OCCUPATIONAL AND ENVIRONMENTAL HEALTH AND SAFETY
THE UNIVERSITY OF UTAH

FACT Sheet

Open Flames (Bunsen Burners) in Biosafety Cabinets

Early microbiologists had to rely on open flames to ensure sterility. However, with the advancement of modern technology, including the introduction of the biosafety cabinet, the use of an open flame is almost always no longer necessary and generate significant hazards. Therefore, open flames (Bunsen Burners) are **NOT ALLOWED** in Biological Safety Cabinets at the University of Utah.

Alternative options

- Use disposable sterile loops and sterile lab supplies. This eliminates the need to use open flames for sterilizing.

- Use a Bacti-Cinerator to sterilize loops and needles safely and conveniently while preventing infectious spatter and cross-contamination.

- An Electrical Bunsen Burner combines the efficiency of a gas burner with the safety and control of an electric heater. It is ideal for sterilizing inoculating needles and loops, and for heating small flasks, test tubes, and beakers.

- The Glass Bead Sterilizer provides a safe, effective, and convenient method for sterilizing small instruments without using flames, gases, or chemicals.

- Autoclave utensils and equipment prior to use. Place loops, spreaders, needles, forceps, scalpels and other tools in autoclavable plastic or wrap in autoclavable foil.

- If it is deemed absolutely necessary for the experiment being done, use a pilotless burner or touch-plate microburner (Touch-O-Matic) to provide a flame on demand.

The use of Bunsen burners inside of a biological safety cabinet is allowed recommended because it:

- Disrupts airflow, compromising the protection of the worker and the product. The Class II BSC maintains product protection through delivery of laminar flow (air volumes traveling in a single direction at a constant speed – without turbulence) down over the work area of the cabinet. The heating of air from the Bunsen burner causes up-flow of air that mixes with the down flowing airstreams to produce turbulence and recirculation within the working area. The notion of laminar flow may be completely destroyed and any aerosols generated beneath the burner may be carried to other parts of the cabinet, jeopardizing the product and personnel working within the cabinet.
- Causes excessive heat build-up within the cabinet. As most Class II BSCs recirculate the majority of the air within the cabinet, heat from the Bunsen burner builds up over time. The excessive heat can inactivate and degrade components in media such as vitamins, amino acids and growth factors, possibly below the threshold for finicky cell lines.
- May damage the HEPA filter or melt the adhesive holding the filter together, compromising the cabinet's integrity. An open flame has the capacity for melting the bonding agent that holds the HEPA filter media to its frame. This destroys the HEPA filters effectiveness, leading to loss of containment in the positive pressure plenum. ENV will charge $250 for decontamination of the cabinet, $250-$1000 for the filter, and $145 for recertification each time the HEPA filter needs to be replaced.
- Inactivates manufacturer's warranties on the cabinet. Biological safety cabinet manufactures are opposed to the practice and will assume no liability in the event of fire, explosion or worker exposure due to the use of a flammable gas in their cabinet.
- Automatically voids UL approval. Underwriters Laboratories Inc. (UL) is an OSHA approved independent product safety certification organization that develops standards and test procedures for products, materials, components, assemblies, tools and equipment, chiefly dealing with product safety. The use of a Bunsen burner in the cabinet will void UL approval of that piece of equipment.
- Presents a potential fire or explosion within the cabinet. The cabinets are not constructed to be explosion proof. If the flame was to go out, there was a leak, or the valve was not shut off completely, flammable gas would be introduced to the cabinet at a steady rate. In the case of a Class II A2, where 70% of the air in the BSC is recirculated, concentrations of the flammable gas could reach explosive potential and pose a serious risk to not only the cabinet, but to the user and the laboratory it is occupied in. Electrical components like the fan motor, lights, or electrical outlets could ignite a flash fire with a spark in this volatile environment. Manufacturers often post their cabinets with warning labels stating that flammable materials should not be used in the cabinet.

Quotes on Open Flames in BSCs:

NIH/CDC: National Institutes of Health and the Centers for Disease Control and Prevention (Appendix A of the BMBL): "Open flames are not required in the near microbe-free environment of a biological safety cabinet. On an open bench, flaming the neck of a culture vessel will create an upward air current which prevents microorganisms from falling into the tube or flask. An open flame in a BSC, however, creates turbulence which disrupts the pattern of HEPA-filtered air supplied to the work surface. When deemed absolutely necessary, touchplate microburners equipped with a pilot light to provide a flame on demand may be used. Internal cabinet air disturbance and heat buildup will be minimized. The burner must be turned off when work is completed. Small electric "furnaces" are available for decontaminating bacteriological loops and needles and are preferable to an open flame inside the BSC. Disposable or recyclable sterile loops can also be used."

WHO: World Health Organization's Laboratory Biosafety Manual: "Open flames should be avoided in the near microbe-free environment created inside the BSC. They disrupt the airflow patterns and can be dangerous when volatile, flammable substances are also used. To sterilize bacteriological loops, micro-burners or electric "furnaces" are available and are preferable to open flames."