**THIS IS A TEMPLATE/BASIC STARTING POINT. CUSTOMIZE THIS TEMPLATE WITH INFORMATION PERTINENT TO YOUR SETUP AND THE PROCEDURE YOU WILL BE USING/YOUR GROUP’S PERSONAL USE.**

STANDARD OPERATING PROCEDURE

|  |  |
| --- | --- |
| **Procedure Title:** | Autoclave Operation |
|  |  |
| **Dept:** |  |  | **Bldg/Rm:** |  |  | **Supervisor:** |  |

**Procedure Overview:**

The purpose of this document is to provide standard operating procedures for the use of autoclaves.

Autoclaving is a process used to destroy microorganisms, decontaminate biohazardous waste and

microbiological equipment and sterilize equipment.

**Potential Risks:**

Always read and understand the safety data sheet (SDS) for a chemical before use or storage.

Autoclaves use high pressure and high temperature steam for sterilization. The potential safety

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 fluid scalds from boiling liquids and spillage in autoclave and during transport of

superheated materials.

* Lacerations from broken or cracked glassware or other sharps.
* Hand and arm injuries when closing the door.
* Body injury if there is an explosion.

**Health and Safety:**

To ensure the health and safety of personnel using the autoclave, it is important for each department to maintain autoclaves and to train personnel in their proper use.

* The name and contact information of the person responsible for the autoclave shall be posted near the autoclave.
* 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.

**Hazard Control Measures:**

(Lab coat, eye and hand protection, and closed toe/heel shoes must be selected as required by Section D of the ISU Laboratory Safety Manual.)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **[ ]**  | **Latex gloves** | **[x]**  | **Insulated gloves** | **[ ]**  | **Face Shield** | **[ ]**  | **Respirator** |
| **[ ]**  | **Nitrile gloves** | **[x]**  | **Safety glasses** | **[x]**  | **Lab Coat** | **[ ]**  | **Fume hood** |
| **[ ]**  | **Neoprene gloves** | **[ ]**  | **Vented goggles** | **[ ]**  | **Apron** | **[ ]**  | **Biosafety cabinet** |
| **[ ]**  | **Vinyl gloves** | **[ ]**  | **Splash goggles** | **[ ]**  | **Dust mask** | **[ ]**  | **Glove box** |
| **[x]**  | **Fully Enclosed Shoes** | **[ ]**  | **Flame Resistant Lab coat** |

**Procedure:**

**A. Training**

All personnel who use autoclaves must have successfully completed a training session from their

supervisor on the safe operating procedures. This requirement applies to both new and

experienced personnel. EH&S recommends completing the online Autoclave Safety training (click [here](https://www.myworkday.com/isu/learning/course/6ad3f59d6e6a1000bf66c892010c0000?type=9882927d138b100019b928e75843018d) for a direct link) in Workday Learning.

**B. Material Preparation (add instructions for your specific materials)**

* Ensure that the material is safe for autoclaving:
	+ Samples containing solvents or substances that may emit toxic fumes should not be autoclaved.
	+ **Do not autoclave bleach!**
* Glassware must be inspected for cracks prior to autoclaving.
* Prepare and package material suitably:
	+ Loose, dry materials must be wrapped or bagged in steam-penetrating paper or loosely covered with aluminum foil. Wrapping too tightly will impede steam penetration, decreasing effectiveness of the process.
	+ Loosen/vent all lids to prevent pressure buildup. All containers must be covered by a loosened lid or steam-penetrating bung.
	+ Place non-borosilicate glass bottles in a tray of water to help prevent heat shock.
	+ Bags should not be tightly sealed – steam must be able to penetrate into the bag.
	+ Do not over fill the containers with liquid. They should be 1/2 – 2/3 full.
* Plastics must be heat-resistant, e.g., polycarbonate (PC), PTFE (“Teflon”) and most polypropylene (PP) items.
* Discarded sharps must be in a designated autoclavable ‘Sharps’ container.
* All items must be tagged with autoclave tape. Biohazard bags must have an “X” of autoclave tape over the biohazard symbol.
* Place items in secondary containers to secure and contain spills: use stainless steel or other autoclavable containers. The secondary containers must be large enough to contain a total spill of the contents.

**C. Loading the Autoclave (add instructions for your specific instrument)**

* Wear a lab coat, eye protection, heat-insulating gloves, long pants, and fully enclosed shoes.
* Place material in the autoclave. Do not mix incompatible materials.
* Do not overload; leave sufficient room for steam circulation. If necessary, place the container on its side to maximize steam penetration and avoid entrapment of air.
* Close and latch the door firmly.

**D. Operating the Autoclave (add instructions for your specific instrument)**

* Close and lock the door.
* Choose appropriate cycle (e.g., gravity, liquid, or dry cycle) for the material. Consult the autoclave manual for assistance in choosing a cycle. The manuals for operation of the autoclave should be located near the autoclave.
* Set appropriate time and temperature if you are using a customized cycle.
* Start your cycle and fill out the autoclave user log with your contact information. A completed cycle usually takes between 1-1.5 hours, depending on the type of cycle.
* Do not attempt to open the door while autoclave is operating.
* If problems with your autoclave are perceived, abort cycle and report it to your PI or supervisor immediately.

**E. Unloading the Autoclave (add instructions for your specific instrument)**

* Wear heat-insulating gloves, eye protection, lab coat, long pants, and fully enclosed shoes.
* Ensure that the cycle has completed and both temperature and pressure have returned to a safe range.
* Wearing PPE, stand back from the door as a precaution and carefully open the door no more than 1 inch. This will release residual steam and allow pressure within liquids and containers to normalize.
* Allow the autoclaved load to stand for 10 minutes in the chamber. This will allow steam to clear and trapped air to escape from hot liquids, reducing risk to operator.
* Do not agitate containers of super-heated liquids or remove caps before unloading.
* Remove items from the autoclave and place them in an area which clearly indicates the items are ‘hot’ until the items cool to room temperature. They should remain in secondary containment until disposed of.
* Shut the autoclave door.

**Note: Allow autoclaved materials to cool for at least 10 minutes before transporting. Never**

**transport superheated materials**. Use a cart and secondary containment to transport the autoclaved items if you are using a shared autoclave away from your lab.

**G. Maintenance and Repair**

* No person shall operate the autoclave unless the autoclave is in good repair.
* Only qualified professionals are permitted to make repairs.
* Once a month, use a biological indicator (*Geobacillus stearothermophilus* spore strips or spore suspension).
	+ Bury the indicator in the center of the load to validate adequate steam penetration.
	+ Document the biological indicator results in a log book or other suitable form.
	+ For more information about the ISU autoclave bioindicator program, contact EH&S at (515) 294-5359.

**First Aid Procedures:**

Minor burns are typically small, red, have swelling, and can blister. Cool burns with cold water and continue until the pain lessens. After cooling, apply burn cream if appropriate, and cover with a dry, sterile bandage or clean dressing. Consult a physician as needed. Report all injuries to a supervisor.

**All accidents and injuries occurring at work or in the course of employment must be reported to the employee's supervisor as soon as possible (even if no medical attention is required).**

<http://www.ehs.iastate.edu/occupational/accidents-injuries>

**Spill/Release Containment, Decontamination, and Clean Up Procedures:**

**(add instructions for your specific materials)**

Spills may occur from a boil-over or breakage of containers.

* No operation of the autoclave is allowed until the spill has been cleaned up.
* The operator is responsible for clean-up of spills. Contain the spilled material Wait until the autoclave and materials have cooled sufficiently before attempting clean-up.
* Review the SDS, to determine appropriate PPE, spill cleanup and disposal protocols.
* Dispose of the waste following the protocol appropriate for the material (e.g. red biohazard bag). If materials have been intermingled, and you’re unsure how to proceed, contact your supervisor and/or EH&S.
* Cracked glassware must be disposed of properly.

**References:**

EH&S Biosafety Manual: <http://www.ehs.iastate.edu/publications/manuals/bsm.pdf>

**Using Substances Requiring Special Procedures?** No [x]  Yes [ ]

(If Yes; identify authorized personnel, designate a use area and specify specialized safety precautions here. Refer to Section B in the ISU Laboratory Safety Manual for details.)

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| **Written By:** |  |  | **Date:** |  |
|  |  |  |  |  |
| **Approved By:** |  |  | **Date:** |  |

 (PI or Lab Supervisor)

**HAZARD ASSESSMENT**

Use the hierarchy of controls to document the hazards and the

corresponding control measure(s) involved in each step of the procedure.

Consider *elimination or substitution* of hazards, if possible.

*Engineering Control(s):* items used to isolate the hazard from the user (i.e. fume hood, biosafety cabinet).

*Administrative Control(s):* policies/programs to limit the exposure to the hazard (i.e. authorizations, designated areas, time restrictions, training).

*Required PPE*: indicate PPE including specific material requirements if applicable (i.e. flame resistant lab coat, type of respirator or cartridge).

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| **Hazard** | **Engineering Control(s)** | **Administrative Control(s)** | **Required PPE**  |
| Heat transfer causing burn |  | Site specific training | Insulated gloves, safety glasses, lab coat, fully enclosed shoes |
|  Lacerations from broken glassware or other sharps |   |  Site specific training |  Cut resistant gloves or insulated gloves, fully enclosed shoes, long pants, lab coat, and safety glasses |
|  Burns from hot materials, steam, and equipment. |  Adequate room ventilation |  Site specific training, Allow material or equipment to cool before handling or opening, access to cool running water | Insulated gloves, lab coat, long pants, fully enclosed shoes, safety glasses |
|  Pinched fingers or damage to hands or arms from autoclave door. |   |   Site specific training | Insulated gloves, lab coat, long pants, fully enclosed shoes, safety glasses |
| **CUSTOMIZE FOR YOUR GROUP/LAB** |  |  |  |
|  |  |  |  |

**Training Record**

Use the following table to record the training associated with this Standard Operating Procedure.

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| --- | --- | --- |
| **Print Name** | **Signature** | **Date** |
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**Note: Attach to or file with written materials and methods**