Biosafety Cabinet Program

Promoting Safety and Compliance in Hazardous Material Handling

A look at the requirements, features, certification, levels of containment, safe work practices and procedures for biosafety cabinets and laminar flow hoods.

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BIOSAFETY CABINET PROGRAM

This document establishes the framework for the Environmental Health and Safety department (EHS) at California State Polytechnic University, Pomona, to implement and maintain a comprehensive Biosafety Cabinet Program. This program ensures the certification, inspection, maintenance, and safe relocation of Biosafety Cabinets (BSCs) under federal guidelines issued by the Centers for Disease Control and Prevention (CDC), National Institutes of Health (NIH), and the U.S. Department of Health and Human Services (HHS), as well as state and local regulations, including those set forth by Cal/OSHA, California Department of Public Health (CDPH), and the Los Angeles County Department of Public Health.

CLASSIFICATIONS

Biological Safety Cabinets (BSCs) serve as essential primary containment devices designed to minimize exposure to biohazardous or infectious agents and prevent contamination of the surrounding environment. While BSCs provide a controlled workspace by enclosing the area where tasks are performed, their effectiveness can be compromised by user errors or improper maintenance, occasionally allowing aerosols to escape.

BSCs are categorized into three primary classes: **Class I**, **Class II** (which includes subtypes A and B), and **Class III**. These classes support work with biohazardous materials within Biosafety Levels (BSL) 1 to 3. For work conducted at BSL 4, a Class III BSC is required to ensure the highest level of containment and safety.

Below is a brief overview of the types of BSCs available for laboratory use. For detailed guidelines on selecting the appropriate BSC, refer to Appendix A. Additional information regarding proper usage and maintenance can be found on the following resources.:

- Centers for Disease Control and Prevention (CDC):
  - Biosafety in Microbiological and Biomedical Laboratories (BMBL)
  - Biosafety Cabinet Checklist

Class I

Class I Biological Safety Cabinets are designed to protect the user and the environment by containing hazardous aerosols and particles through inward airflow. However, they do not provide protection for the product or experiment being conducted. These cabinets are often used for procedures that generate aerosols, such as operating sonicators, shielded centrifuges, blenders, and mixers, provided that the level of protection meets the procedural requirements. As partial containment units, they rely on inward airflow to prevent exposure to aerosols. Sudden movements, such as the rapid withdrawal of hands, can disrupt the airflow and increase the risk of aerosol exposure.

Class II

Class II Biological Safety Cabinets are front-opening containment devices with inward airflow designed to protect personnel, the environment, and the integrity of the work being conducted. These cabinets are categorized into two main types, A and B, which differ based on:

- The vertical dimensions of the front opening.
- The proportion of air recirculated versus exhausted.
- The velocity of inflowing air.
- The method of exhaust discharge.
- Whether the contaminated air plenums operate under positive or negative pressure.

Type A Cabinets:

Class II, Type A BSCs are suitable for work with Biosafety Level (BSL) 1 to 3 agents, provided no volatile or toxic chemicals or radionuclides are used. They recirculate approximately 70% of the

filtered air within the cabinet, which limits their use to non-hazardous materials.

Type B Cabinets:

Class II, Type B BSCs are designed for use with toxic chemicals and radionuclides in specific applications. They are categorized into two subtypes:

- **Type B1:** Recirculates a portion of the air but exhausts contaminated air directly. Suitable for limited use of toxic chemicals and radionuclides.
- **Type B2:** Operates as a 100% exhaust cabinet with no air recirculation, making it suitable for work involving volatile toxic chemicals and radionuclides.

Class III

Class III Biological Safety Cabinets provide the highest level of protection for personnel, the environment, and the experiment. These fully enclosed, ventilated cabinets allow for secure manipulation of materials using attached gloves, ensuring maximum containment. The cabinet operates under negative pressure to maintain a physical barrier against the release of hazardous materials.

While Class III BSCs are highly secure, their effectiveness can be compromised by glove punctures or improper handling of hazardous materials. The use of flammable gases or highly volatile substances may be permitted if the unit and exhaust system are specifically designed and approved for such applications, following appropriate safety standards.

Laminar Flow Hoods

Laminar flow hoods, often referred to as clean benches, differ fundamentally from Biological Safety Cabinets. These devices discharge HEPA-filtered air across the work surface and directly toward the user, providing product protection but offering no protection to the user or the environment.

Laminar flow hoods are best suited for tasks requiring a dust-free environment, such as assembling electronics or sterile equipment. They should **NEVER** be used when handling infectious agents or cell cultures, as they do not prevent contamination or exposure to hazardous materials.

CERTIFICATION

Biosafety cabinet (BSC) certification must comply with **Cal/OSHA** standards and is mandatory on an annual basis. Certification must be performed by qualified and certified technicians, such as those accredited through NSF or equivalent programs. Records of certification should be retained according to institutional policies or state law, which may require retention for up to five years.

In addition to California-specific mandates, all manufacturers and **NSF** standards recommend field certification to ensure proper cabinet performance. Federal agencies such as the **CDC** and **NIH** emphasize the importance of regularly testing and certifying Class I and II biosafety cabinets to maintain safety. NIH-funded grants explicitly require compliance with these certification standards.

Proper maintenance, including regular certification, aligns with the **OSHA General Duty Clause**, which mandates that employers provide a workplace free of recognized hazards. This includes ensuring that BSCs operate safely and effectively to protect personnel and the environment.

Inspection and Certification Schedule

To ensure that Biological Safety Cabinets function properly and meet safety standards, they must be inspected and certified under the following circumstances:

- **Upon Initial Installation:** Certification is required immediately after a new BSC is installed to verify its functionality and compliance with safety standards.
- **After Component Replacement:** Certification is mandatory after replacing critical components, such as HEPA filters or motors, to confirm the integrity of airflow and containment.
- **After Relocation:** Any relocation, even within the same room, requires recertification to ensure proper operation in the new environment.
- **Annually:** Annual certification is required under Cal/OSHA standards and NSF/ANSI 49 guidelines to maintain operational compliance and ensure continued protection of personnel, the environment, and experiments.

These inspections and certifications must be conducted by a trained and certified technician in accordance with California regulations. Certification records must be documented and retained as part of the institution's quality assurance program for a minimum of five years.

SCHEDULING

The respective department and/or college is responsible for contracting the services of an authorized certification company, preparing an annual certification schedule, and forwarding the schedule to lab managers and Principal Investigators (PI) as well as maintaining copies for inspection purposes. A copy shall be sent to the Biosafety Officer in Environmental Health and Safety.

PREPARATION

Lab managers and PIs are responsible for preparing the biosafety cabinets/laminar flow hood for certification and providing access to the area according to the certification schedule. Before the certifying technician can begin testing the cabinet, the following tasks must be completed:

- Remove all materials and equipment from the cabinet
- Decontaminate the cabinet work surface, interior walls, and grill

COSTS

The department and/or college assume the responsibility for the annual certification cost for biosafety cabinets/laminar flow hoods. Individual departments are responsible for any costs associated with replacement parts or any other corrective actions required to bring the cabinet/hood up to standard. Departments are also responsible for certification costs resulting from relocating cabinets, replacement of filters or any other repairs/maintenance operations requiring recertification beyond the annual scheduled certification.
*Note that departments and/or colleges may choose to charge these services to the PI's research grants if applicable.

CERTIFICATES

The The certification contractor is responsible for posting certification labels on the outside of each cabinet after completing the certification process. These labels must indicate the certification date, expiration date, and certifier details. The contractor shall also provide written certification reports to the department and/or college within a reasonable timeframe (e.g., within three business days of certification).

The department and/or college is responsible for maintaining certification reports on file for a minimum of **five years** in compliance with **Cal/OSHA Title 8, Section 5154.2**. A copy of the certification report must be sent to the Biosafety Officer in Environmental Health and Safety within 15 days of certification, as per institutional policy.

INSPECTIONS

Biosafety cabinets and laminar flow hoods are inspected during lab safety inspections to assure certification documents are posted and current. BSCs must be clearly labeled with the class and type, the date of the last performance test, the name of the person performing the test, the company name, and a certification of performance. All personnel working with BSCs shall be appropriately trained in the use of the cabinets to assure proper handling. Departments are responsible for performing routine safety inspections (Department Safety Coordinator Inspections) which shall also include looking at BSCs for obvious violations, signs of malfunction, needs for repair etc.

ASSISTANCE

To schedule repairs/maintenance, the lab manager /PI shall contact the respective department and/or college. The department and/or college are responsible for obtaining and submitting quotes of the required work for approval. Certain repairs/maintenance will require recertification of the equipment.

EMERGENCY PREPAREDNESS

To address potential emergencies such as chemical spills, biological leaks, or radiological contamination, biosafety cabinet users must follow emergency protocols outlined by the Los Angeles County Office of Emergency Management. In the event of an earthquake, ensure the biosafety cabinet remains secured to minimize damage. For immediate spills, follow the Cal Poly Pomona EHS spill response guide in the campus Chemical Hygiene Plan, and report incidents to EHS within 24 hours.

INSTALLATION, RELOCATION, OR REMOVAL

Prior to relocating or removing a biosafety cabinet, the Principal Investigator must obtain written approval from Cal Poly Pomona's EHS department. The cabinet must be decontaminated using protocols that are compliant with Cal/OSHA regulations and verified for safe handling. Guidelines for transporting hazardous equipment must be followed, including securing the unit to prevent spills during transport.

BIOSAFETY CABINET SAFE WORK PRACTICES

- The BSC shall always be on while in use.
- Prior to operation, users must inspect the biosafety cabinet for visible signs of damage or malfunction, as required by Cal/OSHA regulations. If damage is observed, work must be halted, and the issue reported to the EHS department for resolution. Ensure the California Department of Pesticide Regulation approves all disinfectants used.
- Always keep the UV light off when in use, as it can cause eye and skin damage.
- Place all necessary items inside the cabinet before beginning work. The interior of the cabinet must remain free of clutter to prevent any obstruction to the airflow.
- A small waste container shall be placed inside for any disposable materials.
- No materials shall be placed on the air-intake valves to avoid impeding the airflow.
- While working inside the BSC, always wear lab coats and gloves
- Try to limit arm motions and quick, rapid movements inside the cabinet. These motions may cause a disturbance in the air flow pattern letting aerosols escape and causing possible exposure.
- Do not use a Bunsen burner inside the BSC as this will interfere with the air flow inside the BSC. If a procedure calls for a flame, use a burner with a pilot light and place it to the rear of the workspace where any air turbulence will have a minimal effect.
- Do not place large objects such as a centrifuge inside the BSC. It may impede the airflow.
- If an accident occurs during a procedure, immediately clean the area with the appropriate

disinfectant solution and dispose of the used clean-up materials properly. Leave the BSC on during this time to minimize exposure to aerosols.

- It is important to remember that a BSC is not the same as a chemical fume hood and shall not be used for both purposes.
- Once the work is completed, secure waste containers and organize the materials used.
- Allow the cabinet to operate for five more minutes to finish purging the air inside.
- Remove all materials from inside the cabinet, decontaminate the work surface, and turn on the UV light.
- When cleaning/decontaminating the BSC, the work surface, interior walls, and the interior surface of the window shall be wiped with 70% ethanol
- Apply proper sterilization/disinfection techniques. The UV light does provide for some sterilization of the environment when work is finished, but it shall not be used alone to assume that sterilization is complete.
- When not in use the BSC shall not be used for storage of materials.

WASTE MANAGEMENT

HEPA filters are used in biosafety cabinets, laminar flow hoods, and other air-handling equipment to provide clean work environments. When a HEPA filter is changed, proper disposal of the used filter is always a concern.

HEPA filters used in biosafety cabinets must be disposed of following Los Angeles County Department of Public Health guidelines and California's Universal Waste Rule. Biological filters decontaminated with formaldehyde gas should be double-bagged, labeled as 'decontaminated biological waste,' and disposed of per CalEPA Hazardous Waste Control Law. For HEPA filters exposed to chemo drugs or radioactive materials, consult Cal Poly Pomona's EHS department for proper disposal protocols following Los Angeles County hazardous waste regulations.

BIOLOGICAL

HEPA filters used for biohazard work are considered to be contaminated with whatever biological agents are used in the biosafety cabinet. OSHA Blood-borne Pathogen Standard states that equipment, which may be contaminated with blood or other potentially infectious materials shall be decontaminated as necessary. Formaldehyde gas contamination is the commonly accepted method for neutralizing biological hazards in a Class II biosafety cabinet.

Most HEPA filters that have been decontaminated with formaldehyde are viewed as non-hazardous and are disposed of as non-regulated waste. Some biological agents are resistant to formaldehyde treatment and may need special handling.

CHEMICAL

HEPA filters used in biological safety cabinets for the preparation of chemotherapy (anti-tumor) drugs pose a significant chemical hazard. Chemotherapy drugs are associated with hazardous characteristics such as genotoxicity, carcinogenicity, teratogenicity, and toxic manifestations. These

drugs can pose both acute and chronic occupational exposure risks. Guidance on handling hazardous drugs is available in the OSHA Technical Manual, Section VI, Chapter 2, which provides recommendations but is not legally binding.

When a HEPA filter is replaced in a biosafety cabinet used for chemotherapy drug preparation, the used filter is classified as hazardous drug waste. It must be carefully bagged in plastic, appropriately labeled, and disposed of as solid hazardous drug waste. The disposal process is regulated by the EPA, as well as state and local waste laws, depending on the specific drugs involved. For proper disposal procedures, consult your institution's Environmental Health & Safety (EH&S) department.

RADIOACTIVE

Radioactive solutions used in biosafety cabinets may release vapors that could pose a radiation hazard if they contain volatile radioactive isotopes. Beta and gamma radiation hazards are primarily associated with the isotopes present in the solutions. Since HEPA filters do not provide protection against vapors, radioactive vapors can exit the biosafety cabinet through the ventilation system if the system is not equipped to handle them. Properly designed exhaust systems with appropriate filters or scrubbers are required to mitigate this risk.

Prior to accessing or changing a HEPA filter, Environmental Health and Safety must be notified to allow the Radiation Safety Officer (RSO) to assess and document that the biosafety cabinet is free of radioactive contamination. If radioactive contamination is detected, the RSO will guide the decontamination process.

HEPA filters exposed to radioactive materials are typically treated as radioactive waste and disposed of according to federal and state regulations. If no radioactive contamination is present, the filter may be managed as biological or chemical waste, provided no hazardous materials are detected. The RSO will determine and advise on the proper procedures for handling and disposing of the filter.

TRAINING REQUIREMENTS

Lab managers and Principal Investigators are responsible for ensuring all lab personnel complete mandatory annual training as specified by Cal/OSHA and the Los Angeles County Department of Public Health. Training must cover proper handling of biological, chemical, and radiological materials, decontamination procedures, and emergency response protocols. Training records must be retained for five years for audit purposes.

APPENDIX

A. BIOSAFETY CABINETS GUIDELINE TABLES

Table 1 Selection of a Safety Cabinet through Risk Assessment

Biological Risk Assessed	Protection Provided			BSC Class
	Personal	Product	Environmental	
BSL 1-3	Yes	No	Yes	**I**
BSL 1-3	Yes	Yes	Yes	**II (A1, A2, B1, B2)**
BSL - 4	**Yes**	**Yes**	**Yes**	**III** **II- *with suit***

**Los Angeles County-specific restrictions: Cal Poly Pomona does not support Biosafety Levels 3 and 4 (BSL 3–4).*

Table 2 Comparison of Biosafety Cabinet Characteristics

BSC Class	Face Velocity *(lfpm)*≠	Airflow Pattern	Applications	
			Nonvolatile, Toxic Chemicals, Radionuclides	Volatile Toxic, Chemicals, Radionuclides[1]
I	75	In front, through HEPA to outside, or into room through HEPA	Yes	**Yes^**
II, A1	75	70% recirculated to cabinet work area through HEPA; 30% balance can be exhausted through HEPA back into room or outside through canopy.	Yes*	**No**
II, A2	100	30% recirculated, 70% exhausted. Exhaust cabinet air must pass through dedicated duct to outside through HEPA.	Yes	**Yes***
II, B1	100	No recirculation; total exhaust to outside through HEPA.	Yes	**Yes***
II, B2	100	Similar to II, A2. 100 *lfpm*≠ intake air velocity and plenums are under negative pressure to room; exhaust air can be ducted outside through canopy.	Yes	**Yes*^**

III	N/A	Supply air is HEPA filtered. Exhaust passes through two HEPA filters in series and exhausted to outside via a hard connection.	Yes	**Yes***

*** Only small or minute amounts.**

^ When exhausted to outdoors.

≠ Linear Feet Per Minute (lfpm)

1. ***Installation may require a special duct to the outside, an in-line charcoal filter, and a spark-proof (explosion-proof) motor and other electrical components in the cabinet. Discharge of a Class I or Class II, Type A2 cabinet into a room shall not occur if volatile chemicals are used.***
2. ***In no instance shall the chemical concentration approach the lower explosion limits (LEL) of any compound being used.***

[1]*Use of volatile toxic chemicals requires adherence to SCAQMD regulations and approval from the EHS department.*