



Use of Natural Gas in Biological Safety Cabinets

Overview:

Biological safety cabinets (BSCs) are designed to protect personnel, their products, and their environment. Most BSCs at the University of Kentucky are recirculating. The use of natural gas or other flammable gases within a BSC presents several potential safety hazards:

- Use of natural gas, or other flammable gases, presents a potential fire and/or explosion hazard. Most BSCs at the University of Kentucky are recirculating cabinets, which may allow for flammable gases to quickly accumulate. Uncontrolled gas flow from a gas leak or petcock left open can lead to a potentially explosive atmosphere.
- The high efficiency particulate air (HEPA) filters—responsible for providing the sterile environment in the cabinet—can act as a mass of combustible material during an uncontrolled fire inside the cabinet. The heat generated by a Bunsen burner can also damage the HEPA filter and/or the filter's adhesive. This could result in leaks in the filter, adverse flow patterns in the cabinet, and ultimately potential user exposure.
- The heat generated by an open flame compromises the carefully controlled airflow pattern responsible for providing containment of potentially biohazardous materials. Normal airflow in the cabinet is direction from the top down across the working surface. The addition of a Bunsen burner will produce turbulent airflow due to the heated air rising counter-current to the normal downward flow. This may result in spread of contamination within the cabinet and potential user exposure.

The misuse of natural gas or other flammable gases within a BSC can result in...



This document outlines the requirements for preventing flammable gas explosions in BSCs here at the University of Kentucky.

Applicability:

- Investigators using biological safety cabinets that meets the following requirements:
 - BSC recirculates air
 - BSC is connected to natural gas OR
 - BSC is used with other flammable liquids and/or gases
- Building and/or Project Managers who facilitate the installation of new BSCs

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Requirements



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- If you must use flammable liquids within a BSC, first contact the Department of Biological Safety. Always be aware of possible ignition sources (i.e. electrical equipment). Always use the smallest quantity of flammable liquid possible. Place flammable liquids in a metal or glass container, and proceed with extreme caution.
- If using an alternative flame/heat source, small bottled gas or gas cylinders should be used as the fuel supply for the burner to limit the supply of fuel. Plumbed gas provides an inexhaustible source of fuel.
- Plumbed gas may be used if the following design criteria and operator procedures are implemented:
 - The plumbed natural gas line **must have a shutoff valve outside the cabinet**. An **automatic burner** with a foot switch or hand switch to operate the flame must be used.
 - **Excess flow check valves or flow limit valves designed to shut off gas flow if a pre-set limit is exceeded should be installed**. These devices could prevent the flow of flammable or toxic gases into an area when other conditions have resulted in failure of point-of-use control systems. Use of these valves must be considered early in the design of the piping system.
 - Regardless of gas source, **users must be trained** to visually inspect the gas petcock or valve and check for the odor of gas before turning on the BSC blowers. The **burner should only be used in the rear of the cabinet** to minimize the effects of air turbulence. At the end of burner operation, the user must turn the gas petcock or valve off and check for the smell of gas.
 - **The BSC should be ducted to an exhaust system with an explosion-proof roof exhaust fan.**
 - Butyl rubber hose should be used to connect the burner to the fuel supply. ***Use of yellow natural rubber or latex tubing is specifically prohibited.***

The following is **not permitted** within a BSC:

Bunsen Burners



Alcohol Burners



Recirculating BSCs



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Many BSCs on the University of Kentucky campus are recirculating BSCs, designed to contain, not exhaust, most of the air within the cabinet. This feature makes recirculating BSCs prone to accumulating materials within the cabinet. The following 4 types of BSCs are the most common:

BSC Type	Former Name(s)	% Recirculated Air
Class II Type A1	Class II Type A	70
Class II Type A2	Class II Type A/B3	70
Class II Type B1	N/A	30
Class II Type B2	N/A	0

To determine the type of cabinet, locate the unique serial number on the cabinet. This area should also contain the BSC type. If unable to locate this information, contact the Department of Biological Safety for further assistance.

If a gas leak occurs (i.e. a valve is left on or a tube leaks) inside a recirculating BSC, over time the gas would become more and more concentrated and could reach explosive levels. Since the gas is within a BSC, the user may not be able to detect the leak and, upon ignition, could explode.

Following proper working procedures within a BSC maintains a sterile environment within the BSC. According to the National Institutes of Health and the Centers for Disease Control & Prevention, "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 supply to the work surface." [Appendix A: BSC Use by the Investigator: Work Practices and Procedures, CDC Biosafety in Microbiological and Biomedical Laboratories, 5th Edition.](#)

If you feel that your work requires the use of an open flame within a BSC with no suitable alternative, please contact the Department of Biological Safety.