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1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to inform personnel on how to operate autoclaves safely. An autoclave (or steam sterilizer) uses steam heat under pressure to sterilize/decontaminate medical/lab items contaminated with microorganisms such as bacteria, viruses, fungi, and spores. Autoclaves are mostly used in laboratory settings to sterilize surgical instruments and glassware for example. It is recommended that the manufacturer's manual be consulted for up-to-date information and best practices.

2.0 HAZARDS and CAUTIONS

Autoclaves present both physical hazards (e.g., high pressure, steam heat) and biological hazards (e.g., bacteria, viruses). Hence, the user and school/department are exposed to multiple risks.

- Heat burns due to the handling of hot equipment and hot parts of the autoclave such as the chamber walls and door.
- Steam burns may also be caused by residual steam coming out of the autoclave when opening the door at the completion of a cycle.
- Infectious agents from improperly autoclaved material pose a biological risk.
- It is preferable to setup autoclaves under/next to an exhaust hood to circumvent fire alarm activation from excess steam escape.
- Bottles that contain liquids have the potential to crack/rupture from pressure buildup during the autoclave cycle if lids/caps are tightened. **Note:** Ensure lids/caps are loosened and bottles are placed inside a secondary container to capture any spillage and to prevent seepage into the autoclave compartment.

Autoclaves have limitations. One of the main limitations is that certain materials CANNOT be autoclaved. These materials include but are not limited to:

- Items containing solvents may produce toxic fumes when autoclaved.
- Bleach solutions (hypochlorite) can damage an autoclave.
 - DO NOT autoclave any item containing bleach.
- Some plastics are not autoclavable. Only use plastic bottles that are stable at high temperatures.
- DO NOT autoclave damaged glassware.
- USC autoclaves are NOT licensed as an approved disposal method for biohazardous waste.
 - DO NOT autoclave biohazardous waste with the expectation to dispose of it as regular waste.

3.0 ROLES AND RESPONSIBILITIES

Responsible Person

Each school/department shall designate a Responsible Person (or Persons) to oversee autoclave usage in their area(s), such as a building manager. The Responsible Person (RP) will have the following duties:

- Educate and train every autoclave user on proper use and maintenance of the autoclave prior to any operation.
 - Keep training records of autoclave users.
- Post the following documents near the autoclave:
 - A copy of the Safe Autoclave Operation SOP
 - A copy of the autoclave operation manual, if available
 - RP contact information
 - Maintenance technician contact information
- Follow instructions provided by the autoclave manufacturer.
- Conduct a basic visual inspection of the autoclave at least once a month. This would include verification that the autoclave door seals properly and that the gaskets are in good working condition. **NOTE:** Ensure that autoclaves are covered under an adequate Preventive Maintenance (PM) contract and that each unit is inspected at least quarterly for proper operation and safety.

Autoclave User

- Undergo training on proper use of the autoclave.
- Follow instructions provided by the autoclave manufacturer.
- Complete the Autoclave Use Log before each use.
- All users must wear the appropriate Personal Protective Equipment (PPE) when using the autoclave – see *Section 5.0 Personal Protective Equipment (PPE)* below.

4.0 MANUFACTURER'S MANUAL

If available, place a copy of the manufacturer's manual by the autoclave for quick access. In addition to operating instructions, the manufacturer's manual must clearly list the following information:

- Autoclave Information (Make and Model)
- Responsible Party and Contact Information
- Location (Building and Room Number)

5.0 PERSONAL PROTECTIVE EQUIPMENT (PPE)

Autoclave users must adhere to provisions of the [USC PPE Standard](#) and always wear appropriate PPE when operating an autoclave to prevent scalds and burns. See recommended PPE in table below.

Gloves		Glasses/Goggles		Body		Other	
Nitrile	X	Splash	X	Lab Coat, cotton	X		
Neoprene		Safety	X	Lab Coat, Nomex	X		
Heat Resistant	X	Face Shield*	X	Lab Coat, FR**	X		
		Optical Filter		Apron, FR**			

* To be used with safety glasses or splash goggles as necessary. **Fire Resistant.

Additional PPE may be needed depending on the type(s) of material(s) and potential hazard(s). For example, if there is a risk for splashes, a face shield over splash goggles might be necessary. Adapt as needed to address any situation.

6.0 PROCEDURES

Preparation

- Place material to be sterilized in a proper wrapper. Using the wrong wrapper or wrapping the material too tight decreases the effectiveness of the autoclaving process.
- Arrange all materials so that all surfaces are directly exposed to the steam.
- Use autoclave tape as an indicator for reaching the proper/specific temperature during the sterilization process.
- To prevent pressure buildup, all containers holding liquid must be covered with a loose lid/cap and must be placed inside a secondary container.
- Record information (e.g., date, time, username, settings or cycle used, and what is being autoclaved) in the autoclave logbook (see example below) for every autoclave usage.

Loading

- Wear appropriate PPE (e.g., lab coat, heat resistant gloves, eye protection, and closed-toe footwear).
- Place the material to be sterilized into the autoclave. Note that autoclaves have limitations (see [Section 2.0 Hazards and Cautions](#)).
- DO NOT overload the unit. Ensure that steam has sufficient space to properly circulate throughout the chamber.
- Close the door. DO NOT force it to close.
- Do not attempt to open the door once the cycle has started. The autoclave's locking mechanism can be damaged if extreme force is used.
- Select the proper pre-programmed cycle based on the type of load being autoclaved. The cycle runtime is based on a variety of factors including the size of the load and the type of load.
- If you run into any problems, abort the cycle, report it to your PI and RP, and note the problem in the logbook.

Unloading Materials from Autoclave

- Wear appropriate PPE.
- Ensure that the cycle has completed and that the pressure and temperature have dropped to a safe range. Follow instructions on the control panel (newer units) or gauges (older units).
- Standing back, slowly open the door to allow residual steam to be released and the pressure inside to normalize. Depending on the door style of the unit, this will help with cooling down the items inside.
- For liquids, allow the load to stand for approximately 10-15 minutes to cool off to further reduce risk to the operator.
- Be careful not to agitate or remove caps from any liquid container since liquids in an autoclave can become superheated. Superheated liquid, if disturbed may nucleate bubbles and boil explosively without warning. Wait until liquids are cooled down and safe to handle before handling. This will reduce the risks of scalds or burns.

- Remove items from the autoclave and place them in a designated area where items can cool down to room temperature. Place warning signs (see below) to alert users that items are hot.
- Close the autoclave door properly.



7.0 EMERGENCY

Emergency Notification and Incident Reporting

1. Notify the Department of Public Safety (DPS) at (213) 740-4321 or (323) 442-1000. For a non-emergency, dial (213) 740-6000.
2. Notify EH&S immediately at (323) 442-2200 or injuryprevention@usc.edu to report the injury/incident.
3. Notify the RP.
4. Notify your Supervisor/PI if different from RP.

Biohazardous Spill

Follow instructions in the [Biohazardous Spill Clean-Up Guide Sheet](#) for minor biohazardous spills. For major biohazardous spills, notify DPS. Contact Biosafety at biosafety@usc.edu for additional information.

8.0 REFERENCES

- Steris Healthcare: [Everything About Autoclaves](#)
- [USC Biosafety Manual](#)

9.0 SAFE AUTOCLAVE OPERATION SOP ACKNOWLEDGEMENT

The Principal Investigator must ensure that his/her research group is trained in the application of this SOP by the principal investigator himself/herself or designee.

Each user will enter his/her name, physical or electronic signature, and date below and acknowledge by their signature that they:

1. Have read, understood, have access to, and agree to abide by the directions provided in this Safe Autoclave Operation SOP AND
2. Will refer to the RP for specific questions about the use of the autoclave.

The RP/ Principal Investigator will maintain this document (electronic or hard copy) in his/her files or central repository and will make it available upon request by EH&S or other investigative party during periodic or impromptu inspections. Each user will have access to a copy of the signed document.

NOTE: Users are subject to all applicable safety training including the General Lab Safety Course, annual laboratory safety training refresher, etc.

Name	USC ID	Email	Signature	Date	PI	Lab	Autoclave Location



Responsible Person Email/Phone No.:

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