Autoclave Safety

Purpose:

Sterilization refers to the complete killing of all living organisms, including spores. Common sterilization techniques include the application of wet heat, dry heat, chemicals, and radiation. The type of material, the container, and quantity of items to be sterilized determines which method to use. Various pieces of equipment are used for sterilization in laboratory animal facilities, but the autoclave is the primary means of sterilizing materials. Despite built-in safeguards, an autoclave presents the possibility of serious injury to personnel's from hot surfaces and from the release of steam. It is important, therefore, that laboratory personnel understand the proper operation, limitations, and safeguards for sterilization by autoclaving.

ASSOCIATED RISKS:

Autoclaves are sterilizers using high pressure and high temperature steam. The potential safety risks for the operators are:

- 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.
- Hand and arm injuries when closing the door.
- Body injury if there is an explosion

Autoclaves are used in laboratories to sterilize equipment, instruments, and infectious waste. No one who has not received training in autoclave procedure or is not working under the supervision of an experienced autoclave worker should attempt to operate the autoclave. In addition, users should read and understand the owner's manual from the particular model of autoclave that they are using.

SAFETY PRECAUTIONS:

- All operators must receive training on the safe operation of the autoclave prior to using the equipment. Training may be delegated to a qualified individual, but it remains the responsibility of the supervisor to ensure their personnel are adequately trained.
• Always wear suitable personal protective equipment. Closed toed shoes, lab coats and insulated gloves must be worn when handling autoclaved materials. When a splash hazard exists, face shields and aprons must be worn.

• Never attempt to sterilize flammable materials. The sterilizer is not designed for flammables and this may cause a fire or explosion.

• When sterilizing liquids, use liquid cycle only and do not agitate containers of heated liquids, place containers in an autoclavable tray.

• Jarring containers can cause hot-bottle explosions. Place containers on carts or trolleys lined with paper to avoid shattering of glass.

• Use only heat resistant glass (Type I borosilicate glass, Pyrex), or heat resistant plastics (e.g., polycarbonate, PTFE, many polypropylene plastics) that are suitable for sterilization. Ensure all lids have loose, vented closures to prevent pressurization/vacuum.

• Sterilizers, racks, and materials will be very hot after processing. Stand back from the sterilizer when opening the door, and allow materials to cool before unloading.

• Immediately clean any spilled material or condensate from the floor to prevent slips or falls.

• Keeps hands and arms out of the door opening when closing the sterilizer.

• Report any problems with the equipment, including unexpected noises, vibration, or smells to the contact above.

• Place any sharps to be autoclaved in a designated sharps container.

• Do not attempt to open the door when a cycle is in process, or in the event of an alarm

PROCEDURE:

• Preparation of Materials

• Confirm all materials and containers are safe to autoclave.

• **Oils, waxes, some plastics, flammable materials, radioactive materials, and samples containing solvents or substances which may emit toxic fumes must not be autoclaved.**

• All glassware and plastic to be autoclaved must be heat resistant.
• Glassware should be inspected for cracks. Examples of heat resistant plastics include polycarbonate, PTFE, and many types of polypropylene.

• If any biohazardous materials are to be autoclaved, ensure they are labelled appropriately placed in suitable container or autoclavable bag.

• Containers of waste must allow steam penetration and must be arranged in the autoclave in a manner that permits free circulation of steam. Tight-fitting containers do not permit steam penetration.

• For loose, dry materials, place in a container loosely covered with aluminum foil or bag/wrap with an autoclavable, steam penetrable material.

• For liquids, ensure containers are less than 2/3 full and lids/cover are fully loosened.

• Any sharps must be placed in a designated sharps container.

• Place items to be autoclaved in plastic or metal secondary containers for ease of handling and to capture any spills. Secondary containers must have sufficient volume to contain the contents.

• Apply thermal indicator tape to materials

• Loading Autoclave

• Ensure personal protective equipment and clothing is adequate. You must wear closed toed shoes and a lab coat and gloves when loading the autoclave. If the sterilizer has been recently used, wear insulated gloves to protect against accidental contact with hot surfaces.

• Place materials to be sterilized into the autoclave. Do not overload the sterilizer. Steam must circulate in order to effectively sterilize the contents.

• Piling containers above one another and overloading can result in decontamination failure.
• Operating autoclave:

There are unique operating procedures for each autoclave used in labs for appropriate autoclave cycles.

In general for all autoclaves:

• Select the appropriate cycle time for sterilization. There are multiple cycles to choose from, depending on the autoclave.

• For liquid sterilization, use a liquid cycle.

• When cycle is complete, a message will display on the screen. Never attempt to open the door while the autoclave is in operation.

• Unloading Autoclave

• Wear a lab coat, insulated gloves and closed toed shoes when unloading. A face shield and splash apron should be worn if a splash hazard exists.

• Carefully, slowly open the door. Keep back from the door as residual steam may be released.

• Allow sterilized material to stand for 10 minutes before unloading. For large loads, items may need to stand for an additional 10 minutes. Do not remove caps or agitate containers of heated liquids.

• Remove items from autoclave and place in an area which clearly indicates the items are 'hot'. Caps may be tightened at this point to maintain sterility of liquids.

• Allow items to cool to room temperature. Place material on cart lined with paper or paper towel. This will prevent shattering of glass which may occur if it is placed directly on metal.

• Clean the autoclave. Do not use chloride-containing solutions as these may corrode the metal components of the autoclave.
• Autoclave Log

• Entries must be placed in the log books each time autoclaves are used. These records are used for maintenance/service schedules and reporting of incidents, accidents or faults. Log information must include date used, name of operator & research lab, cycle used, and cycle parameters.

• Sterility Assurance

• Biological indicators are used for routine monitoring (e.g., every month, based on the frequency of use) of the sterilization process. A biological indicator is a standardized population of bacterial spores intended to demonstrate favorable sterilization conditions in the load. The results of biological indicator testing should be kept on file.

Decontamination of Infectious Waste

• Infectious waste must be autoclaved for a minimum of 30 / 60 minutes at 121°C based on the agent produced in the waste.

• Spills Cleanup

• Spills may occur from boil over or breakage of containers. Do not attempt to operate the autoclave until the spill has been cleaned up.

• If a spill occurs, prevent the spill from spreading and wait until both the autoclave and the material inside have cooled to room temperature. Do not attempt to clean a spill when it is hot. Clean affected area and dispose of waste appropriately. Any broken glass must be placed in the designated pail.

• The operator of the equipment is responsible for spill clean up.

• Record the spill in the autoclave log book.