Bio 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 septums, filling a syringe
- pouring liquids
- centrifugation steps such as filling centrifuge tubes, removing plugs or caps from tubes after centrifugation, removing supernatant, resuspending sedimented pellets, breakage of tubes during centrifugation, and centrifugation itself
- sonicating, homogenizing, blending, grinding, cell disruption with French press
- 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:

Use 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 worker from aerosols. Other safety devices include safety centrifuges with automatic locking mechanisms or solid lids, safety centrifuge cups, safety blenders, safety sonicators.
- If aerosol production cannot be prevented or contained, see the DEHS Respiratory Protection

Program to determine if 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**

- 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 whole 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) should be used.
- 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 before opening.

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

- Operate blender, sonicator, and grinder in a biological safety cabinet, or place a towel moistened with disinfectant over the top of blender, grinder, or sonicator.
- 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.
- Allow aerosols to settle for at least 5 minutes before opening blender.
- 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 are 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](http://www.dehs.umn.edu/PDFs/chemicalDecontaminate.pdf) to sterilize inoculating loops. Disposable plastic loops and culture needles are good alternatives to open flames.
- If a spill occurs that may generate aerosols, leave the area, close the door, wait 30-60 minutes to allow dissipation of aerosols. See [http://www.dehs.umn.edu/PDFs/chemicalDecontaminate.pdf](http://www.dehs.umn.edu/PDFs/chemicalDecontaminate.pdf) for spill cleanup.
- Wear gloves when handling infectious materials, or infected animals.
- For animal work follow CDC *Biosafety in Microbiological and Biomedical Laboratories* [animal biosafety guideline](http://www.dehs.umn.edu/PDFs/chemicalDecontaminate.pdf).