

## Are open flames in laboratories necessary?

Open flames have been used for many types of work and experimental procedures. Depending on your laboratory work, there may be alternatives to open flames that minimize the risks. As a best practice, we discourage the use of open flames in laboratories and instead encourage using alternative methods that do not require open flames. When work with open flames cannot be avoided, follow safe practices.

### ➤ Open flame risks

- Using open flames near flammable solvents or other combustible materials may cause flash fires, explosion, rapid spread of fire, and generate toxic combustion products. See **Ethanol/Improper Sterilization, Fire Risk Lessons Learned:** <https://ehs.stanford.edu/reference/ethanol-improper-sterilization-fire-risk-lessons-learned>
- Faulty or leaking Bunsen burners or hoses can cause highly flammable gas to escape
- Open flames in biological safety cabinets creates turbulence that disrupts the pattern of HEPA-filtered air being supplied to the work surface, contaminating your work

### ➤ Laboratory work with recommended open flame alternatives

**No open flames needed and less environmental impact compared to natural gas usage**

Laboratory Work	Alternatives	Pros	Cons
Sterilization	<a href="#">Autoclave</a>	<ul style="list-style-type: none"> <li>- Rapidly microbicidal</li> <li>- Penetrates medical packing</li> <li>- Rapid cycle time</li> </ul>	<ul style="list-style-type: none"> <li>- Deleterious for heat-sensitive instruments</li> <li>- Microsurgical instruments may be damaged by repeated exposure</li> <li>- May leave instruments wet, causing them to rust</li> <li>- Potential for burns</li> </ul>
	<a href="#">Sterile disposables</a>	<ul style="list-style-type: none"> <li>- Pre-sterilized and designed for single use</li> <li>- No risk of cross contamination and no need for flaming</li> </ul>	<ul style="list-style-type: none"> <li>- Creates waste</li> </ul>
	<a href="#">Glass bead sterilizer</a>	<ul style="list-style-type: none"> <li>- Ideal for sterilizing surgical instruments with dry heat using glass beads at 233°C</li> <li>- Can sterilize submerged portion of surgical instrument in 15 seconds</li> <li>- Replacement glass beads can be purchased separately</li> <li>- No gas line or open flame needed</li> </ul>	<ul style="list-style-type: none"> <li>- Only sterilizes surgical instruments</li> </ul>

Laboratory Work	Alternatives	Pros	Cons
Yeast or bacterial colony work	<a href="#">Disposable spreaders/pickers/loops</a>	- No heat/flame sterilization needed	- Creates waste
	<a href="#">Bacti-cinerator</a>	- Sterilizes loops and needles by infrared heat - Heat is contained in deep ceramic tube to protect laboratory personnel - Completes sterilization in 5-7 seconds at 1500°F (815°C)	- Types of items able to be sterilized are limited
	<a href="#">Autoclavable reusables</a>	- Reusable items reduce waste - One-time purchase	- Microsurgical instruments can be damaged by repeated autoclaving - Autoclave may leave instruments wet, causing them to rust - Higher risk of cross contamination
Drawing/pulling pipettes	<a href="#">Pre-pulled glass pipettes</a>	- Less physical work - Less risk of glass injury - More consistency with pulled pipettes	- May be more expensive than making your own
Histology	<a href="#">Slide-warming tray</a>	- Provides even heat transfer - Able to warm up multiple slides - Precise temperature control	- Slide-warming tray costs \$400-\$500
	Alternative stains or methods	- Can obtain better results without heat (no shrinkage, etc.) - May require more research to find	- Alternative stains costs may vary - Alternative stain chemicals may be more hazardous (e.g. methanol) - Slides take more time to air-dry without heat
Drying glassware for water-sensitive chemistry	Oven overnight followed by cooling in a dessicator	- Less risk of injury or equipment damage	- Takes more time to dry
Heating flasks, beakers, crucibles, etc.	Hot plates	- Can heat larger items - Some hot plates have magnetic stir function with heating	- Older models of hot plates can cause runaway heating and fires

Laboratory Work	Alternatives	Pros	Cons
Heating smaller flasks, test tubes, smaller beakers, crucibles, etc.	<a href="#">Electric Bunsen burner</a>	<ul style="list-style-type: none"> <li>- Vented housing keeps base cool enough to hold during operation</li> <li>- Burner consumes only 400W of power</li> <li>- No gas line or open flame needed</li> </ul>	- Items able to be heated are limited by size

➤ **If the use of open flame is unavoidable**

- Have an SOP in place to ensure equipment or gas is shut off between uses
- Have an emergency shut-off valve that is accessible to the user
- If possible, use equipment that has a dimmer switch
- Follow safe practices
- **Contact EH&S for an evaluation.**

➤ **Open flame laboratory work with alternative equipment**

Laboratory Work	Alternatives	Pros of Alternative	Cons of Alternative
Removing bubbles in agar	<a href="#">Portable flame sterilizer</a>	<ul style="list-style-type: none"> <li>- Portable, handheld, battery-free</li> <li>- Immediate ignition independent of any power source or battery</li> <li>- Various gas cartridge adapters for gas connections and cartridges</li> <li>- Size and temperature of flame can easily be adjusted by an air and gas regulator</li> </ul>	- Gas cartridges create waste

References:

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