**Fact Sheet: Aerosol Production and Exposure Control**

Aerosols are liquid droplets or fine solid particles suspended in the air. Aerosols with a diameter of 5 microns or less can remain airborne for long periods of time, spread wide distances, and can be easily inhaled. Particles with a diameter larger than 5 microns tend to settle rapidly and can contaminate surfaces including the exterior of gloves, clothing, skin, bench tops, and ventilation systems.

**Examples of Aerosol-Producing Activities in the Lab:**

* pipetting
* cell sorting
* 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
* aspirating liquids
* centrifugation
* sonicating, homogenizing, blending, grinding, cell disruption with French press
* intranasal and gavage inoculation of animals
* cage cleaning, changing animal bedding
* harvesting infected material from animals, eggs, and other virology procedures
* necropsies of potentially infected animals
* biological spills

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

Using a combination of 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 (BSC) (Class I or II)](https://bohd.umn.edu/biological-safety-cabinets) 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, and safety sonicators with enclosure.
* If aerosol production cannot be prevented or contained, see the [Respiratory Protection website](https://dehs.umn.edu/respiratory-protection) to determine if use of respiratory protection is appropriate.
* A [vacuum line](https://bohd.umn.edu/vacuum-lines) trap and in-line HEPA filter must be used to protect the vacuum system from aerosols when a vacuum system is used to aspirate biohazardous material.

**Safe Work Practices for Centrifugation of Biohazards (Risk Group 2 or greater):**

* Routinely inspect centrifuges 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. Load centrifuge tubes in a biosafety cabinet (BSC) if it is available.
* Centrifugation should be done in a centrifuge that is contained within a BSC or other physical containment device.
* If a whole centrifuge containment device is not available, internal aerosol containment devices should be used (e.g., sealed canisters, safety cups or buckets with covers, or sealed rotors with O-ring, etc.).
* Aerosol containment devices should be removed from the centrifuge and opened in a BSC. If a BSC is not available, 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 biosafety cabinet, or place a towel moistened with disinfectant over the top of blender, grinder, or place sonicator in the sonicator enclosure if available and wait for at least 10 minutes before opening sonicator enclosure.
* 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 10 minutes before opening blender.
* Filter lyophilizer vacuum pump exhaust through HEPA filters or vent into a biosafety cabinet.
* Autoclave or disinfect all equipment promptly after use.

**Safe Work Practices for Pipetting of Biohazards:**

* Pipette all biohazardous materials in a biosafety 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 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 the vortex mixer in a BSC if possible when vortexing biohazardous materials. Ensure tubes are tightly sealed prior to mixing with a vortex mixer.
* 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](https://bohd.umn.edu/sites/bohd.umn.edu/files/fact_sheet_-_open_flame_alternatives_for_bsc.docx).
* If a spill occurs that may generate aerosols, leave the area, close the door, wait 30-60 minutes to allow dissipation of aerosols. See [Biological Spills](https://bohd.umn.edu/biological-spills) for more information.
* Wear appropriate personal protective equipment when handling potentially biohazardous materials or potentially infected animals.
* For animal work, follow guidelines in the CDC’s [Biosafety in Microbiological and Biomedical Laboratories](https://www.cdc.gov/labs/BMBL.html)