Autoclaves

Standard Operating Procedure

Revision Date: 05/20/22

This standard operating procedure (SOP) outlines the use of autoclaves. Review this document and supply the information required in order to make it specific to your laboratory. In accordance with this document, laboratories should use appropriate controls and personal protective equipment when using autoclaves.

# Description [Provide additional information as it pertains to your research protocol]

Autoclaves sterilize equipment and decontaminate waste through a process that incorporates high pressure and high temperature.

## Process [Write the steps for using the equipment in your research protocol]

# Potential Hazards [Provide additional information as it pertains to your research protocol]

The potential hazards include heat, steam, pressure, and biological hazards (e.g. improperly autoclaved infectious materials).

# Engineering Controls [Provide additional information as it pertains to your research protocol]

Autoclave monitoring and maintenance is an important aspect of a safe and properly functioning autoclave. Follow the manufacturer’s recommendations for preventive maintenance and ensure that all contractors hired to perform regular maintenance and repairs are approved by the manufacturer. Autoclave operators shall ensure that each autoclave is monitored as follows:

* Heat Sensitive Tape Monitoring – Operators shall use heat sensitive sterilization indicator tape for each load to indicate that the load has undergone an effective steam sterilization process.
	+ Note that this tape only indicates that the proper temperature for the cycle has been reached, but does not indicate that it was heated at the proper pressure or for the appropriate length of time.
	+ Ensure that the heat sensitive tape used does not contain a lead based indicator as this type of tape **must** be collected and managed as hazardous waste.
* Biological Indicators – Operators who autoclave medical/biohazardous waste need to do the following:
	+ At least once a month, use a biological indicator such as Bacillus Stearothermophilus (e.g. Prospore2), placed at the center of a load and processed under standard operating conditions to confirm the attainment of adequate sterilization conditions.

# Work Practice Controls [Provide additional information as it pertains to your research protocol]

**Do not autoclave items containing corrosives, solvents, volatiles or radioactive materials.**

## Prior to Loading

* Before using the autoclave, check inside the autoclave chamber for any items left by the previous user that could pose a hazard.
* Ensure that the drain strainer is clean before loading the autoclave.
* Ensure that the door gaskets have not deteriorated, but are still intact and pliable.
* Turn the autoclave on, and allow time for the jacket to reach sufficient temperature and pressure.

## Loading

* Load the autoclave as per the manufacturer’s recommendation. **Do not** overload the autoclave.
* Make sure that the door of the autoclave is fully closed and latched and ensure that the correct cycle for the items being autoclaved has been selected before starting the cycle.

***Standard Autoclave Cycles for Commonly Used Material***

* Glassware and trash: 121°C for 1 hour with 15 minutes pre-vacuum of 27 in. Hg.
* Liquids: 121°C for 1 hour for each gallon.

## When Autoclaving Liquids

1. When running an autoclave cycle with liquids, the cycle time is longer but uses lower temperatures to minimize evaporation of the liquids. Liquid cycles also have a longer depressurization time to avoid “boil-over” of liquids.
2. To prevent bottles from shattering during the pressurization, the caps of containers with liquids **must** be loosened before loading.
3. Use only borosilicate glass (Pyrex™ or Kimax™) that can withstand the high autoclave temperatures.
4. Use a heat resistant “autoclave tray” with a solid bottom and walls to contain the contents and catch spills. The tray should contain an inch of water.
5. Label bottles by writing lab name and date on autoclave tape.
6. Bottles should not be filled more than 2/3.
7. Keep 1-2 inches of space between bottles.
8. Don heat-resistant gloves.
9. Wait 10 minutes after the cycle ends before removing autoclaved liquid load items.
10. Open the door slowly. Keep your head, face, and hands away from the opening.
11. Let the liquids stand for at least a full hour before touching with ungloved hands. Be sure to let others in the area know that a heat hazard is present.

## When Autoclaving Dry Loads

When autoclaving dry loads, you **must** use a university approved autoclave bag, which is a clear bag with a biohazard symbol and a printed-on sterilization indicator badge.

1. Check plastic materials to ensure that they are compatible with being autoclaved.
2. Place waste in the university approved autoclave bag; avoid over packing autoclave bags.
3. Place the bag in a heat resistant “autoclave tray” with a solid bottom and walls to contain the contents and catch spills. **Do not seal bags**.
4. Label waste by writing lab name and date on autoclave tape.
5. Add 200-500ml of water to the bag to promote steam penetration.
6. Don heat-resistant autoclave gloves.
7. Open the door slowly. Keep your head, face, and hands away from the opening.
8. For dry loads, let the glassware cool for a minimum of 15 minutes before touching it with ungloved hands.

# Personal Protective Equipment (PPE) [Provide additional information as it pertains to your research protocol]

Wear the proper PPE, including heat resistant gloves, lab coat, eye protection and close toed shoes when opening the autoclave door after a cycle.

# Waste Disposal [Provide additional information as it pertains to your research protocol]

After sterilization cycle, close and seal bag. The sterilized waste can be transported directly to the dumpster by Building Services or laboratory staff without boxing or labeling.

## Hazardous Waste that Has NOT Been Sterilized

Because most spent, unused, and expired chemicals/materials are considered hazardous wastes, they must be properly disposed of. **Do not dispose of chemical wastes by dumping them down a sink, flushing in a toilet or discarding in regular trash containers, unless authorized by EHS Hazardous Materials Management (HMM)**. Contact EHS-HMM at (734) 763-4568 for waste containers, labels, manifests, waste collection and for any questions regarding proper waste disposal. Also, refer to the EHS [Hazardous Waste](http://ehs.umich.edu/haz-waste/) Web page for more information.

# Exposures/Unintended Contact [Provide additional information as it pertains to your research protocol]



If the employee is in need of emergency medical attention, call 911 immediately.

Discontinue use immediately if an autoclave is not working properly. Post a sign alerting others not to use the autoclave. Mechanical failures need to be attended to by a trained technician. Contact the service company responsible for the maintenance of your autoclave or your department’s safety representative for further guidance.

For a chemical exposure/injury:

| injury type | action | notes |
| --- | --- | --- |
| Exposure-Skin | **Seek medical treatment immediately**. Burns to the face, third- degree burns or burns over large areas of the body should be treated as emergencies. (Call 911). **Minor Burns** 1. Use first aid procedures, including the following steps:
2. Immerse the burn in cool water immediately
3. Removing clothing from the burn area.
4. Keep the injured area cool for at least 5 minutes.
5. Regardless of the severity, notify your Laboratory Director/Supervisor!
 |  |
| **NOTE**: If an ambulance is needed, call the University of Michigan Division of Public Safety and Security (DPSS) at 911 to request assistance. |

Report all work related accidents, injuries, illnesses or exposures to Work Connections within 24 hours by completing and submitting the [Illness and Injury Report Form](http://www.workconnections.umich.edu/employees/work-related-illness-injury/step-one/). Follow the directions on the Work Connections website [Where to go for treatment](http://www.workconnections.umich.edu/treatment.html) to obtain proper medical treatment and follow-up.

Complete the [Incident and Near-Miss Report](https://ehsa.oseh.umich.edu/EHSA/public/injuryillnesssubmit/injuryillnessinitialedit) form.

## Treatment Facilities

**U-M Occupational Health Services -- Campus Employees**Mon-Fri 7:00 am - 4:30 pm, hours may vary.
C380 Med Inn building
1500 East Medical Center Drive, Ann Arbor (734) 764-8021

**University Health Services -- University students (non-life threatening conditions)**
Mon-Fri 8 am - 4:30 pm, Sat 9 am - 12 pm
Contact for current hours, as they may vary
207 Fletcher Street, Ann Arbor (734) 764 - 8320

**UMHS Emergency Department -- after clinic hours or on weekends**
1500 East Medical Center Drive, Ann Arbor (734) 936-6666

**Report all emergencies, suspicious activity, injuries, spills, and fires to the University of Michigan Police (DPSS) by calling 911 or texting 377911. Register with the** [University of Michigan Emergency Alert System](http://dpss.umich.edu/emergency-management/alert/) **via Wolverine Access**.

# Training of Personnel

All personnel are required to complete the Autoclave Operation and Safety Procedures training online through [My LINC](https://ehs.umich.edu/safety-training/ehs-training-login/) (Course EHS\_BLS013w\_TAB).

# Certification

I have read and understand the above SOP. I agree to contact my Lab Manager if I plan to modify this procedure.

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| Lab Director | Revision Date |

### Major Revisions (Tracking purposes only – Do not print as part of SOP)

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| --- | --- |
| Date | Revision |
| 09-13-18 | EHS name and logo were added, updated the formatting, and revised the content under Exposure/Unintended Content (AKJ). |
| 03-04-19 | Reviewed and updated. |
| 05-15-20 | Updated editing rights to headings (RSH) |
| 05-20-22 | Updated steps to include labeling autoclave tape and donning heat-resistant gloves (FTB) |