

SOP Number	EQ-11-03
Title	Use and Maintenance of Biological Safety Cabinets
Revisions Made	<ul style="list-style-type: none">• Minor editorial changes for clarification purposes.• New BSCs were installed in March through May of 2023. Changes were made to reflect the operation of the new models (NU-540 and NU-560).• Specified that chlorinated materials should not be used on the stainless steel surfaces of the BSCs.• Added a caution statement regarding closing of the cabinet sash.• Updated <i>Clostridium difficile</i> to <i>Clostridioides difficile</i>.• Added the use of disinfectant towelettes to disinfect the BSC.• Added language to refer to the Select Agent Plan for work with select agents and/or other BSL-3 organisms.• Changed Attachment 1 to Appendix 1.

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Title	Use and Maintenance of Biological Safety Cabinets
Scope	The purpose of this SOP is to describe the procedures for the use and maintenance of the Biological Safety Cabinets (BSC).
Application	Proper use and cleaning of the BSCs are the responsibilities of laboratory personnel. Performing maintenance and repairs on the BSCs and maintaining annual certification of the BSCs are the responsibilities of the Facility Manager or their designees (e.g., operations, maintenance and repair contractors).

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1. Definitions	Abbreviations/definitions are provided in the text.
2. Health and Safety	Follow procedures specified in SOP MB-01, Laboratory Biosafety. The Study Director and/or lead analyst should consult the Safety Data Sheet for specific hazards associated with products.
3. Personnel Qualifications and Training	Refer to SOP ADM-04, OPP Microbiology Laboratory Training.
4. Instrument Calibration	<ol style="list-style-type: none"> 1. BSC working parameters are controlled by the Facility Manager or their designee. 2. There are two types of BSC monitoring boards, NU-560 biosafety cabinet control system (BSCC) Monitor displayed on a TOUCHLINK LCD screen and NU-540 Aeromax™ control system. 3. Parameters for both monitoring boards: <ol style="list-style-type: none"> a. Work zone air downflow is uniform and held to an average velocity of 60±5 linear feet per minute (LFPM) (0.30±0.025 m/s) measured in the plane of the bottom edge of the viewing window. The BSC will alarm if the average velocity falls below 54 LFPM or above 66 LFPM. The significance of this airflow control is that the work zone air is flowing down like a huge piston carrying contaminants rapidly out of the work zone with 24 air changes per minute. The work zone airflow is ducted such that the quantity of air leaving through the rear perforated area is half of the downflow air quantity. The remainder, that is the other half of the downflow air, and the air entering through the work access opening flow into the front perforated area. Room air flowing into the 8-inch (203 mm) work access opening forms the air barrier protecting personnel at 105 ±5 feet per minute (FPM) (0.53±0.25 m/s). 4. Exhaust Volume Display is featured on the front panel of the BSC. <ol style="list-style-type: none"> a. For NuAire NU-560 BSCC TOUCHLINK LCD display, the BSC alarms if the exhaust volume falls below 954 cubic feet per minute (CFM) or rises to above 1290 CFM. b. For the NuAire NU-540Aeromax™ control system, the BSC alarms if the airflow goes out of set range via the PresurFlow™ - digital pressure sensor.
5. Sample Handling and Storage	Not applicable.

6. Quality Control	1. For quality control purposes, the required information is documented on the appropriate form(s) (see section 14).
7. Interferences	<ol style="list-style-type: none"> 1. If a procedure requires the use of a flame (e.g., to flame sterilize hooks, forceps, etc.), place a burner with a pilot light in the center of the work surface, so that the flame can be ignited only when required. Do not use constant flame gas burners. 2. Gas burners should only be used (ignited) towards the rear of the work surface, where resulting air turbulence will have a minimal effect. 3. A permanent paper catch is installed behind the rear divider panel of the work zone. This area forms the return air path to the motor/blower. If the air flow is blocked, it could seriously affect the performance of the cabinet. Regularly verify that the paper catch is clear of any paper products that may disrupt the air flow.
8. Non-conforming Data	1. Management of non-conforming data will be consistent with SOP ADM-07, Non-Conformance Reports.
9. Data Management	1. Data will be archived consistent with SOP ADM-03, Records and Archives.
10. Cautions	<ol style="list-style-type: none"> 1. Failure to clean and disinfect all BSC surfaces on a quarterly basis may result in contamination of test systems. 2. Failure to clean the ultraviolet lamps in the BSC will reduce the lamps' effectiveness. 3. Check grills and diffuser grids periodically for spilled or splashed nutrients which may cause contamination of the work surface. 4. Do not use chlorinated and/or halogenated materials (e.g., bleach). These materials are not recommended for use on stainless steel surfaces of the BSC. 5. Exercise care to ensure that no items are placed over the front intake grills. 6. Avoid passing contaminated materials over uninoculated cultures or clean glassware to avoid contamination. 7. Do not use cabinet as a repository for excess lab equipment during periods of non-operation. 8. Do not close the cabinet sash completely at any time to maintain the integrity of the glass.
11. Special Apparatus and	<ol style="list-style-type: none"> 1. The list of BSCs is maintained as an appendix to the SOP. See section 14. 2. For a list of model and serial numbers for each BSC, please refer to the

Materials	MLB Master List (ADM-02_F3). The Master List is stored on the G drive.
12. Procedure and Analysis	Follow the instructions below for operation, use and maintenance of the BSC.
12.1 Use and Operation	<ul style="list-style-type: none"> a. Wear long-sleeved lab coat and gloves when performing work in the BSC, even when not manipulating culture. This minimizes the shedding of skin flora into the work area and concurrently protects the hands and arms from viable agent contamination (see section 15). b. The laminar flow BSCs create an environment that has little to no airborne particulates. It is not necessary to flame tube and flask necks. c. Turn on the blowers, lights, and outlets, and allow equipment to operate for a minimum of 15 minutes prior to initiating work inside the BSC. <ul style="list-style-type: none"> i. The TOUCHLINK LCD screen should switch from standby mode to run mode. ii. The PresurFlow™ LED indicators will blink anytime the blower key is pressed to initiate run mode. It will go through a sequence during the 3-minute warm up period. Once the warmup period is complete, only one LED will indicate cabinet airflow status. d. Complete the BSC Monitoring Record Form (see section 14) immediately prior to use. Check the appropriate box (“Yes” or “No”) to indicate if the unit’s Downflow (FPM) and Exhaust (CFM) are within the acceptable range (see section 4.2). e. Disinfect the interior surface of the BSC workspace thoroughly by spraying/wetting with an appropriate amount of an EPA registered hospital disinfectant; allow to stand for the label-specified contact time before wiping. Alternatively, an EPA registered hospital disinfectant towelette may be used to disinfect the BSC; allow the wiped surface to remain wet for the label-specified contact time. f. Place apparatus and materials into the cabinet. Arrange the work area so that clean and dirty (used) materials are well separated. g. Transfer viable materials (such as test cultures) as deeply into the cabinet (away from open face) as possible. h. Allow purging of the workspace without any user activity for 2-3 minutes after materials and apparatus have been placed in the unit(s). i. Allow the BSC to run for 2-3 minutes after completion of work

	<p>without activity to purge the unit.</p> <ul style="list-style-type: none"> j. Remove all materials, cultures, and equipment and decontaminate BSC as in section 12.2. k. Turn on the ultraviolet light and leave it on overnight when working with bacteria or fungi in spore form (e.g., <i>Bacillus subtilis</i> spore suspensions, <i>Trichophyton interdigitale</i> spore suspension, <i>Clostridioides difficile</i> spore suspension, spore strips, etc.). l. Refer to the laboratory’s Biosafety Plan and/or Select Agent Plan for <i>Bacillus anthracis</i> and/or other BSL-3 organisms for BSC clean up procedures following work with select agents and/or other BSL-3 organisms. m. After use, turn off lights and outlets. Turn off blowers as per facility recommendations. When blowers are turned off the BSC will enter standby mode as displayed on the TOUCHLINK LCD screen. n. Record all maintenance activities, incidents, or corrective actions taken on the BSC Monitoring Record Form (see section 14).
<p>12.2 Quarterly Maintenance</p>	<ul style="list-style-type: none"> a. Thoroughly clean and disinfect all BSCs on a quarterly basis. b. Remove work surface panel and grill from the BSC and set aside. c. Disinfect all surfaces and the panel grill of the BSC thoroughly by spraying/wetting with an appropriate amount of a hospital disinfectant and allow to stand for the label-specified contact time before wiping. d. Replace the panel and grill, and properly secure. e. Clean the ultraviolet lamps in the BSC with a lint-free cloth dampened with alcohol. <ul style="list-style-type: none"> i. The output of an ultraviolet light deteriorates with burning age. The useful life of the light is approximately 7000 hours under specific test conditions. ii. It is recommended that either a time schedule be established, or the tube’s output be measured periodically, and the tube replaced when its output falls below 40 microwatts per square centimeter or exceeds 7000 hours of operation. Lights should be allowed to operate approximately 5 to 10 minutes (longer when the light is in low temperatures) to warm up sufficiently before reading the output with a meter. f. Record quarterly maintenance on the Quarterly BSC Cleaning and

	Maintenance electronic log (see section 14).
12.3 Service and Certification	<p>a. Notify the Facilities Helpline at (410) 305-4357 if the BSC needs service. The Facility Manager or their designees will investigate and make a service call, if necessary. Laboratory staff notes the event on the BSC Monitoring Record Form (see section 14) and documents any corrective action taken.</p> <p>b. <u>Certification</u>: The BSCs are certified annually by a qualified technician. A series of tests are performed on the BSC during recertification including the HEPA filter leak test and a measurement of the downflow blower speed (designated “Blower” or “Blower Speed” on the certificate and report).</p> <p>i. If a BSC does not pass recertification, it will be placed out of service until it can meet the criteria for certification.</p> <p>c. <u>Scheduling for recertification</u>: Scheduling recertification is the responsibility of the Facility Manager or their designee. Certificates are maintained by the Facility Manager. The OPP Microbiology Laboratory requests a copy of the Test and Certification Reports each year for review.</p> <p>d. <u>HEPA filter usage and replacement</u>:</p> <p>i. HEPA filters on each BSC do not need to be replaced under normal usage, and barring an accident (puncture), until the exhaust volume or the access flow velocity cannot be maintained. Making this determination and scheduling HEPA filter replacement is the responsibility of the Facility Manager or their designee.</p> <p>Refer to the laboratory’s Biosafety Plan and/or Select Agent Plan for HEPA filter replacement recommendations following work with select agents and/or BSL-3 organisms.</p> <p>ii. The Facility Manager takes into consideration the downflow blower speed (if $\geq 90\%$) and other indicators (e.g., age – 8 to 10 years) to determine the need for replacement of the HEPA filter.</p> <p>The TOUCHLINK LCD screen will display a visible alarm as well as an audible alarm sounding when the HEPA filter reaches 0%.</p> <p>iii. Once the HEPA filter is replaced, the BSC is recertified, and the certification is annotated by a Performance Certification sticker.</p>

13. Data Analysis/ Calculations	None
14. Forms and Data Sheets	<ol style="list-style-type: none">1. Appendix 1: Current Inventory of BSCs2. Forms. Forms are stored separately from the SOP under the following file names: BSC Monitoring Record Form EQ-11-03_F1.docx Quarterly BSC Cleaning and Maintenance Record Form EQ-11-03_F2.xlsx
15. References	<ol style="list-style-type: none">1. Bordner, R.H., Winter, J.A. &, Scarpino, P.V., eds. 1978. Microbiological Methods for Monitoring the Environment, Water and Wastes. EPA 600/8-78-017, Environmental Monitoring & Support Lab., U.S. Environmental Protection Agency, Cincinnati, Ohio.2. NuAire LabGard ES Energy Saver Class II, Type B2 Laminar Flow Biosafety Cabinet Operation & Maintenance Manual.3. NuAire LabGard ES Energy Saver Class II, Type A2 Laminar Flow Biosafety Cabinet Operation & Maintenance Manual.

Appendix 1

Bio-Safety Cabinets Parameters Display

Unit #	Location	Display Board Type		Parameters
		NuAire NU-560 BSCC TOUCHLINK LCD*	NuAire NU-540 Aeromax™ control system**	
1	B204	X		Downflow: 54-66 FPM Inflow: 99-111 FPM Exhaust: 954-1290 CFM
2	B204	X		
3	204	X		
4	B 205	X		
5	B207	X		
6	B207	X		
7	B202	X		
8	B202	X		
11	B201	X		
12	D122	X		
13	C206	X	X	

***NuAire NU-560 BSCC TOUCHLINK LCD:** The downflow, inflow and exhaust volume are displayed on the front screen. The BSC alarms if the exhaust volume falls below 954 cubic feet per minute (CFM) or rises to above 1290 CFM.

****NuAire NU-540 Aeromax™ control system:** The BSC alarms if the inflow volume falls below 95 feet per minute (fpm) or rises to above 120 fpm. The red alarm LED will indicate any alarm condition and remain indicating until the alarm condition is cleared.