



## UNIVERSITY OF SOUTH ALABAMA

# Standard Operating Procedures: Autoclave Safety and Operation

### PURPOSE

This document is to provide standard operating procedures for the use of autoclaves. Autoclaving is a process used to destroy microorganisms and decontaminate biohazardous wastes and microbiological equipment used at Biosafety 1, 2, and 3 at the University of South Alabama.

NOTE: This standard operating procedure does not cover additional requirements for autoclave use/disposal of biosafety/animal biosafety level 3 materials.

### SCOPE

This Standard Operating Procedures (SOP) applies to individuals who operate and maintain autoclaves. This SOP should be used in conjunction with the autoclave manufacturer's manual.

This SOP does not cover additional requirements for autoclave use/disposal of biosafety/animal biosafety level 3 materials.

### RESPONSIBILITIES

- Supervisor

Overall responsible for ensuring employees, students and volunteers under their supervision:

- Adhere to all guidelines, policies and regulations pertaining to the use of autoclaves
- Complete safety training on the safe operating procedures and document the training
- Made aware of and trained in the hazards affiliated with autoclave operation

The Principal Investigator may appoint a designee to conduct training on safe operating procedures and hazards affiliated with autoclave operation.

- Laboratory Personnel/Unit Operators

Autoclave users have the responsibility to:

- Comply with guidelines in this SOP and document safety training related to autoclave operation
- Notify their immediate supervisor of any problems with an autoclave
- Notify their immediate supervisor of any injuries related to its use

## HAZARDS

Autoclaves use high pressure and high temperature steam for sterilization. The potential risks for the operators include:

- **Heat burns** from hot materials and autoclave chamber walls and door
- **Steam burns** from residual steam coming out from autoclave and materials on completion of cycle
- **Hot fluids scald** from boiling liquids and spillage in autoclave and during transport of superheated materials
- **Hand and arm** injuries when closing the door
- **Body injury** if there is an explosion

## SAFETY

To insure the health and safety of personnel using the autoclave, it is important for each College/Department/Facility to maintain autoclaves and to train personnel in their proper use.

- This SOP should be posted near the autoclave.
- It is the supervisor's responsibility to ensure employees are trained before operating any autoclave unit
- Procedural and instructional documents provided by the manufacturer must be followed.
- Personal protective clothing and equipment must be worn when loading and unloading the autoclave
- Autoclaves must be inspected at least annually. Inspection services may be managed by your manufacturer's preventative maintenance contract. The inspection, service and repair records should be available upon request. Safety and Environmental Compliance will perform annual audits/investigations.
- Spore strips/Biological Indicator may be used to validate autoclave effectiveness

## PERSONAL PROTECTIVE EQUIPMENT

Equipment to protect against scalds and burns include:

- Heat-insulating gloves that provide complete coverage of hands/forearm
- Lab coat
- Highly recommend eye protection, especially when loading
- Closed-toe footwear

## OPERATOR INSTRUCTIONS

- Material Preparation
  - Ensure material is safe for autoclaving
    - i. Sample containing solvents/substances that emit toxic fumes should not be autoclaved
    - ii. Do not autoclave bleach
  - Glassware must be inspected for cracks
    - i. Cracked glassware must not be autoclaved
  - Prior to decontamination, all potentially biohazardous material shall be kept in secondary containment containers to protect against leakage
  - Prepare and package material appropriately
    - i. Loose, dry materials must be wrapped/bagged in a steam-penetrating paper or loosely covered with aluminum foil. Wrapping too tightly will impede steam penetration.
    - ii. Loosen all lids to prevent pressure build-up. Containers must be covered by a loose lid, steam-penetrating bung, or aluminum foil
    - iii. Containers of liquid must not exceed 80% full
    - iv. Glassware must be heat-resistant
    - v. Discarded sharps must be in a designated sharps container
    - vi. Autoclave tape is recommended for each separate container in each load
  - Place items in secondary containers to secure and contain spills:
    - i. Items should be placed in a stainless steel pan or other autoclavable container
    - ii. Place containers of liquid, agar plates, or other material that may boil over or leak into a secondary pan in the autoclave
    - iii. Bags must NOT be sealed tightly so steam can penetrate
- Biohazardous waste must be processed according University of South Alabama Institutional Biosafety Committee guidelines
  
- Loading the Autoclave
  - Wear Personal Protective Equipment
  - Place material in autoclave. Do NOT mix incompatible materials
  - Do not overload; leave sufficient room for steam circulation [refer to owner's manual]
  - Close and latch door firmly
  
- Autoclave Operation
  - Verify the door is latched firmly
  - Select appropriate cycle (i.e. gravity, liquid, or dry cycle) for the material. Consult your supervisor/or individual responsible for the autoclave for assistance in choosing a cycle
  - Begin your cycle and fill out the autoclave log with your contact information. A complete cycle typically takes between 0.5-1.5 hours, depending on the cycle type.
  - Do not attempt to open door while the autoclave is in operation
  - If problems with the autoclave are perceived, abort cycle and report it to your supervisor immediately.
  
- Unloading the Autoclave
  - Wear heat-insulating gloves and personal protective equipment
  - Ensure that the cycles are complete and both temperature and pressure had returned to a safe range
  - Wearing personal protective equipment, stand to the side of the autoclave and unlatch the door, open the door no more than 1-2 inches to allow release of residual steam and allow pressure within liquids/containers to normalize

- Allow autoclave load to sit for a few minutes in the chamber. This allows steam to clear and trapped air to escape from hot liquids, minimizing risk to the operator.
- Do not remove caps until liquids have cooled to a safe level
- Wearing heat-insulated gloves remove items from the autoclave and place them in an area to cool to room temperature.
- Shut autoclave door
  
- Autoclave Log
  - Entries must be placed on the lab sheet each time the autoclave is used. The records are kept for maintenance/service reasons and reporting of incidences/accidents.
  - Entries should include: operators name, lab in which individual works, type and duration of load, date and time
  - Log must be kept adjacent to the autoclave
  - An example of the log sheets utilized are provided in this document
  
- Maintenance and Repair
  - No person shall operate the autoclave unless the autoclave is in good repair
  - Only qualified professionals are permitted to make repairs
  - Report possible malfunctions to the individual responsible for the autoclaves, noted on the front page of this document

## **AUTOCLAVE VALIDATION**

- Autoclaves shall be used to ensure sterilization utilizing biological indicator assays
  - Time tape or steam indicators do not validate sterilization
  - Typical biological indicator assays involve sterilization or inactivation of spores with demonstration sterilization rather than just heat
    - An Attest™ Biological Indicator assay by 3M or equivalent is recommended
- Validation utilizing a biological indicator assay should be conducted by inserting the biological indicator into a run to be validated
- A log of autoclave validation should be kept near the autoclave
  - Autoclaves should be validated every six months at minimum

## **RECORDS**

Records from validation autoclave runs should be maintained in an accessible location close to the autoclave for a minimum of three years. After three years, paper records can be archived electronically or in a designated storage location for a minimum of seven years.

## **ROUTINE/NON-ROUTINE MAINTENANCE**

### Routine:

All autoclave cycles should be validated on at least a yearly basis using appropriate biological and/or chemical indicators. This validation will be completed by the Department of Safety and Environmental Compliance. Validation should be documented including all relevant data to support validation.

Each individual run should include appropriate biological and/or chemical indicators as a control to ensure the autoclave performed as expected. Results from the controls should be maintained with the autoclave records.

Non-Routine:

Contingency Plans

- Equipment Malfunction
  - If the autoclave does not operate exactly as expected, do not attempt to fix the problem
  - Record the problem in the autoclave log
  - Contact the individual responsible for the autoclave maintenance and your supervisor to report the problem
  - Only qualified professionals are permitted to make repairs.
  - All incidents, including spills of biohazardous materials must be reported to your supervisor. Incident reports must be completed within 72 hours of the incident via completion of an online [Incident Report Form](#).
  - If an injury occurs, seek medical assistance from a USA healthcare provider or by dialing 911 in the injury is serious.
  - If clothing is soaked in hot water, remove the clothing and place the injury in cool water.
  - Place a notice on the autoclave indicating that it is not to be used until cause of the incident is determined and deemed safe for operation.
- Spill Clean-Up
  - Spills may occur from a boil-over or breakage of containers
  - No operation of the autoclave is allowed until the spill is cleaned up
  - The operator is responsible for clean-up for spills. Wait until the autoclave/materials have cooled to room temperature before clean-up. Contain spilled material using paper towels. Autoclaves are required to have a designated spill kit.
  - Review the Safety Data Sheet, if appropriate, to determine appropriate PPE, spill clean-up and disposal requirements.
  - Dispose of the waste following the appropriate USA Biological Waste Disposal guidelines
  - Cracked glass must be disposed of properly
  - Record the spill and clean-up procedure in the autoclave log

**Responsible Party:**

Office of Research Compliance and Assurance  
Safety and Environmental Compliance

**Next Review Date:**

January 2020

**References:**

[USA Biomedical Waste and Sharps Disposal Flowchart](#)

## AUTOCLAVE USE LOG

Print Name	Contact Number	Date	Time	Cycle	Comments

