers in large commercial compactors where the waste will be transported to a disposal facility without being transferred to another container.

Appendix A

Weekly Autoclave Validation Log

