

Biosafety Basics Fact Sheet: Aerosol Production and Exposure Control

Background:

Over the years, there have been many documented cases of lab personnel acquiring diseases due to their work with infectious agents. Approximately 80% of these cases are assumed to be primarily related to the creation of aerosols in the lab. Whenever work with infectious agents is performed, all appropriate measures must be taken to protect workers and the environment. This Fact Sheet describes aerosol-producing activities and safe work practices to protect workers from aerosols.

Definitions:

Aerosols are liquid and solid particles suspended in the air. An aerosol with a diameter of 5 microns or less can remain airborne for a long period of time, spread wide distances, and is easily inhaled. Particles with a diameter larger than 5 microns tend to settle rapidly and can contaminate skin, other surfaces, and ventilation systems.

Examples of Aerosol-Producing Activities in the Lab:

- blowing out pipettes
- cell sorters
- shaking or vortexing tubes, stirring
- opening lyophilized cultures, opening snap top tubes, breakage of culture containers
- flaming loops or slides
- pulling needles out of septa, filling a syringe
- pouring liquids
- centrifugation steps such as filling centrifuge tubes, removing plugs or caps from tubes after centrifugation, removing supernatant, resuspending pellets, breakage of tubes during centrifugation, and centrifugation itself
- sonicating, homogenizing, blending, grinding, other cell disruption processes
- intranasal inoculation of animals
- cage cleaning, changing animal bedding
- harvesting infected material from animals, eggs, and other virology procedures
- necropsies of infected animals

Safe Work Practices to Minimize the Creation of and Exposure to Aerosols:

Using a combination of the appropriate safety equipment and safe procedures is the primary method to minimize the creation of and exposure to aerosols.

Lab safety equipment to protect personnel from aerosols

- The certified biological safety cabinet (class I or II) is the primary barrier to protect workers from aerosols. Other safety devices include safety centrifuges with automatic locking mechanisms or solid lids, bioseal rotors, safety centrifuge cups, safety blenders, safety sonicators.
- If aerosol production cannot be prevented or contained, respiratory protection may be required. [Contact EHS Lab Safety](mailto:ehs_labsafety@utk.edu) at ehs_labsafety@utk.edu to determine if the use of a respirator is appropriate.
- Vacuum line trap and filter systems are used to protect the vacuum system from aerosols.

Safe work practices for centrifugation of biohazards

- Wear appropriate personal protective equipment according to the lab's assigned biosafety level or documented risk assessment. If respiratory protection is indicated, special training and a medical evaluation may be required. Contact ehs_labsafety@utk.edu for more information.
- Routinely inspect centrifuge to ensure that leakage is not occurring.
- Do not overfill centrifuge tubes. Wipe the outside of the tubes with disinfectant after they are filled and sealed.
- Centrifugation may be performed in a centrifuge that is contained within a specially designed biological safety cabinet or other physical containment device.
- If a centrifuge containment device is not available, internal aerosol containment devices (e.g., sealed canisters, safety cups or buckets with covers, heat sealed tubes or sealed rotors, etc) may be indicated.
- Aerosol containment devices should be removed from the centrifuge and opened in a biological safety cabinet. If a biological safety cabinet is unavailable, a minimum of 10 minutes settling time should be allowed



Safe work practices for blending, sonicating, grinding, and lyophilizing of biohazards

- Operate blender, sonicator, and grinder in a biological safety cabinet if required for the biosafety level of the lab, or place a towel moistened with disinfectant over the top of blender, grinder, or sonicator.
- Segregate the sonication procedure to a specific area of the lab, keeping the sonication vessel covered to the extent possible
- Thoroughly disinfect the area when the process has been completed.
- Use safety blenders designed to prevent leakage.
- If leak-proof blender is not available, regularly inspect the bottom of the blender for leakage.
- Avoid glass blenders.
- Open equipment in a biosafety cabinet if required for the biosafety level of the lab. If not, allow aerosols to settle for at least 10 minutes before opening equipment.
- Filter lyophilizer vacuum pump exhaust through HEPA filters or vent into a biological safety cabinet.
- Autoclave or disinfect all equipment promptly after use.

Safe work practices for pipetting of biohazards

- Pipette all biohazardous materials in a biological safety cabinet if possible.
- Drain a pipette with tip against the inner wall of the receiving vessel. Never forcibly expel any hazardous material from a pipette.
- Place reusable pipettes horizontally in a pan filled with enough liquid disinfectant to completely cover them.
- Mouth pipetting is prohibited; mechanical pipetting devices must be used.

Other safety precautions

- Minimize air bubbles when filling a syringe. Place a pad moistened with disinfectant over the tip of the needle when expelling air. Perform work in a biological safety cabinet whenever possible.
- Use a shielded electric incinerator or hot bead sterilizer to sterilize inoculating loops. Disposable plastic loops and culture needles are good alternatives to open flames.
- If a spill occurs that may generate aerosols, follow the lab specific spill response plan. Ensure that all lab personnel are aware of the lab's spill response plan.
- Wear gloves when handling infectious materials, or infected animals.