Biological Safety

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Centrifuge Safety

A centrifuge is a common piece of equipment in most research laboratories. All centrifuges, regardless of size, present a hazard to laboratory personnel if not used safely and properly maintained. Hazards include physical hazards due to mechanical failure (mechanical stress, metal fatigue, corrosion of rotor, imbalanced loads, etc.) and exposure hazards due to the materials utilized in the centrifuge (aerosolization of biohazardous, chemical, or radioactive materials).

Benchtop centrifuges are typically low speed centrifuges (up to 5000rpm) or microcentrifuges (up to 15,000rpm). High speed centrifuges (up to 25,000rpm) are generally floor model centrifuges. Ultracentrifuges, which may exceed 100,000rpm, are typically found in core (shared) equipment areas. These are the most expensive and dangerous types of centrifuge on UK's campus. Knowledgeable use, careful procedures, and preventive maintenance are all necessary to ensure centrifuge safety for all lab personnel.

Centrifuge rotors undergo tremendous mechanical forces and will show signs of metal fatigue over time. Always follow manufacturer guidance as to when to derate (permanently lower the speed) and when to retire centrifuge rotors. Although centrifuges have been designed to contain the rotor in case of failure, there have been documented incidences of rotor failure that were not contained and caused physical injury to personnel and property.

In addition to mechanical failure of the machine, centrifuge tubes may break and release aerosols into the surrounding environment. Improper centrifuge use or malfunction is often cited as the most common cause of laboratory-acquired infections (LAIs).

The following procedures will help ensure safe centrifuge operation and the longevity of the machine.

Preventive Maintenance

- Establish a preventive maintenance schedule
  - Schedule regular cleaning of the centrifuge interior, depending on frequency of use. Ensure this schedule is maintained by ALL USERS of a shared centrifuge. Refer to the operator's manual or contact the manufacturer for guidance.

- Record Log Book
  - For ALL high speed and ultracentrifuges, maintain a log book.
    - Run dates, duration, speed, total rotor revolutions and any notes regarding the rotors condition should be recorded for every run.

Proper Use

- Ensure all personnel are trained PRIOR to operating the centrifuge.

- Wear appropriate Personal Protective Equipment (PPE), including lab coat, safety glasses, gloves.

- Inspect the centrifuge prior to use.
  - Ensure tubes are rated for the intended use (speed, temperature) and free of cracks or stress marks before use.
  - The rotor must be compatible with the centrifuge and seated correctly on the drive.
  - O-rings should not be cracked, missing, or worn. Ensure O-rings are appropriately greased.
  - Safety cups/buckets should be attached correctly and able to move freely.
  - If your inspection identifies centrifuge components in need of repair or replacement, contact a qualified service technician. DO NOT use the centrifuge. Post signage on the centrifuge to communicate to other users that the centrifuge is unfit for use.

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Proper Use (continued...)

- Prepare centrifuge tubes for loading.
  - When centrifuging biohazardous materials, fill and decant centrifuge tubes/bottles inside a Biological Safety Cabinet (BSC).
  - DO NOT overfill. Follow manufacturer's limits for tubes/bottles.
  - Wipe down the exterior of tubes/bottles with an efficacious disinfectant.
  - Load tubes/bottles into safety buckets/cups or sealed rotor within the BSC.
  - Wipe down the exterior of safety buckets/cups or sealed rotor with an efficacious disinfectant prior to removal from BSC.

- Balance centrifuge and start run.
  - Monitor the centrifuge until full operating speed is reached and running safely.

- If any unusual noise or shaking is noticed, immediately stop centrifuge.

- DO NOT exceed maximum speed or mass limits for the centrifuge rotor.

- Ensure the centrifuge has come to a complete stop before opening.

- Check for leaks or spills.

- Sealed rotors or safety buckets/cups must be opened and unloaded in a BSC.

- Using an efficacious disinfectant, wipe down centrifuge rotors, buckets, cups after use.

Emergency Response

In case of leaks/spill or centrifuge malfunction, follow the steps below.

- Turn off the centrifuge and unplug the power cord.

- Alert personnel nearby to leave the area. Post signage warning personnel of a centrifuge malfunction and Do Not Enter.

- Allow 30 minutes for aerosols to settle.

- Don appropriate PPE (lab coat, gloves, and face shield) prior to opening the centrifuge (carefully) to assess damage.

- Cover all interior surfaces of the centrifuge with an efficacious disinfectant and allow appropriate contact time (ex. 10% bleach for 20 minutes).

- Transport (carefully) centrifuge rotors/buckets/cups to the nearest available BSC to open containers.
  - Use a sturdy cart for transport.

- Disinfect contents with an efficacious disinfectant (as described above).

- Remove materials for proper decontamination (ex. autoclave) and disposal.
  - DO NOT use your hands to pickup any sharp materials. Use forceps to safely remove broken/damaged items.
  - Sharps materials should be disposed of in a designated sharps container.
  - Non-sharp solid materials should be disposed of in an orange/clear autoclave bag for autoclaving and disposal.

References

CDC Biosafety in Microbiological and Biomedical Laboratories - 6th Edition