



Environmental Analysis Program

Pomona College
Biogeochemistry Laboratory

SOP-L113

Laminar Flow Cabinet Operation

Standard Operating Procedure

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1. Purpose

This procedure describes the operation, decontamination, and maintenance of the ESCO laminar flow cabinet (clean bench) used in the EA Program laboratory. The cabinet provides an ISO Class 5 (Class 100) particle-free work environment by passing HEPA-filtered air across the work surface in a unidirectional (laminar) flow pattern. It is used for aseptic work that requires protection of the *sample or product* from airborne contamination, including eDNA extraction setup, PCR master mix preparation, sterile media preparation, and filter handling for microplastics analysis.

! Important

A laminar flow cabinet (clean bench) protects the **work** from contamination. It does **not** protect the **operator** from hazardous aerosols, pathogens, or chemical vapors. For work involving biohazardous materials (BSL-2 organisms, human pathogens), a biological safety cabinet (BSC, Class II) is required. The EA Program does not currently work with BSL-2 materials, but if the scope changes, consult the PI and campus biosafety officer.

2. Scope

- **Applies to:** All use of the ESCO laminar flow cabinet in SGM 134, including eDNA and PCR work, sterile reagent preparation, and microplastics filter handling
- **Does not apply to:** Fume hoods (for chemical vapor protection); biological safety cabinets (BSC, Class II); field work
- **Location:** SGM 134

3. Definitions

- **Biosafety cabinet (BSC):** A ventilated enclosure that protects both the user and the environment from aerosols; classified as Class I, II, or III depending on the level of protection. Not the same as a laminar flow cabinet.
- **HEPA filter (High-Efficiency Particulate Air):** A filter rated to remove at least 99.97% of particles 0.3 μm or larger; used in laminar flow cabinets to produce particle-free air over the work surface.
- **Horizontal laminar flow cabinet:** A clean bench in which HEPA- filtered air flows horizontally from the back of the cabinet toward the user; protects samples from particles but does not protect the user from aerosols (not suitable for hazardous biological agents).
- **Laminar flow:** Smooth, parallel flow of air in one direction at uniform velocity; prevents turbulence that would re-introduce particles to the work surface.
- **UV germicidal lamp:** A short-wave ultraviolet lamp installed in some cabinets to reduce surface contamination between work sessions; effective only on exposed surfaces; never operate with personnel present.
- **Vertical laminar flow cabinet:** A clean bench in which HEPA- filtered air flows downward from the top onto the work surface; the standard configuration in the EA Program lab.

4. Responsibilities

Role	Responsibility
Lab PI	Approve SOP, schedule HEPA filter replacement
Lab Manager	Coordinate annual certification, maintain UV lamp log
Trained Personnel	Operate the cabinet per this SOP
New Students	Complete training before independent use

5. Safety and Hazards

Hazards

- **UV radiation:** The cabinet may include a UV germicidal lamp for surface decontamination. UV-C (254 nm) causes skin burns and eye damage. Never operate the UV lamp while hands or face are inside the cabinet. The UV lamp must be off and the sash open before working.
- **Electrical:** The cabinet uses high-voltage blower motors. Do not modify electrical components.
- **Chemical:** If using ethanol or bleach for surface decontamination, follow standard chemical safety precautions.

5.1. Required PPE

- ☐ Nitrile gloves
- ☐ Lab coat (clean; lint-free preferred for molecular work)
- ☐ Safety glasses (if UV lamp has been recently active, as a precaution during the transition)

6. Equipment and Materials

Item	Notes
ESCO laminar flow cabinet	SGM 134; horizontal or vertical flow
70% ethanol spray bottle	For surface decontamination
10% bleach solution (for eDNA work)	Destroys residual DNA on surfaces
Lint-free wipes (Kimtech or equivalent)	For wiping surfaces
UV germicidal lamp (if installed)	Built into cabinet; timer-controlled or manual

7. Procedure

7.1. Startup

1. Ensure the UV lamp is off
2. Raise or open the sash to the working position
3. Turn on the blower fan and allow it to run for at least 15 minutes before beginning work. This purges the cabinet interior and establishes stable laminar flow.
4. While the cabinet purges, wipe down the entire work surface, side walls, and interior of the sash with 70% ethanol using lint-free wipes. For eDNA work, follow the ethanol wipe with a 10% bleach wipe, then a final ethanol wipe to remove bleach residue.
5. Place only the materials needed for the immediate task inside the cabinet. Minimize clutter; objects block airflow and create turbulence.

 Tip

Arrange items so that clean (sterile) materials are upstream (closer to the HEPA filter) and used/contaminated items are downstream (closer to the operator). This prevents contaminated air from passing over clean surfaces.

7.2. Working in the Cabinet

1. Wear clean nitrile gloves; spray gloves with 70% ethanol before reaching into the cabinet
2. Work at least 10 cm from the front edge to stay within the laminar flow zone
3. Move slowly and deliberately; rapid arm movements disrupt laminar flow and pull room air into the work zone
4. Do not block the air intake grilles (front and/or rear) with equipment, paper, or notebooks
5. Do not use open flames (Bunsen burners) inside a laminar flow cabinet; they disrupt airflow and can damage the HEPA filter
6. Keep the cabinet running continuously while working; do not turn the blower off between tasks during a session

7.3. Shutdown

1. Remove all materials from the cabinet
2. Wipe the work surface with 70% ethanol (and bleach for eDNA work)
3. Lower the sash if applicable
4. Optionally, turn on the UV lamp for 15–30 minutes for surface decontamination. Ensure no personnel are exposed to UV light during this period. Post a “UV Lamp Active” sign.
5. After UV exposure, turn off the UV lamp
6. Turn off the blower (or leave it running on low if lab policy requires continuous operation to maintain cabinet cleanliness)

7.4. UV Lamp Use

1. The UV lamp is a supplemental decontamination tool, not a substitute for chemical wipe-down
2. Run the UV lamp for 15–30 minutes after each use session
3. Record UV lamp use in the UV lamp log (posted on the cabinet). UV lamps lose efficacy over time; replace after the manufacturer’s recommended hours (typically 5,000–8,000 hours).
4. Do not rely solely on UV decontamination for eDNA work; chemical wipe-down with bleach is more effective at destroying DNA.

8. Maintenance

Task	Frequency
Wipe interior with 70% ethanol	Before and after each use

Task	Frequency
Bleach wipe (eDNA/PCR work)	Before and after each use
Check blower operation and airflow	Monthly (hold a tissue at the intake to confirm airflow direction)
Replace pre-filter (if present)	Every 6 months or when visibly dirty
HEPA filter certification (by qualified technician)	Annually
Replace UV lamp	Per manufacturer hours or when annual certification shows reduced germicidal output

9. Quality Control

- Annual HEPA filter certification must confirm that the cabinet meets ISO Class 5 (less than 100 particles per ft³ at 0.5 μ m). If it fails, the cabinet must not be used for aseptic work until the filter is replaced and the cabinet re-certified.
- For eDNA/PCR work: periodically swab the work surface and run a PCR negative control to verify that the decontamination procedure is effective
- Log all UV lamp hours to track lamp aging

10. Waste Disposal

Waste Type	Disposal Method
Used wipes (ethanol/bleach)	Standard trash
Used gloves	Standard trash
Spent HEPA or pre-filters	Standard trash (non-hazardous unless contaminated with biohazardous material)
Spent UV lamp	Mercury-containing waste; coordinate with campus EH&S for recycling

11. References

- ESCO Corporation. *Laminar Flow Cabinet User Manual*. (Consult for model-specific instructions.)
- NSF/ANSI 49. *Biosafety Cabinetry: Design, Construction, Performance, and Field Certification*. (Reference standard for BSCs; laminar flow cabinets are distinct but share some maintenance practices.)

12. Related SOPs

SOP	Title	Relationship
L002	Laboratory Safety	General safety framework
L700	DNA Extraction	eDNA work requiring clean bench
L703	PCR and Gel Electrophoresis	PCR master mix preparation
L308	Microplastics in Water	Filter handling under clean air

13. Training Record

Before operating the laminar flow cabinet independently, personnel must:

1. Read this SOP in full
2. Demonstrate proper startup, surface decontamination, and shutdown
3. Demonstrate correct working technique (arm position, airflow awareness, material arrangement)
4. For eDNA/PCR users: demonstrate the bleach decontamination protocol
5. Be signed off by the PI or lab manager