Baker

BSC MYTHBUSTERS: Do large lab machines require an enclosure to maintain protection?

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BSC MythBusters

There are a lot of rules, “guidelines”, rumors, and myths for using a Biosafety Cabinet.

Which are true?

Which are not?

WHY?

*Baker is not affiliated with this TV show!

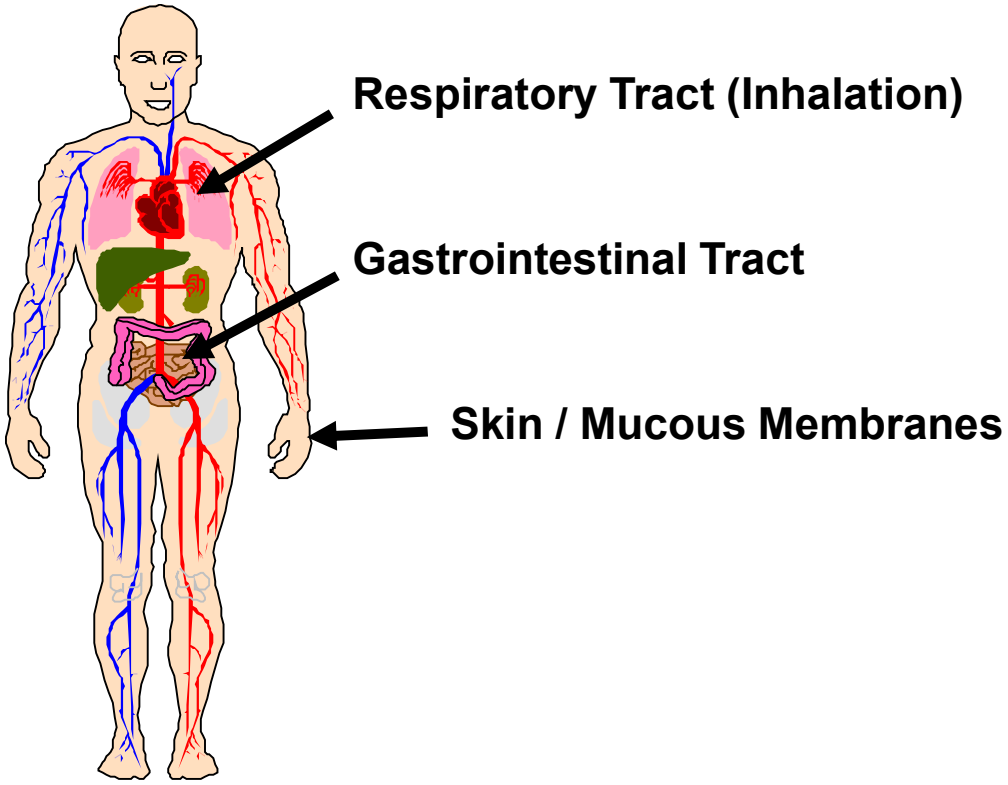
MYTH: Large Laboratory Equipment does not need to be enclosed in a BSC

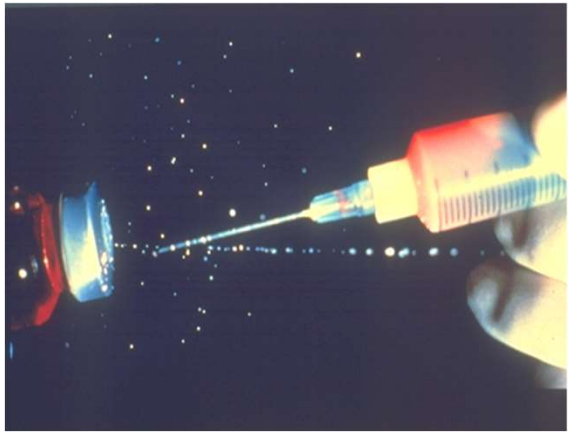
Cell sorters, plate washers, robotics, centrifuges, 3D printers, etc.

CONS
- Takes up a lot of space
- Harder to access the equipment
- Equipment can be too large or barely fit in BSC

PROS
- Aerosol protection from biohazards

Routes of Exposure to Biohazards

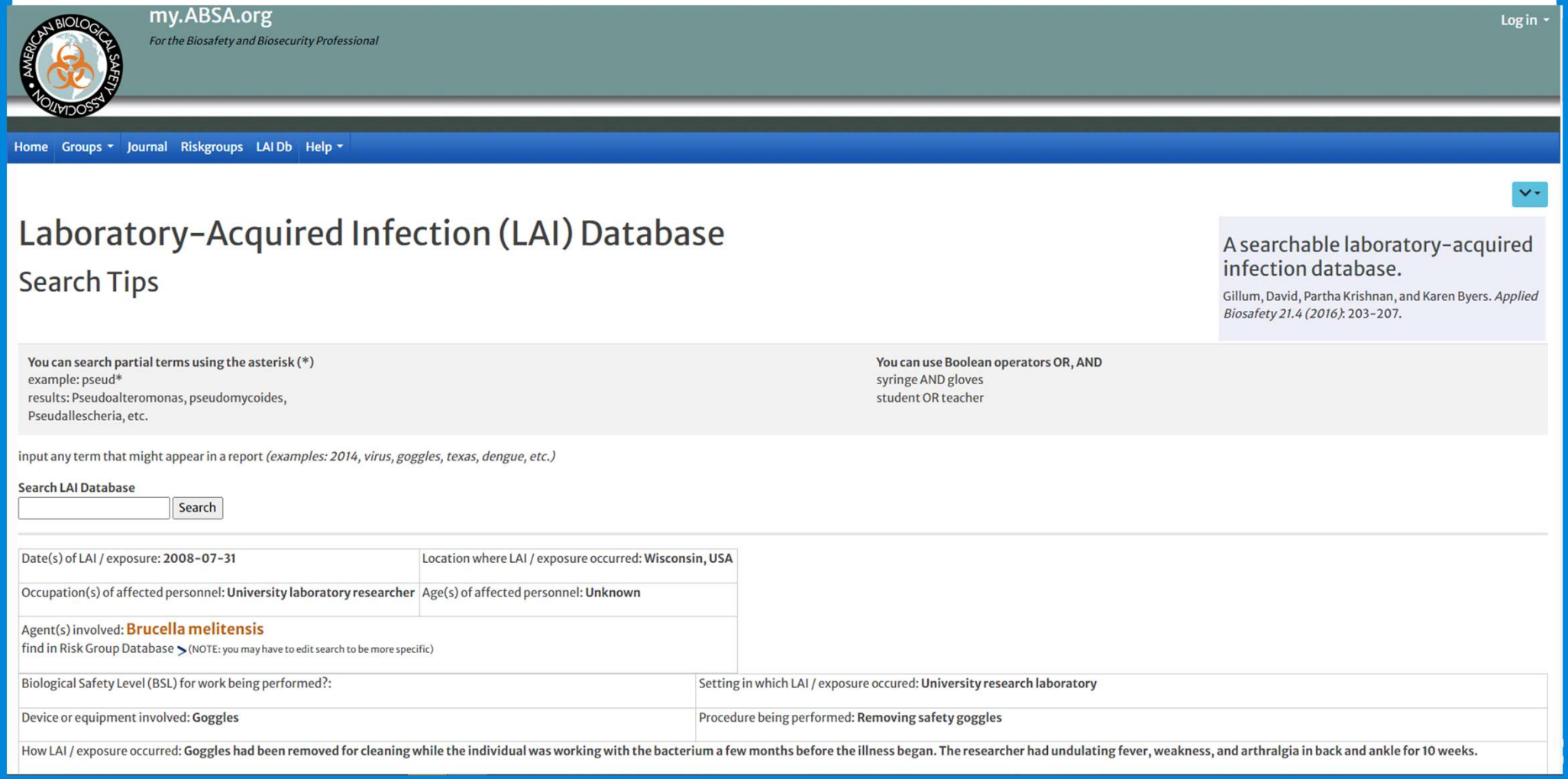




Aerosols can be inhaled and need to be controlled at the site of their generation by a Primary Engineering Control

Laboratory Acquired Infections (LAIs)

https://my.absa.org/LAI



my.ABSA.org
For the Biosafety and Biosecurity Professional

Log in

Home | Groups | Journal | Riskgroups | LAI Db | Help

Laboratory-Acquired Infection (LAI) Database

Search Tips

A searchable laboratory-acquired infection database.

Gillum, David, Partha Krishnan, and Karen Byers. *Applied Biosafety 21.4 (2016)*: 203-207.

You can search partial terms using the asterisk (*)
example: pseud*
results: Pseudoalteromonas, pseudomycoides, Pseudallescheria, etc.

You can use Boolean operators OR, AND
syringe AND gloves
student OR teacher

input any term that might appear in a report *(examples: 2014, virus, goggles, texas, dengue, etc.)*

Search LAI Database

Search

Date(s) of LAI / exposure: **2008-07-31**	Location where LAI / exposure occurred: **Wisconsin, USA**
Occupation(s) of affected personnel: **University laboratory researcher**	Age(s) of affected personnel: **Unknown**
Agent(s) involved: **Brucella melitensis** find in Risk Group Database > (NOTE: you may have to edit search to be more specific)	
Biological Safety Level (BSL) for work being performed?:	Setting in which LAI / exposure occured: **University research laboratory**
Device or equipment involved: **Goggles**	Procedure being performed: **Removing safety goggles**
How LAI / exposure occurred: **Goggles had been removed for cleaning while the individual was working with the bacterium a few months before the illness began. The researcher had undulating fever, weakness, and arthralgia in back and ankle for 10 weeks.**	

Primary Engineering Control

Primary Containment

Capturing the aerosol or hazard at the point of its generation.

The sooner it is contained, the less likely it is to spread.

Biosafety cabinets were created specifically for this purpose.

Class II Type A2 Biosafety Cabinets (BSCs)

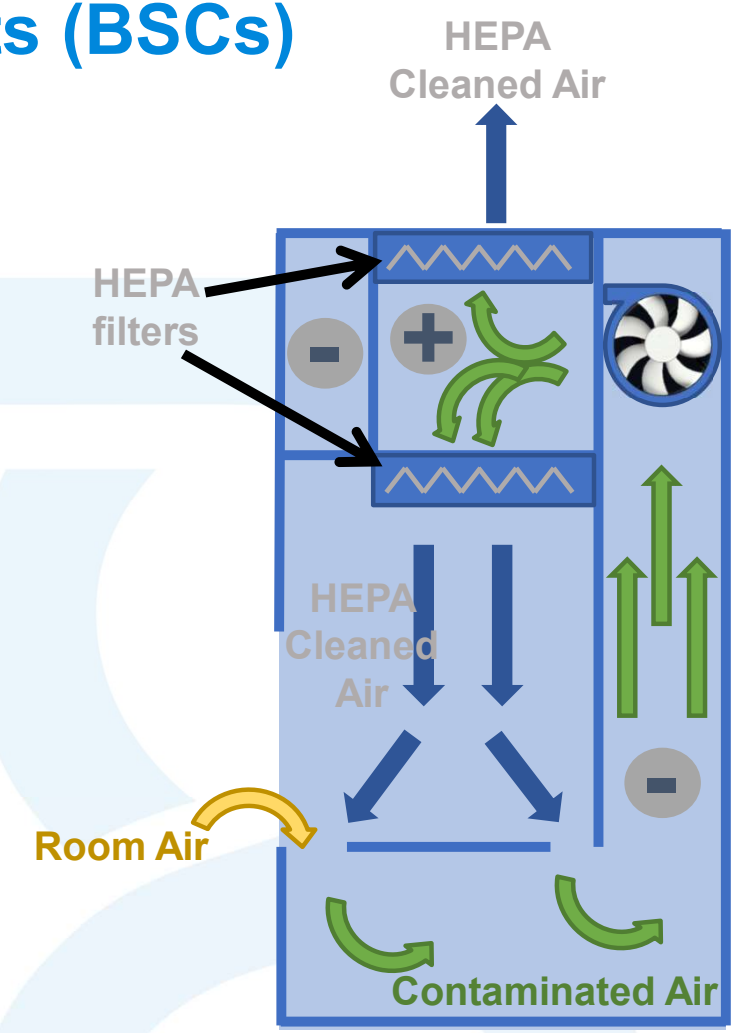
For BSL 1 through 4 work

Contains a motor/blower and 1+ HEPA filters

Provides Containment: Personnel, Product and, Environmental Protection from particulates and aerosols.

Minimum 100 fpm intake air

Partial recirculation

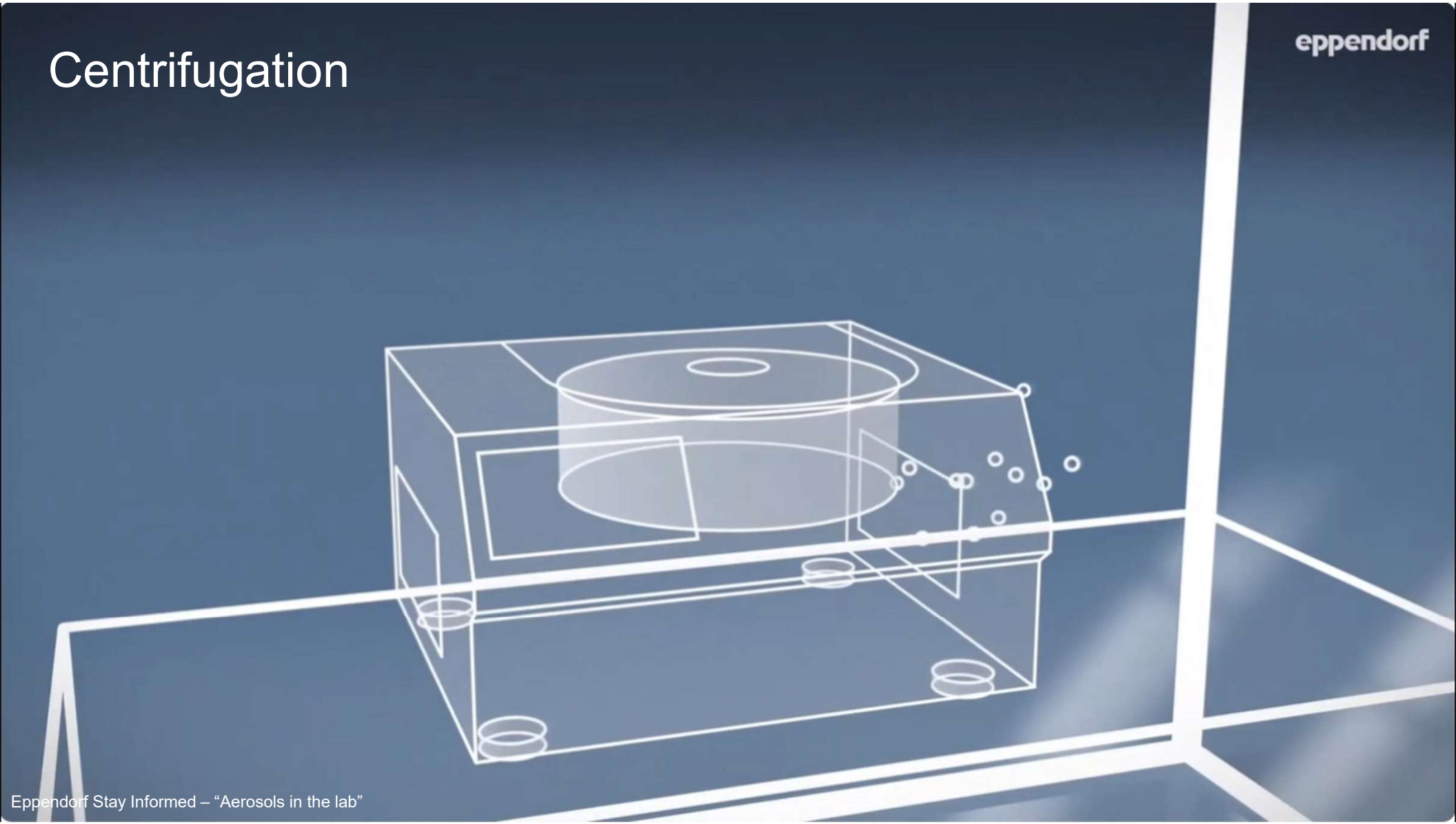


Airflow in a Class II Type A2 BSC

1. Strong front intake air
2. Side suction slots
3. Downward HEPA filtered air
4. Smoke split to front and back
5. Momentum Air Curtain
6. ReadySAFE mode
7. Partially recirculating air

Methods of Aerosol Creation in the lab by large equipment

Centrifugation

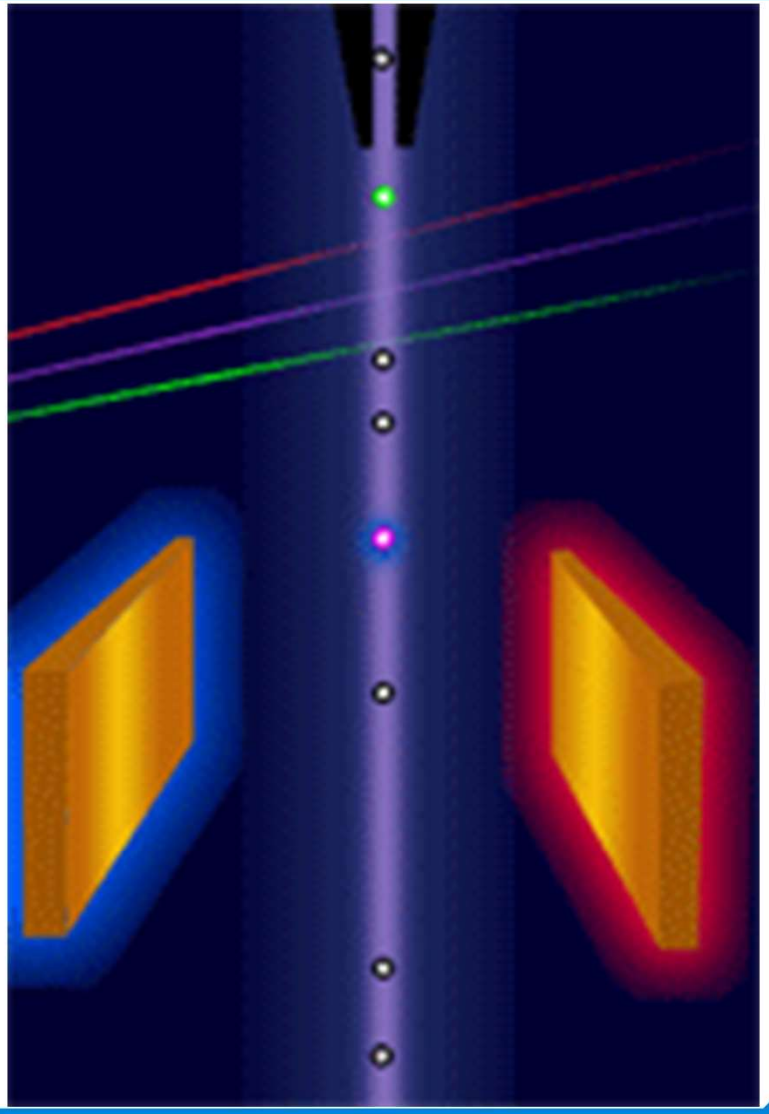


Eppendorf Stay Informed – “Aerosols in the lab”

Automated Pipetting

BioTek BioSpa System
https://www.youtube.com/watch?v=u7wf7PatWuo

Flow Cytometry



BD FACSDiscover™ S8

https://immunology.ufl.edu/instrumentation/facsariaiii/

Why enclose Flow Cytometers?

Flow Cytometry and Cell Sorters have been classified as high-risk laboratory procedures due to their ability to generate bioaerosols, especially in a failure mode. The need for validated aerosol containment was identified in the International Society for the Advancement of Cytometry Cell Sorter Biosafety Standards

Must have an AMS system installed

BD FACSymphony™ S6
Holmes et al, Cytometry Part A, 2014.
Perfetto et al, Cytometry Part A, 2018.

Why consider a BSC over a flexible side wall container?

Rigidity
Longevity
Proven airflow and cleanout (100fpm inflow vs 75fpm)
Easier access opening
Resistant to disinfecting chemicals
Ability to add AMS high flow evacuation system

How to enclose large laboratory equipment in a BSC appropriately

How to determine if a BSC is maintaining containment:

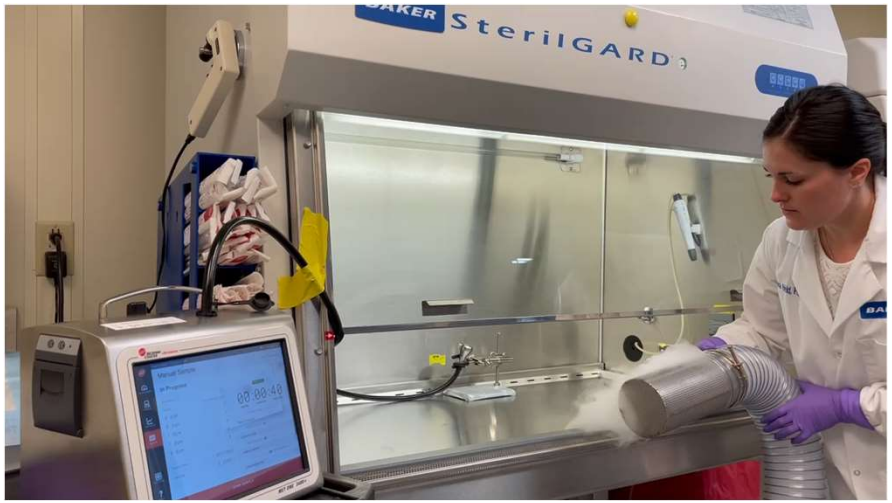
Smoke
Particle Counting
Aerosol Microbiological Testing

Containment testing in a BSC

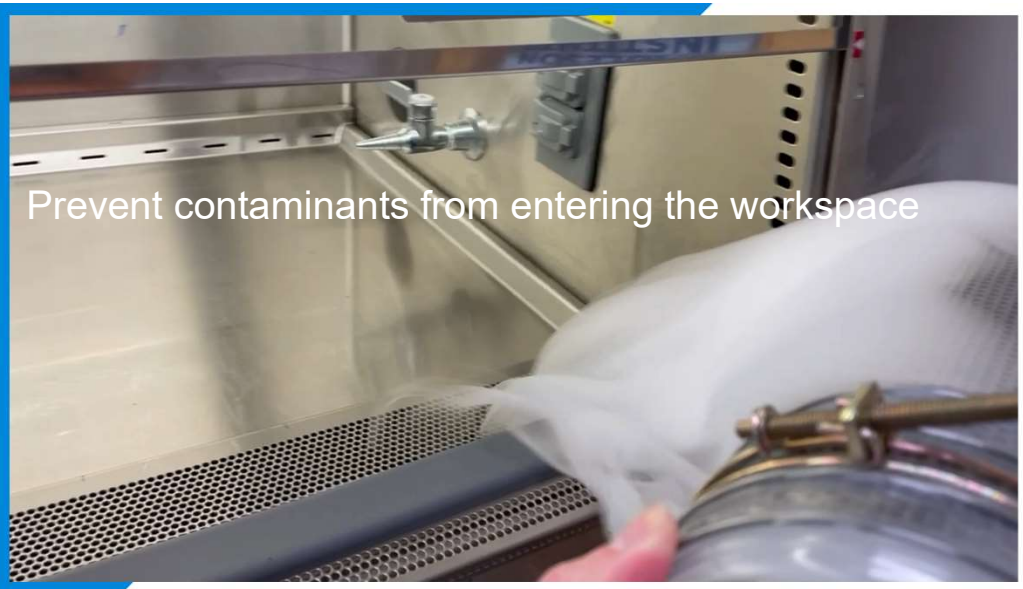
Smoke: use theatrical smoke (PEG), dry ice and water, smoke sticks, etc. to visualize air patterns and look for disruptions in airflow.

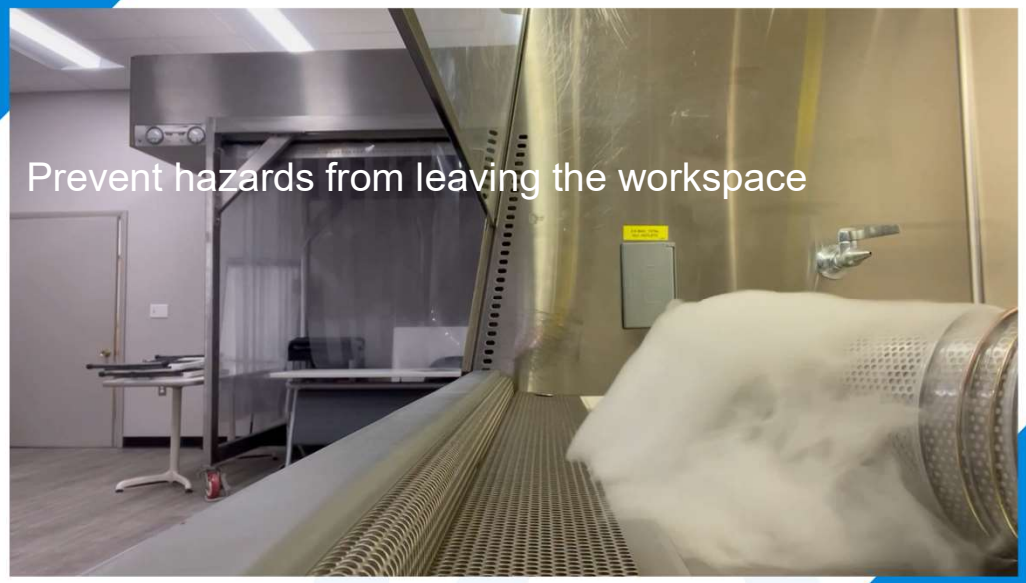
Particle counter: use a particle counter to measure air quality and look for ingress of room air particles into the (supposedly) cleaner BSC

Aerosol Microbiological Testing: bacterial slurry is sprayed in or out of the BSC and spore capture is measured and compared to international standards (e.g. NSF/ANSI Standard 49) for pass/fail criteria.



Smoke testing on a BSC





Particle Counter testing in a BSC

Fit: not every machine will fit and still provide containment in every BSC

Placing equipment close to the front grille (here shown at 2 ¾”) may be fine in static conditions, but product protection is lost when the unit is in use by an operator.

Particle counts jump from 0 to 12398

Moving the equipment back away from the front grille (4”) maintains product protection while in use by an operator.

Particle counts maintain 0

You can't just pop any machine into a BSC and expect Containment

Too tall, loss of downflow

When equipment fits all the way up to the diffuser, there is very little downflow to protect the work area, front access opening, and keep containment inside the BSC.

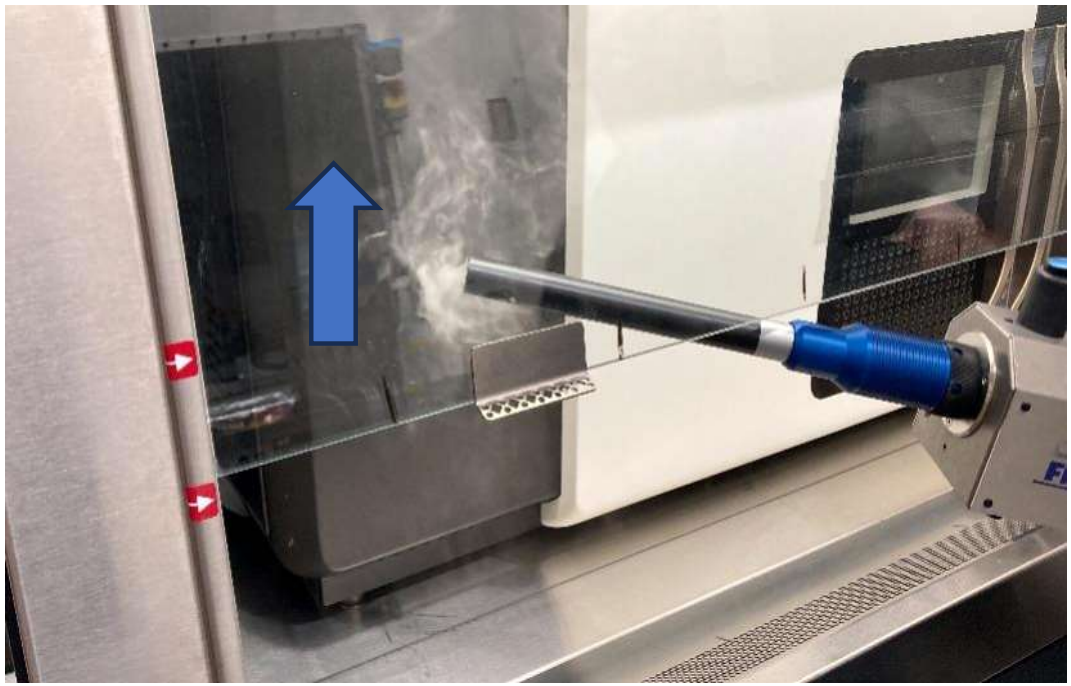
Adjustments to product shape may need to be made.

Note the sloped sides of the top and the perforated shelf.

Even with these changes, this failed the product protection test at normal setpoints. Additional adjustments to the inflow and downflow needed to be made.

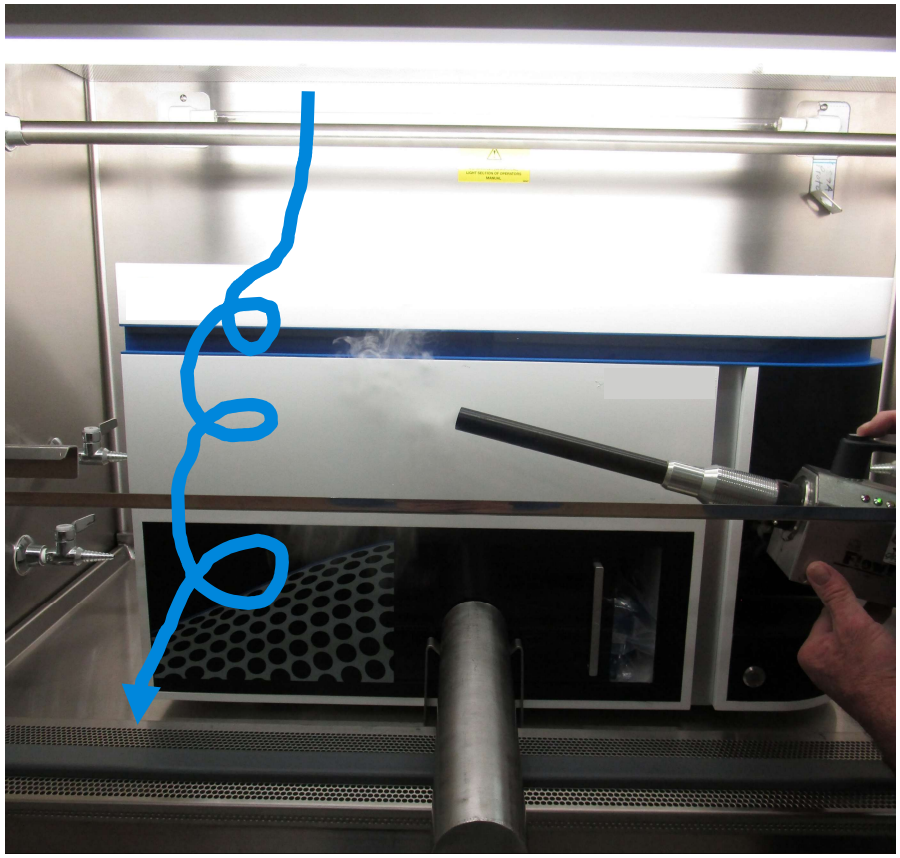
You can’t just pop any machine into a BSC and expect Containment

Too tall, loss of downflow



You can’t just pop any machine into a BSC

Flat top creates eddies in the downflow losing uniformity especially when close to front grille



You can’t just pop any machine into a BSC

Flat top creates eddies in the downflow losing uniformity especially when close to front grille

Rolling off

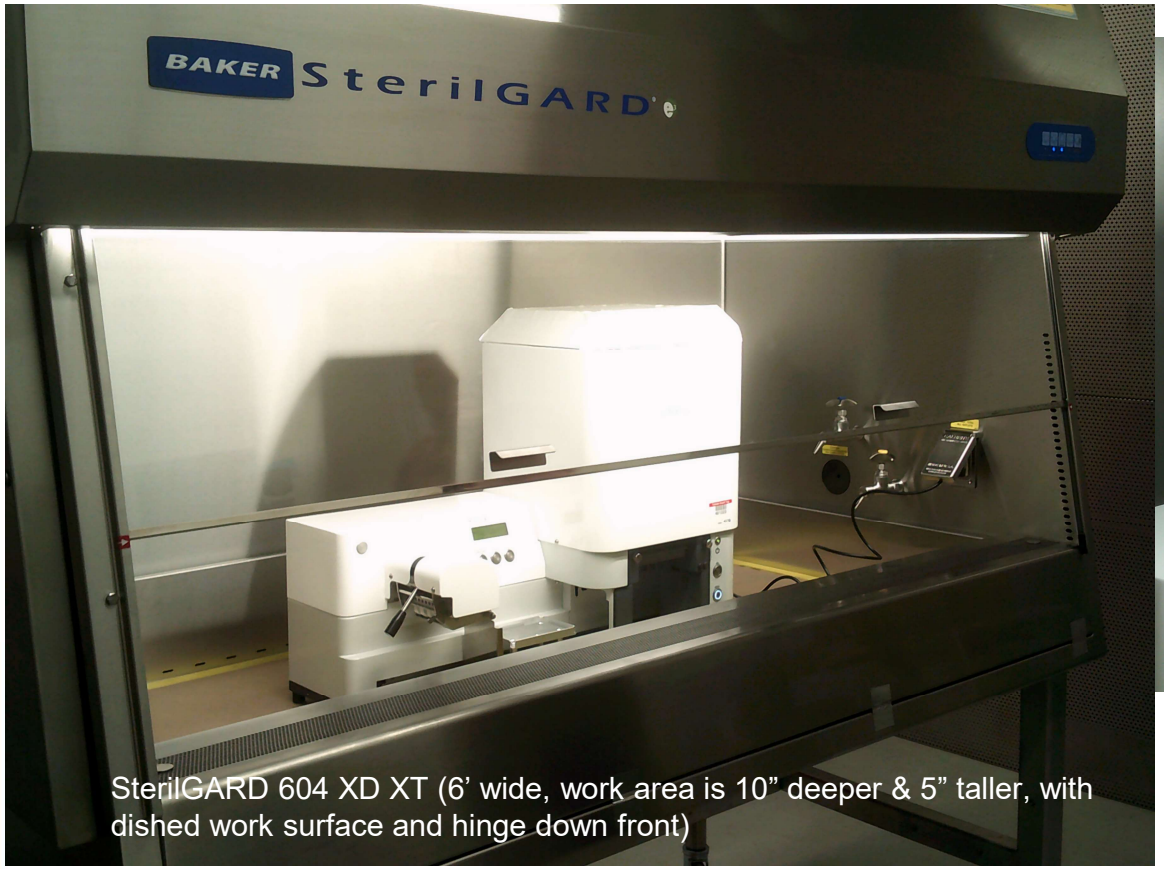
Too close and too tall

Add air deflector cap

Push back from front

You can’t just pop any machine into a BSC

Larger BSCs are a great option



SterilGARD 604 XD XT (6’ wide, work area is 10” deeper & 5” taller, with dished work surface and hinge down front)

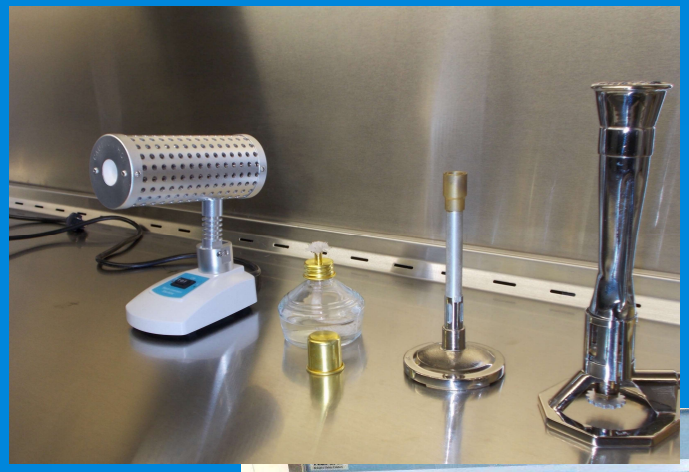
Creating a Secondary Downflow Method for Annual Recertification after passing Microbiological Aerosol Testing.

MYTH: Large lab equipment does not need to be enclosed in a BSC

BUT:

The BSC needs to be fitted for the equipment, and tested to ensure proper containment is maintained.

Baker BSC Mythbusters



https://bakerco.com/communication/bsc-mythbusters/

- Can you use volatile chemicals in a Class II Type A2 Recirculating BSC?
- Does heat really affect my protection?
- Can 2+ people work in a BSC at the same time?
- How much space around a BSC is required to maintain protection?

BAKER
Environments For Scien

If you have any BSC myths that need busting, send them to us!

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