Beryllium Workstation (BWS) Procedures Manual

Reference documentation: LLEINST 6706: Beryllium Safety Procedures

ESCO Labculture Class II, Type A2
Biosafety Cabinet User and Service Manual

LABCONCO Purifier® HEPA-Filtered Enclosures and
Purifier® Class I Filtered Enclosures
Users Manual

Preventive Maintenance Database (PMDB) items included in this document:

67.32.01.001	Annual Recertification of BWS	Section 4.b
67.32.01.003	Monthly Cleaning of BWS	Section 4.b

LLE RELEASED DATE: 02 AUGUST 2018

Contents

(1) Introduction

This document defines procedures and protocols and delegates responsibilities for operation and maintenance of beryllium workstations (BWS) deployed within the Omega Laser Facility and related support areas within LLE. These workstations are self-contained units with either ultra-low penetration air filters (ULPA) or high efficiency particulate air (HEPA) filters that function to both minimize the spread of beryllium particulates and prevent worker exposure during operations where decontamination, processing, and disposal of beryllium, beryllium-containing, or beryllium-contaminated articles occurs.

(2) BWS equipment nomenclature and locations

LLE employs commercially available biological safety cabinets as BWS units within the facility. These units have some inherent design properties that make them ideal for this application:

- ULPA- or HEPA -filtration with recirculation and front-surface airflow design to insure that all hazardous particulates will remain within the workstation at all times
- stainless steel inner work surfaces with radiused corners to facilitate easy decontamination and cleaning
- a moveable front sash to control both access to and airflow within the workstation
- various controls, monitors, and alarms to insure that the workstation is operating properly and efficiently at all times and to alert the operator to any maintenance issues or items that need correction.

Biosafety cabinets from two different vendors are used as BWS units at LLE. Table 1 gives location information for the units deployed within LLE and identifies the manufacturer of each unit. Figures 1 and 2 show photographs of the equipment referenced in Table 1.

Location	BWS unit installed
OMEGA Target Bay	ESCO Labculture Biosafety Cabinet Model LA2-6A2
OMEGA EP Target Bay	
OMEGA EP Diagnostic Workshop (Rm 6106)	
LaCave (Rm 146)	LABCONCO Purifier® Biosafety Cabinet Model 3980402
OMEGA Target Bay SEMSPLAT Mid Deck	
OMEGA Target Bay SEMSPLAT Top Deck	

Table 1: BWS units and their locations within LLE.

Fig. 1: ESCO Labculture biosafety cabinet Model LA26A2 located in the OMEGA EP Diagnostic Workshop (Rm 6106).

Fig. 2: LABCONCO Purifier® Class I HEPA-Filtered Safety Enclosure located in LaCave (Rm. 146)

(3) Operating Procedures and Protocols for BWS units at LLE

(3.1) General requirements and responsibilities

- All individuals who use the BWS units at LLE must have successfully completed LLE Beryllium safety training and reviewed the contents of this document to insure that they are aware of how to work properly in the BWS.
- The supervisor for the work area in which the BWS is deployed is responsible for ensuring that users have received appropriate instruction in proper use of the workstation and are complying with all protocols outlined in this document and in LLEINST 6706.
- All users of the workstation must wear appropriate *personal protective equipment* (PPE) when working in or cleaning/decontaminating the workstation. The minimum PPE as defined by LLEINST 6706 for working with beryllium, beryllium-containing or beryllium-contaminated items is eye protection (safety glasses) and disposable latex or nitrile rubber gloves. A laboratory coat or gown with knit/elasticized cuffs is also strongly recommended.
- The BWS units are intended for operations where decontamination, processing, and disposal of beryllium, beryllium-containing, or beryllium-contaminated articles occurs. ***The use of this equipment for other processes is strictly prohibited without the express permission of the area supervisor, the Chemical Hygiene Officer and the LLE Chief Safety Officer.***
- After completing operations in the BWS, it is the user's responsibility to insure that the inner surfaces of the workstation have been thoroughly decontaminated of beryllium particulates and that all items are removed from the workstation. ***The BWS units are NOT to be used for long-term storage of beryllium, beryllium articles, or beryllium-containing/beryllium contaminated diagnostics and equipment.***
- The BWS units are not designed for use with flammable solvents and will NOT provide any protection against flammable solvent vapor. The use of solvents such as ethanol or isopropanol must be limited to the absolute minimum required to clean or decontaminate equipment, articles, or the inner work surfaces of the BWS. The use of commercial wet decontamination wipes are a safer alternative for decontamination and cleaning operations in the BWS.
- Each BWS must be certified as to its proper operating condition at least annually by a contractor qualified to test these units according to the manufacturer's test protocols (see **Sec. 4, Maintenance and certification)**.

(3.2) BWS Step-by-Step Operations Guide

The step-by-step operations guide below assumes that the operator has reviewed the condensed operator's manuals found in Appendix A and is familiar with the workstations features and controls prior to using the workstation. More detailed information on operation and maintenance of the workstations can be found in the installation and operator's manuals for the specific workstation manufacturer and model listed as references on the front page of this document.

(3.2.1) Workstation start up

(3.2.1.1) Labconco BWS

- Put on PPE
- Turn on exhaust system and workstation lighting from front panel controls
- Only raise the sash for loading and cleaning
- Insure that air grilles and slots in the workstation walls or bottom surfaces are not obstructed with equipment or materials
- Wiping down the work surface with either commercial isopropanol/water-based, or ethanol/water-based decontamination wipes or alternatively, a clean room wipe "Dampened" with water is recommended before loading equipment into the workstation or starting work. ***DO NOT use a spray of solvent delivered from a squeeze bottle to decontaminate or clean equipment or the inner surfaces of the workstation.*** Dispose of used wipes in accordance with LLEINST 6706
- Allow enclosure to operate unobstructed for 1 minute

(3.2.1.2) ESCO BWS

- Put on PPE.
- Lift sash to proper operating height, the light will come on
- Turn on fan
    1. Alarm will sound for 10 seconds
    2. Light will go out and the unit will "Warm-up" for 3 minutes
    3. Light will come back on when unit is ready
- Insure that air grilles and slots in the workstation walls or bottom surfaces are not obstructed with equipment or materials.
- Wiping down the work surface with either commercial isopropanol/water-based, or ethanol/water-based decontamination wipes or alternatively, a clean room wipe "Dampened" with water is recommended before loading equipment into the

workstation or starting work. ***DO NOT use a spray of solvent delivered from a squeeze bottle to decontaminate or clean equipment or the inner surfaces of the workstation*.** Dispose of used wipes in accordance with LLEINST 6706.

(3.2.2) Loading materials and equipment into the BWS

- Follow all protocols established in LLEINST 6706 for transportation of materials, equipment and/or parts that are either contaminated or potentially contaminated with beryllium from either general or operation areas of LLE to the BWS.
- Raise the sash to its maximum extent.
- After transferring materials, articles and equipment into the BWS, return the sash to its normal operating height/position. Wait for at least 3 minutes before beginning work to allow the BWS to purge and collect loose particulates.

(3.2.3) Working in the BWS

- Separate materials, equipment, and/or parts into separate clean, working, and dirty zones to prevent cross contamination.
- Place all needed materials, equipment, and/or parts to be decontaminated or used for decontamination inside the BWS before starting work to prevent excess movement that will disrupt air flow in the workstation.
- Avoid placing objects on the air grilles to prevent obstruction of airflow.
- Keep large objects away from each other to prevent change in airflow.
- Work in the designated safe work area, at least 6 inches behind the front air intake grille. (See Fig. 4).
- Work in a slow and controlled manner, minimizing arm movement (especially near the workstation opening) to avoid producing turbulence that can disrupt airflow and allow airborne particulate contaminants to escape.
- The use of aerosol-generating units, blow off guns and “dusters” should be avoided if at all possible. If they must be used, they need to be placed and operated as far inside the BWS as possible.
- Bags or bins for immediate and temporary collection of contaminated materials, wipes, or other articles must be located within the BWS and NOT on the outside of the workstation.
- ***Any items to be removed from the BWS must be first decontaminated as described in Section 3.2.1..***

(3.2.4) Workstation decontamination

- After removing all decontaminated equipment and articles from the BWS, wipe down all interior walls and work surfaces as described in Section 3.b.1.
- Wipe down all exterior surfaces of bags containing NON-RADIOACTIVE beryllium-contaminated waste as described in Sec 3.b.1. Once decontaminated, these bags can be removed from the workstation and placed in appropriate containment for hazardous waste as outlined in LLEINST 6706.
- Allow the circulation fan to run for at least 2-3 minutes after completing decontamination activities and removing all articles from the workstation before shutting down the BWS.
- Turn off fan and lights.
- Lower sash to its fully closed position.
- ***Check to make sure that there are no items left behind in the BWS.***

(3.2.5) Workstation shutdown

(3.2.5.1) Labconco BWS

- Rotate sash down to its normal operating position
- Turn off the exhaust system and light

(3.2.5.2) ESCO BWS

- Lower sash to its normal operating position if opened for decontamination
- Turn off the exhaust system
  - Press Fan Button, light will go out
  - Automatic 3 minute post purge begins
  - Fan turns off
- Close sash

(4) Maintenance and Certification

(4.1) Annual Certification

Each BWS must be certified as to its proper operating condition at least annually by a contractor qualified to test these units according to the manufacturer's test protocols. A copy of the certification performed after the cabinets were installed, can be found in Appendix B. Omega and EP Operations keep copies of these reports.

(4.2) Manufacturer's recommendations for routine BWS maintenance:

Daily

- Decontaminate the work zone surfaces
- Verify power-up alarm

Weekly

Check the paper catch for retained materials

Monthly **PMDB Item 67.32.01.003**

- Clean exterior surfaces of the BWS
- Clean the sash window using the clean mode
- Check all service fixtures for proper operation

Quarterly

Inspect BWS for any physical abnormalities or malfunction

Annually **PMDB Item 67.32.01.001**

Re-certification to be scheduled by OMEGA and OMEGA-EP Operations

Appendix A
General Description of Beryllium Workstations

(a) ESCO Labculture Biosafety Cabinet

Figures 1-3 show exterior photographs, control panels, and the airflow patterns for the ESCO Labculture biosafety cabinets used as BWS in all areas of LLE except for LaCave.

Fig. 1: *Exterior view of ESCO Labculture biosafety cabinet used as a BWS in the OMEGA EP Diagnostics Workshop (Rm 6106).*

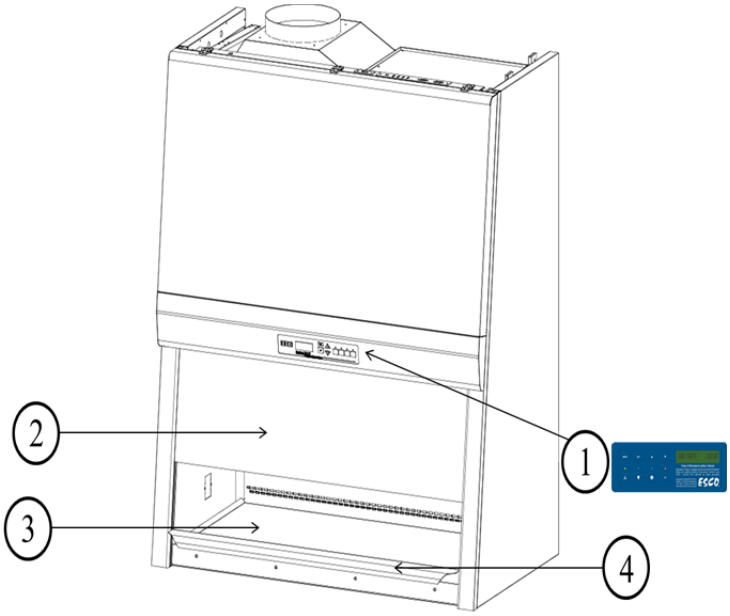

***Fig. 2**: ESCO Labculture biosafety cabinet parts identification*

1. *Sentinel Control System*
2. *Sash Window*
3. *Interior Work Area*
4. *Armrest*

***Fig. 3:** Sentinel operator control panel for the ESCO Labculture biosafety cabinet.*

The ESCO Sentinel Control System (#1 in Fig 2; also shown in Fig 3) provides both information about the condition of the workstation and access to various controls and functions. Access to workstation administrative controls is provided through the use of an administrative personal identification number (ADMIN PIN) that the operator enters at the Sentinel panel. This PIN restricts access to some specialized menu functions that should only be available to authorized personnel. The FAN PIN allows access to the workstation's circulation fan controls and must be entered before changing settings. It also restricts certain workstation functions to authorized personnel. The ADMIN PIN overrides the FAN PIN. Currently, no admin controls are in use on BWS units within LLE.

The *sash window* (#2 in Fig 2) is used in conjunction with the circulation fan and UPLA filter to keep contaminates within the BWS while work is being performed. Raising the sash to the safe working height will turn on the interior light in the BWS automatically. The sash window must remain in the normal operating range when working in the hood. There is an indicator on the right side of the hood opening that displays the proper level for sash placement during normal operations. **The sash must only be raised to its maximum**

position when loading or unloading materials and/or equipment into the workstation. Raising the sash above the safe working height will trigger an alarm to alert the user to a potentially unsafe condition where contaminants may exit the workstation due to air turbulence. The operator can mute this alarm from the Sentinel control panel during pre- and post-work operations (such as loading and unloading items from the workstation) as needed. Closing the sash to the bottom of its travel will turn off both the workstation lighting and the circulation fan.

The interior of the workstation (#3 in Fig. 2) is made of stainless steel and has radiused corners for easy decontamination and cleaning. Within this interior section is a *designated safe work area* (Fig. 4) in which decontamination operations should be conducted. Materials, equipment and/or parts must be placed within the interior of the workstation in a manner that does not obstruct flow into the air grilles (Fig. 4). The workstation also has an *arm rest* (#4 in Fig. 2) to provide ergonomic support to operators working in the BWS.

Fig. 4: Airflow patterns in the ESCO BWS. Work should be conducted only in the safe working area (outlined in red). The air grilles (indicated in green) must not be blocked with materials or equipment in order to insure proper airflow in the workstation and minimize turbulence.

(b) LABCONCO Purifier Biosafety Cabinet (LaCave, Rm 146. OMEGA Target Bay)

Figure 5 shows a photograph of the LABCONCO Purifier® biosafety cabinet used as a BWS in LaCave (Room 146). This workstation was selected due to the limited overhead height of the LaCave area, which prevented the use of the ESCO BWS units used in other areas of LLE. The LABCONCO unit employs HEPA filters for particulate contamination removal rather than the ULPA filters used in the other ESCO BWS units.

Fig. 5: LABCONCO Purifier® Biosafety Cabinet deployed in LaCave.

The LABCONCO BWS is constructed with inner work surfaces of stainless steel to facilitate easy cleaning. The rear baffle directs laminar airflow horizontally into three zones and minimizes the potential for airborne particulate contaminants to exit the BWS. Side-entry airfoils prevent turbulent air from outside from entering the workstation and allow clean air to sweep the workstation's interior walls. The sash window is used to keep contaminates within the BWS while work is being performed. **The sash must remain rotated down as seen in Figure 5 when working in the hood *and* when hood is not in use, and must be in the open position only when loading or unloading materials and equipment.** When the workstation is in operation, it is important to prevent material, equipment and/or parts from obstructing both the front air foil and the rear baffle air slots, as this will disrupt air flow in the workstation.

Access to the LABCONCO Purifier's air circulation system and light source controls is achieved through a control panel mounted on the front right of the unit.

Appendix B
Post Installation Certification
Performance Evaluation Report
ENV Services Testing and Certification, Inc.

dba ENV Services Testing & Certification, Inc.
2880 Bergey Road, Suite K
Hatfield, PA 19440
(800)345-6094

Test Report Number
NY0274:160826:084703
Inventory Number
557245

BIOLOGICAL SAFETY CABINET TEST REPORT

Customer	UNIV. OF ROCHESTER/GOLER HOUSE	**ENV Services Technician**	RICK SHAUGHNESSY
Address	ATTN: PURCHASING SERVICES	**Test Date**	08/26/2016
	70 GOLER HOUSE	**Test Frequency**	Certification - Annual
	ROCHESTER, NY 14620	**Equipment Manufacturer**	LABCULTURE
		Model	ESCO
		Serial Number	2010-50211
Contact	COREY MCATEE	**Type**	(DIM) Class II, Type B2 BSC
Telephone	585/275-8390	**Location**	EXTENDED PERFORMANCE
Extension			

Testing and Certification: The purpose of field testing this equipment is to assess whether it is functioning as designed in compliance with the specifications, outlined in the appropriate version of NSF/ANSI-49. We perform all test procedures in accordance with these standards and specifications as detailed in ENV Services Procedures, applicable copies of which are available on request. Our testing and certification apply only to to the equipment above, and do not signify approval of the use of any hazardous agents or operational procedures.

SERVICE SUMMARY

	PASS	FAIL	N/A
OVERALL CERTIFICATION	☒	☐	☐

Containment tests performed:

	PASS	FAIL	N/A
HEPA Filter Leak Test	☒	☐	☐
Airflow Smoke Patterns	☒	☐	☐
Downflow Velocity Profile Test	☒	☐	☐
Inflow Velocity Test	☒	☐	☐
Site Installation Assessment Tests	☒	☐	☐
Cabinet Leak Test	☐	☐	☒

Worker comfort and safety tests performed:
Corrected noise level meets NSF criteria for Class II BSCs.
Light intensity meets NSF criteria for Class II BSCs.
Electrical results: 120 VAC Polarity was correct
0.000 ohms GFI is functional

Repairs performed:
- ☒ None
- ☐ Filter Leaks Repaired
- ☐ Structural Repairs Made
- ☐ Filters Replaced
- ☐ Airflow Adjusted
- ☐ Pressure Gauge Adusted
- ☐ Warning Alarm System
- ☐ Electrical System Repaired
- ☐ Other: _____

EQUIPMENT UTILIZATION SURVEY

Use Research
Biological Agent Used
Biosafety Classification Level 2
Tissue/Cell Cultures HUMAN:ANIMAL:PLANT:

Chemicals Non-Carcinogens
Isotopes NO
Surface Decontamination Performed Yes **Using** 70% EtOH
Formaldehyde Gas Decontamination Performed No
Decontamination Report # N/A

COMMENTS AND RECOMMENDATIONS

WO 943-119776 HEPA LEAK TEST WITH PSL SPHERES.UNIT PASSED ALL TESTS.

SITE INSTALLATION

Exhaust Alarm or Interlock Functional	PASS	**Cabinet Exhaust**	Vented to Room
Sash Alarm Function	PASS	**Exhaust Connection Pressurization**	N/A

Customer: _____ *Signature*
Corey McAtee *Please print name*

Service Technician: _____ *Signature* 8/26/16 *Date*

ENV TLBSC- 04/23/12 *ENV SERVICES, INC. HEADQUARTERS; HATFIELD, PA (800)883-3681* Page 1 of 2

ENV SERVICES
(800)345-6094

BIOLOGICAL SAFETY CABINET TEST REPORT

Test Report Number
NY0274:160826:084703
For: UNIV. OF ROCHESTER/GOLER
Model: ESCO
S/N: 2010-50211

HEPA FILTER LEAK TEST

Supply Filter Quantity/Size: (1) 1809mmx457mmx66mm
Leaks Detected Media: 0 **Gasket:** 0 **Structural:** 0
Leakage Repaired with N/A
Approximate Filter Obstruction Caused by Repairs 0.0 %

Exhaust Filter Quantity/Size: (1) 1122mmx457mmx90mm
Leaks Detected Media: 0 **Gasket:** 0 **Structural:** 0
Aerosol Challenge Concentration: >= 10 MicroGms/Liter PAO
Filter Scanning Rate: 2 inches per second

Overall Test Result: PASS

AIRFLOW SMOKE PATTERNS

Smooth downward flow with no dead spots or reflux	PASS	No outside smoke penetrates onto the work surface	PASS
No Smoke escapes from the cabinet	PASS	No upward refluxing toward the sash wiper seal	PASS
No outside smoke billows over the work surface	PASS	No escape of smoke through the sash wiper seal	PASS
		No external turbulence at front access opening	PASS

Cause of external turbulence, if any _____

Overall Test Result: PASS

SECONDARY TESTS AND TEST EQUIPMENT

			Criteria	
NOISE Total	64 dbA	Ambient 56dbA Corrected 63dbA	<= 70 dbA Corrected	Meets
LIGHTING Average	80 FC	Background 12 FC	Avg. 45 FC > Bkgd, Bkgd <= 15 FC	Meets
ELECTRICAL Line Voltage	120 VAC		N/A	N/A
Ground Resistance	0.000 ohms		<= 0.15 ohms or meter min. sensitivity	Meets
Polarity	PASS		Must be correct	Meets
Ground Fault Interrupter	PASS		Trips when tested	Meets
UV LIGHT At the work level	Microwatts/square centimeter		None	N/A

Velometer Model: TSI-9535 **S/N:** 95351335 **Cal. Date:** 03/07/2016 **Photometer:** TDA-2G **S/N:** 11058 **Cal. Date:** 02/05/2016

DOWNFLOW VELOCITY PROFILE TEST AND INFLOW VELOCITY TEST

	Avg. Vel.	Specification	Uniformity		Area	Volume	Inflow Method	DIM
Inflow	108 fpm	100 - 110	N/A	Inflow	4.08 ft^2	442 cfm	Pressure/Flow Gauge Reading	
				DIM Corr. Factor	1.0000		Gauge Zeroed	
Downflow	67 fpm	60 - 70 fpm	3%				Fan Speed Adjustment Made	
							Final Fan Speed	
				Dens. Corr.	1.000	0 elevation	Specification Used	U623D

All downflow readings must be within the greater of 25% or 16 fpm of the average.

Overall Downflow Velocity Profile Test Result: PASS
Overall Inflow Velocity Test Result: PASS

AIR VELOCITY PROFILES:

NOTE: Inflow was determined using a DIM, the data labeled "Exhaust" are actually inflow volume measurements.

Downflow Grid:

65	66	65	67	67	66	66	67	65	67	67
67	68	67	65	68	67	68	67	67	65	68
67	68	67	66	68	67	68	67	67	66	65

Exhaust Grid:

442	442	442	442	442

ENV TLBSC-05/22/09

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