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Baker BSC MYTH BUSTERS

BSC MythBusters

How much space around a BSC is required to maintain proper 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?

A recurring Baker webinar series that puts common BSC beliefs through controlled testing.

Biosafety cabinets (BSCs)

A ventilated enclosure for work with biohazard agents assigned to biosafety levels 1 through 4.

All BSCs contain one or more HEPA filters and a motor/blower.

Provides three types of containment:

- Personnel protection
- Product protection
- Environmental protection



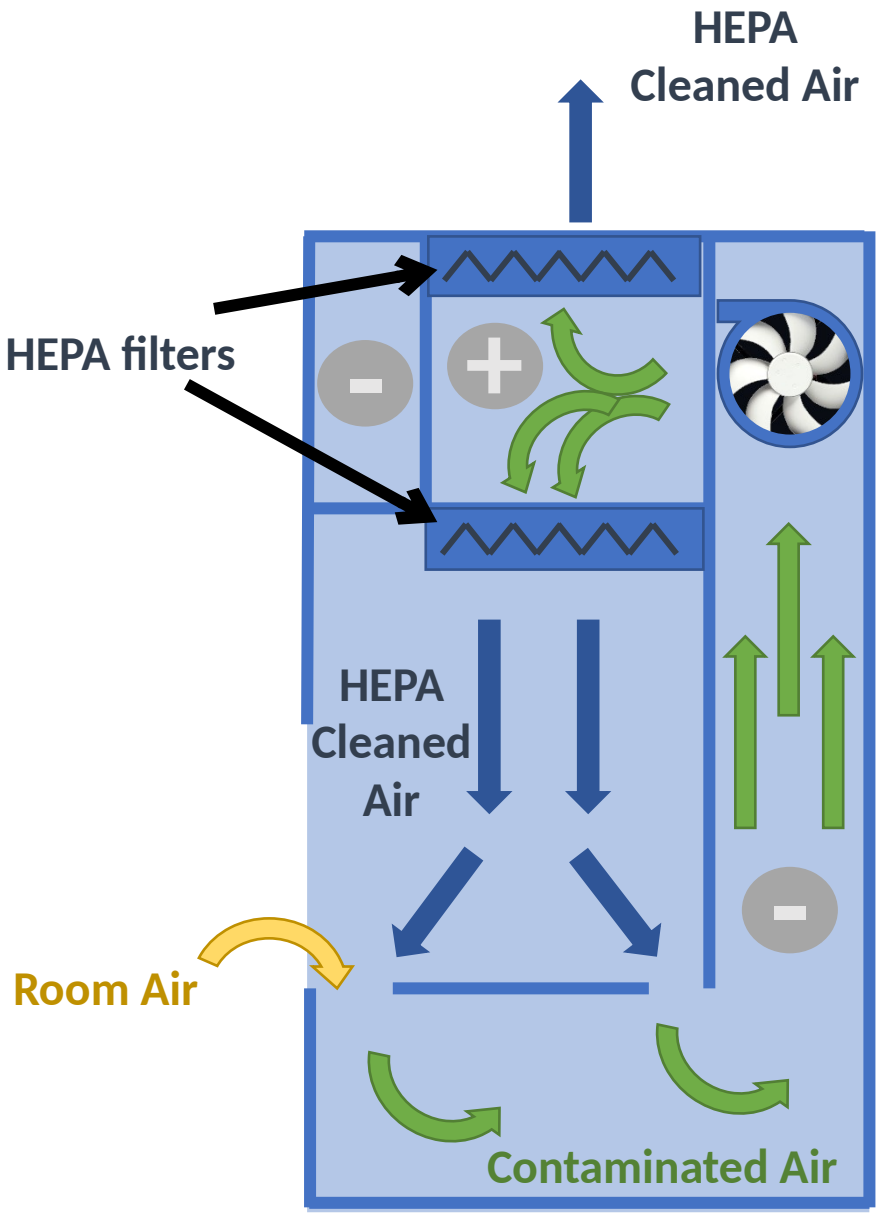
BMBL, 6th Edition, 2020

Class II Type A2 BSCs

Personnel, product and environmental protection from particulates and aerosols.

Minimum 100 fpm intake air.

Partial recirculation.



NSF International, Standard 49

Normal BSC operation

- Strong front intake air
- Side suction slots
- Downward HEPA filtered air
- Smoke split to front and back

- Momentum Air Curtain
- ReadySAFE mode
- Partially recirculating air

Airflow demonstration video https://youtu.be/H-qXtsMdEsE

BSC airflow: Class II Type A2

Directional, volumetric airflow is critical for BSC function and its ability to maintain containment.

Inhibiting this specific airflow quantity and/or pattern will have detrimental effects on protection.

Air flows in or out through:

1. The front access opening
2. The side suction slots
3. The top

Spacing compared in:

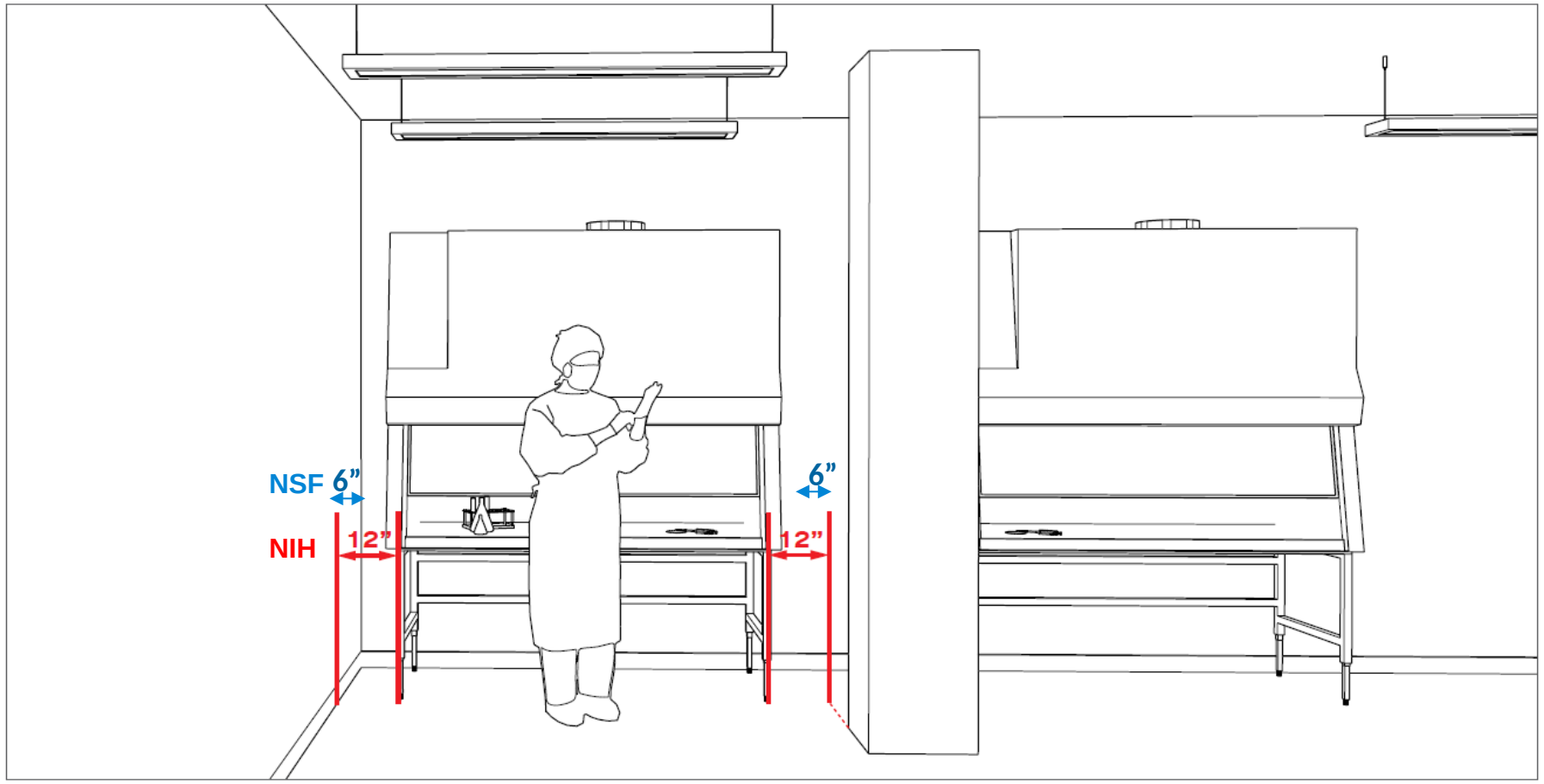
NIH DRM, NSF/ANSI Standard 49, WHO Laboratory Biosafety Manual, BMBL

Tested through:

- Smoke patterning to visualize airflow
- Particle counter to measure air quality
- Microbiological aerosol testing per NSF/ANSI Standard 49



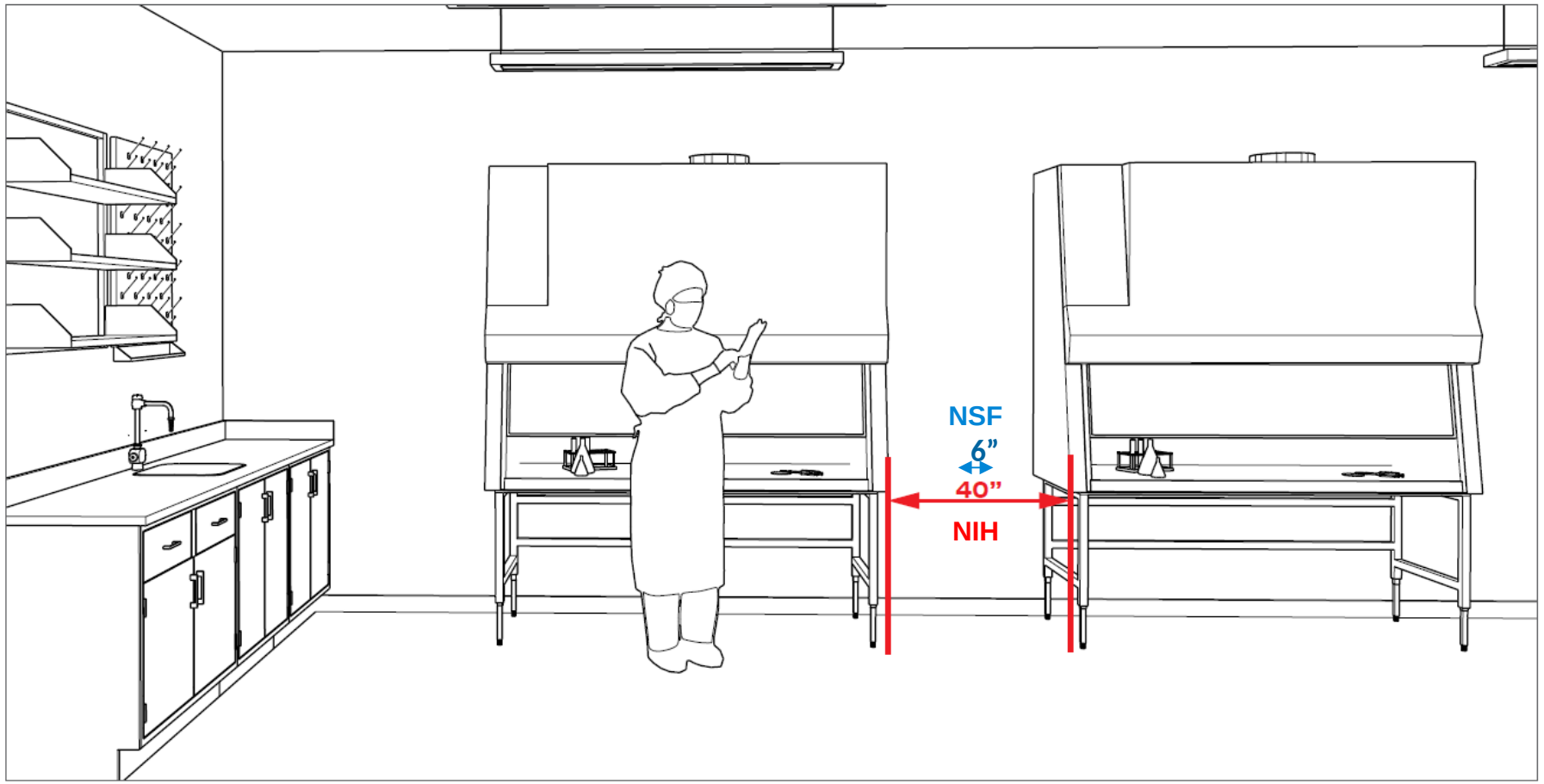
Distance to adjacent walls and columns



Maintain a distance of 12” to adjacent walls and columns. Note: columns can help define traffic routes.

Source: NIH DRM, Appendix A

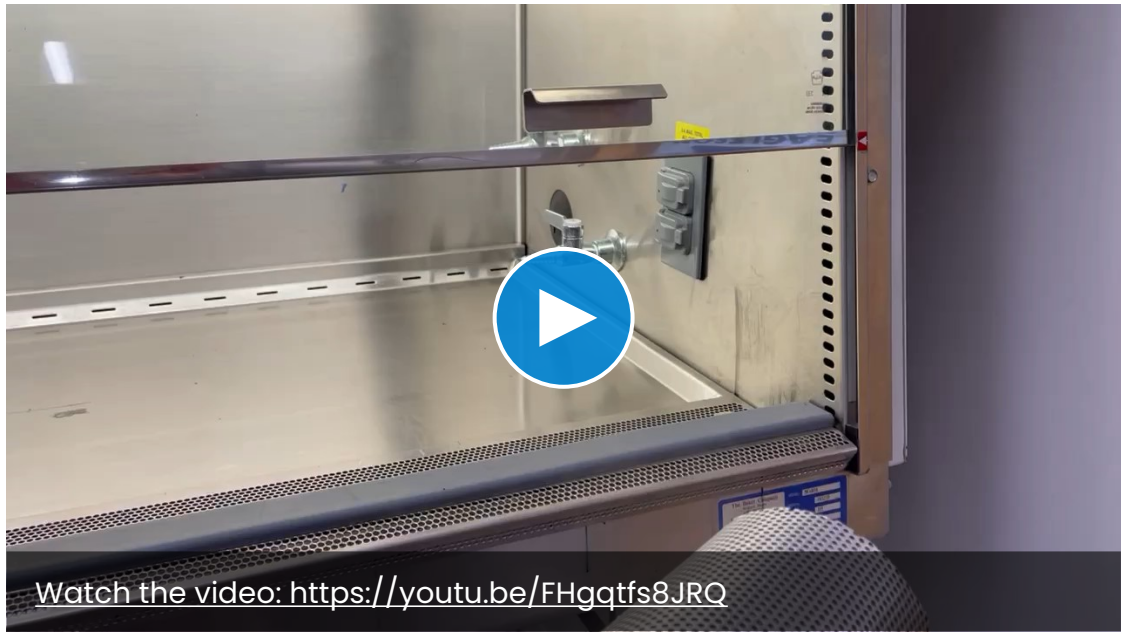
BSC placement along the same wall



Maintain a distance of 40” between BSCs along the same wall.

Source: NIH DRM, Appendix A

Open space beside a BSC





Both BSCs still exhibited perfect particle and smoke containment.

Open space beside a BSC: needed for serviceability



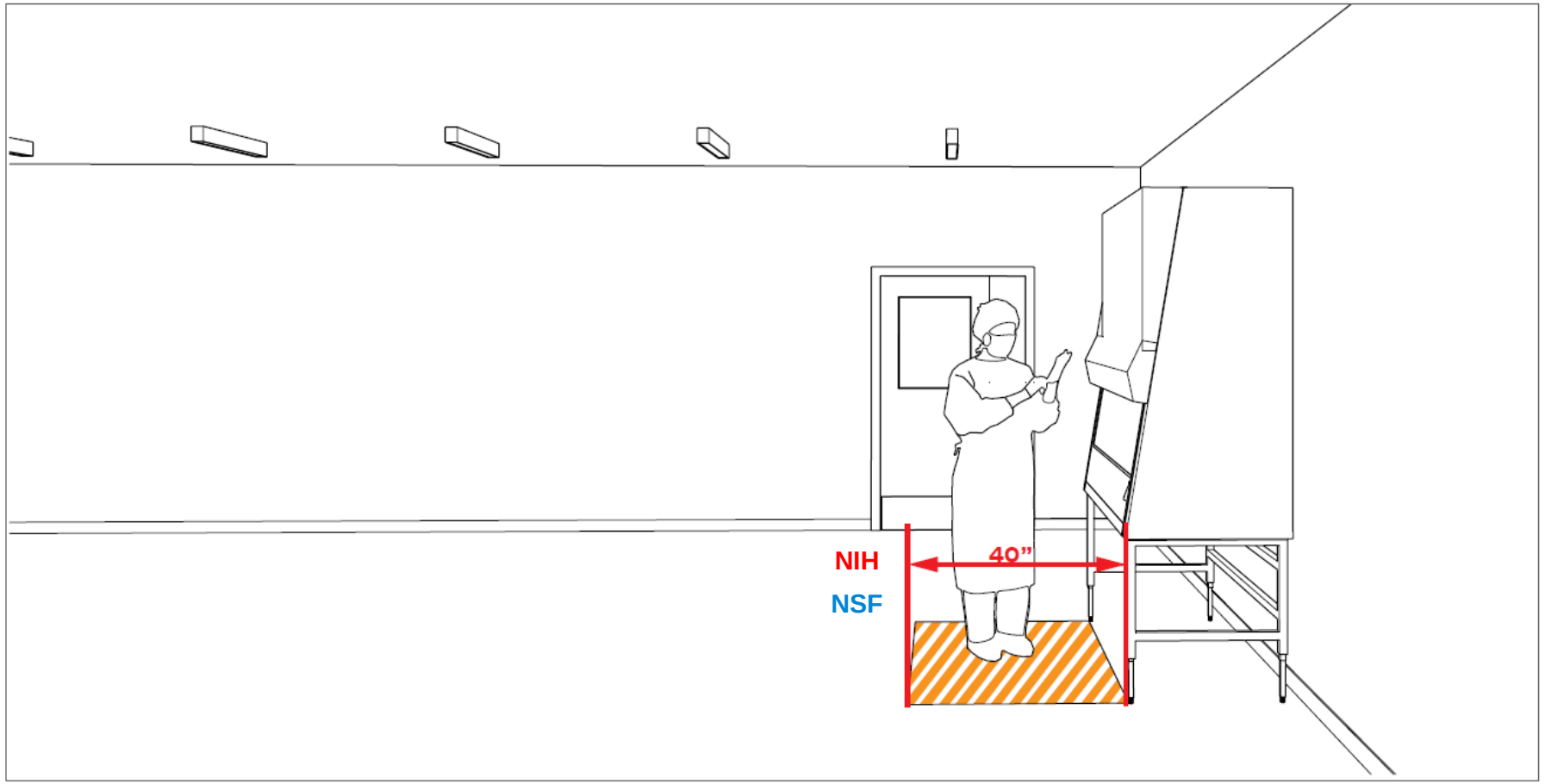




Leave room to reach the side panel, cable ports and gas/vacuum hookups.

Required minimum: 12 inches (30 cm)

Open space in front of a BSC

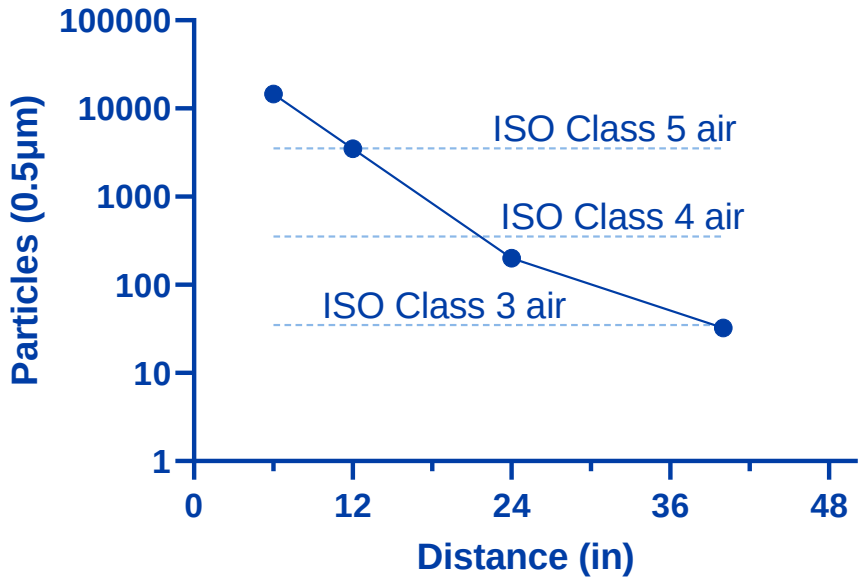


Maintain an undisturbed space of 40” around the BSC.

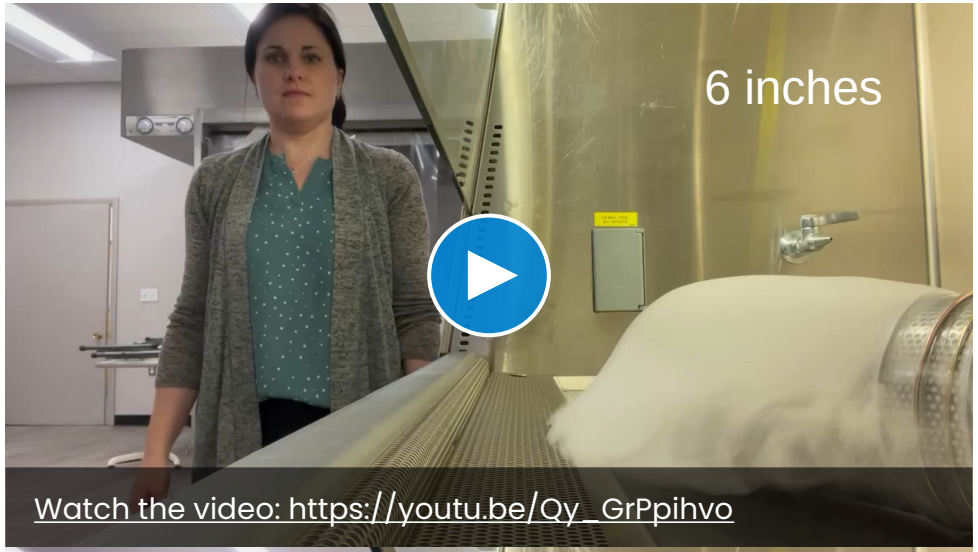
Source: NIH DRM, Appendix A

Open space in front of a BSC: testing

To keep the air inside the BSC as clean as possible, keep walkways at least 24 inches from the front opening. 40 inches is best.

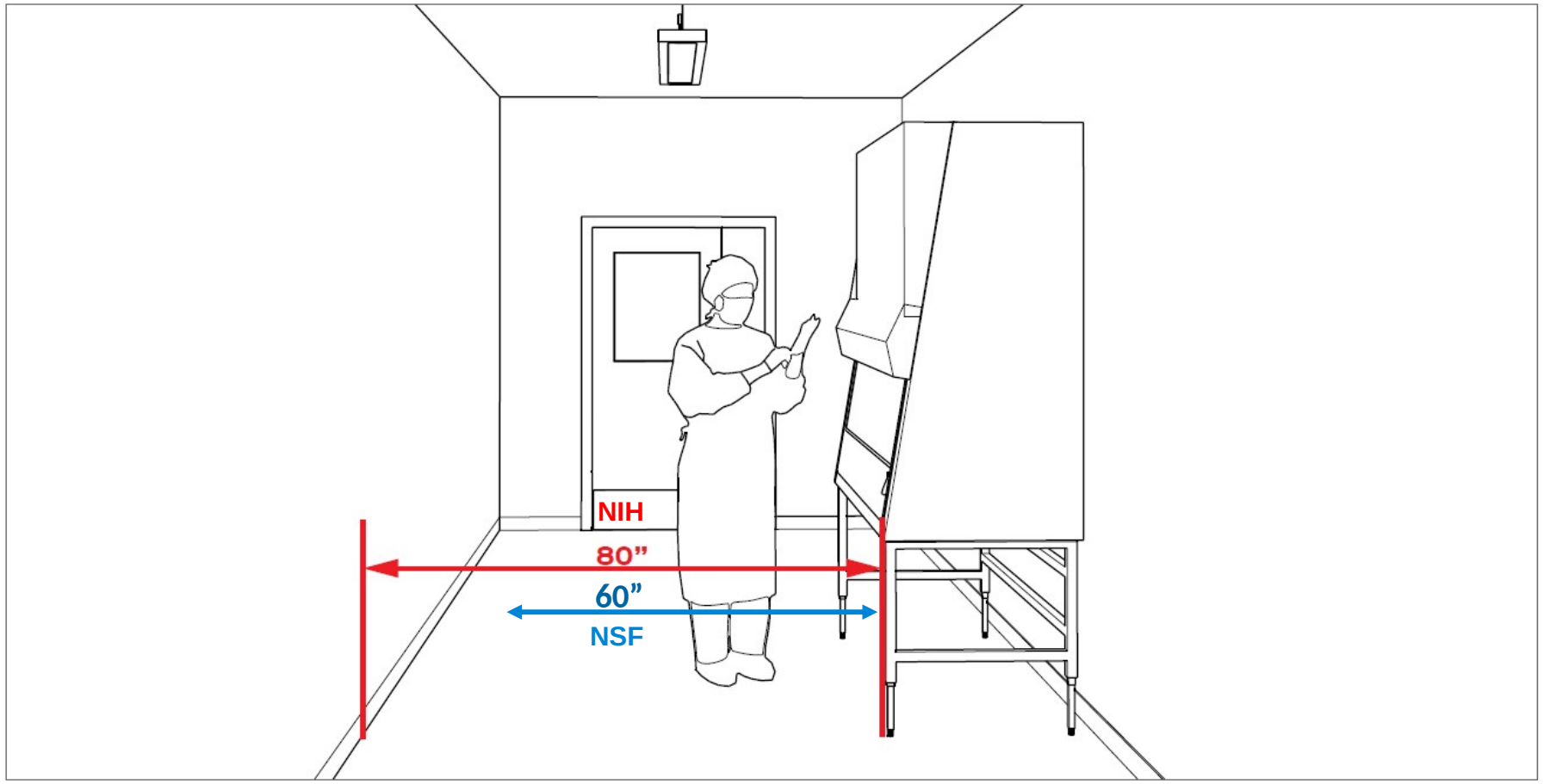


Recommended: 40 inches (100 cm)





Distance to opposing walls



Place BSCs at least 80” from opposing walls.

Source: NIH DRM, Appendix A

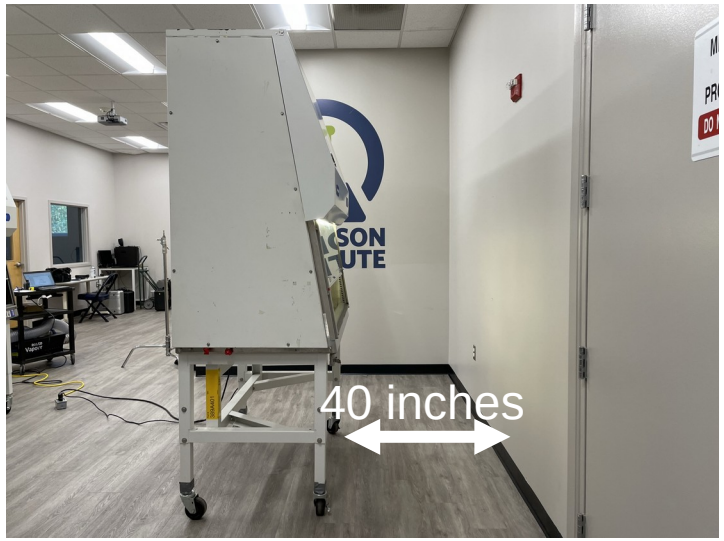
Wall in front of a BSC

Particle counts, walk-by traffic and microbiological aerosol tests at four distances from an opposing wall.

	20”	40”	60”	80”
Maintains particle protection?	✗	✓	✓	✓
Allows travel around the cabinet front?	✗	✗	✓	✓
Microbiological aerosol testing	Not tested	✓	✓	✓

Minimum recommended: 60 inches (150 cm)





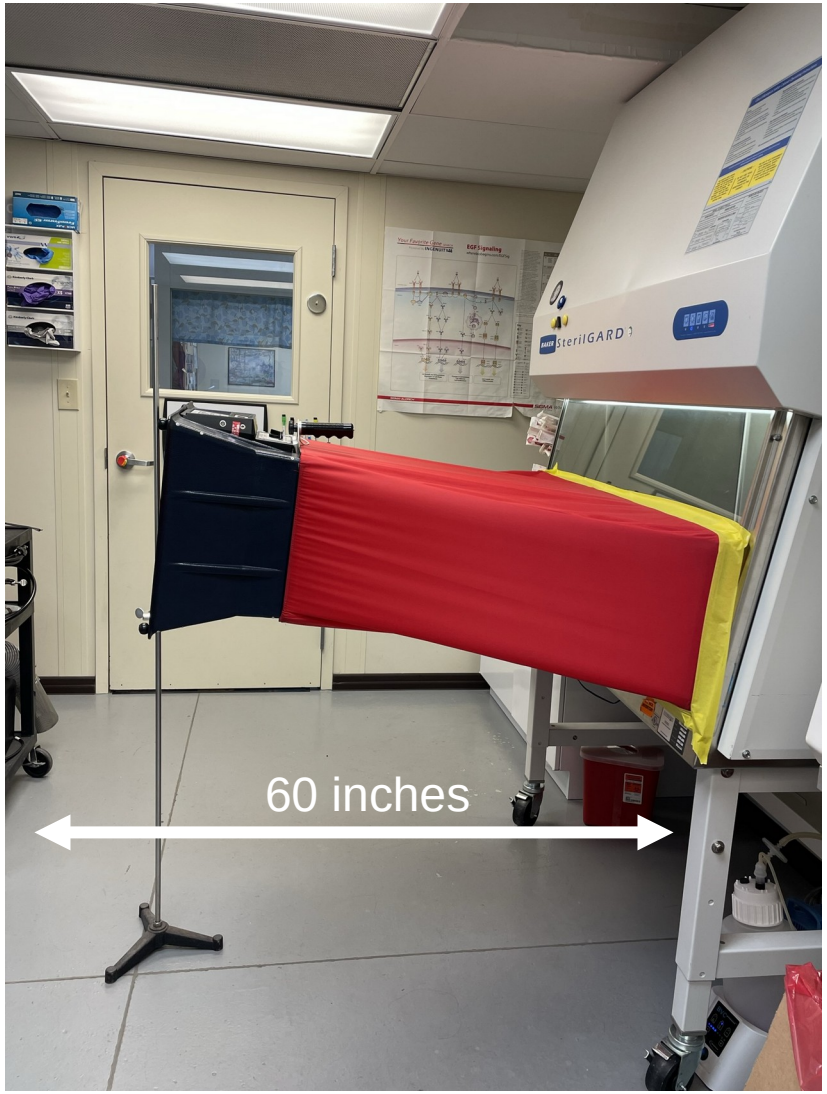
Wall in front of a BSC: serviceability

For serviceability, a certifier needs room for a DIM (direct inflow measurement) hood to balance the cabinet airflow.

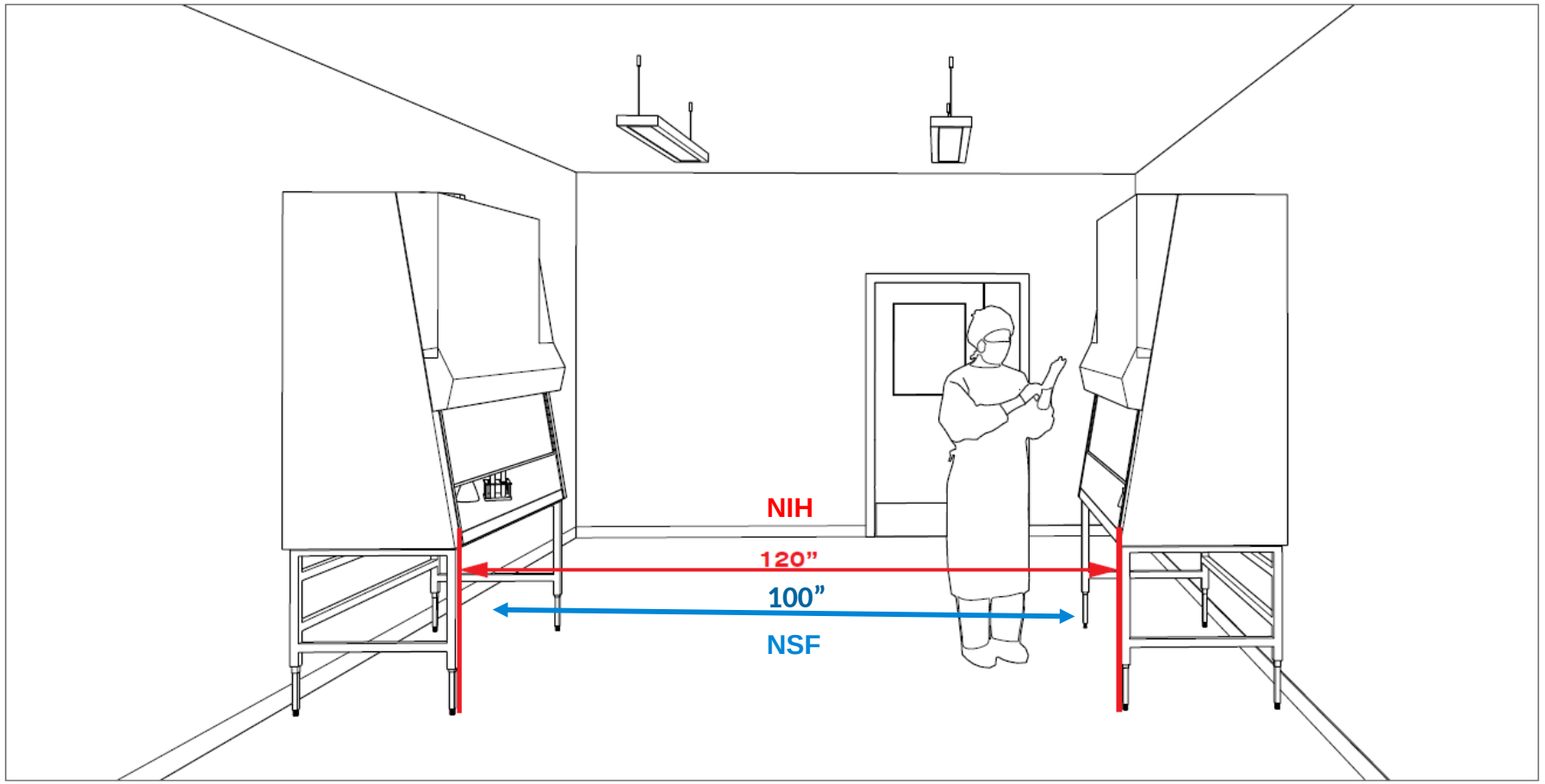
Required space:

- 4 ft BSC: 41” DIM + 12” for accurate airflow measurements = 53”
- 5 ft BSC: 48” DIM + 12” for accurate airflow measurements = 60”
- 6 ft BSC: 51” DIM + 12” for accurate airflow measurements = 63”

Minimum recommended: 60 inches (150 cm)



BSC placement along opposing walls



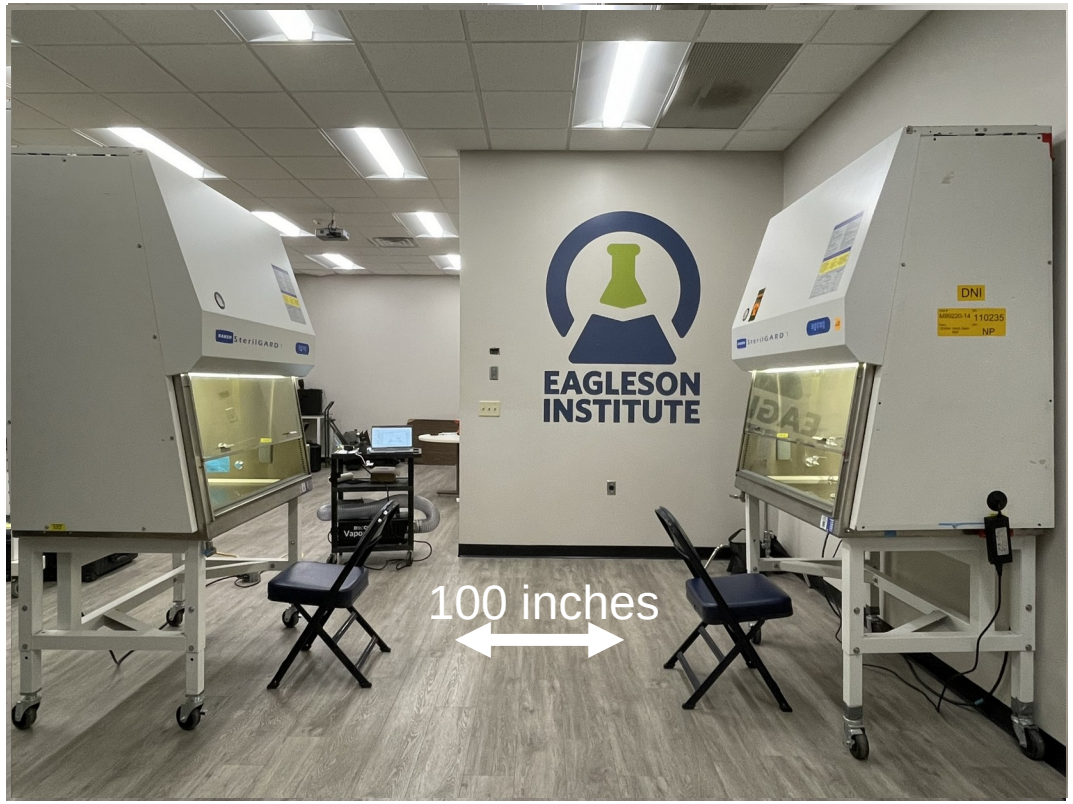
Maintain a distance of 120” between BSCs on opposing walls.

Source: NIH DRM, Appendix A

Two facing BSCs

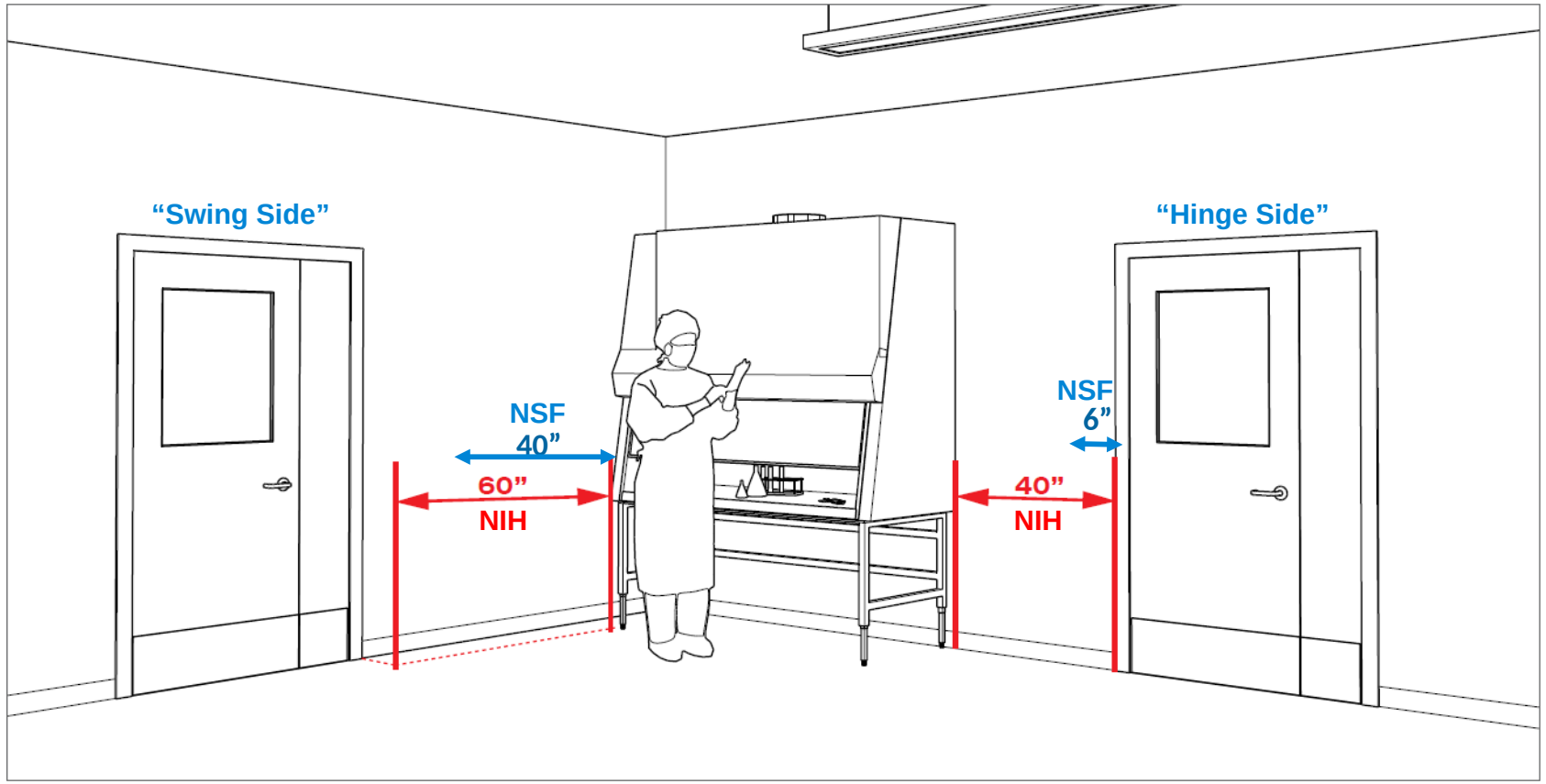
Particle counts and microbiological aerosol tests with two BSCs facing each other.

	60”	80”	100”	120”
Maintains particle protection?	✗	✗	✓	✓
Microbiological aerosol testing	Not tested	✓	✓	✓



Minimum recommended: 100 inches (250 cm)

BSC placement near doorways

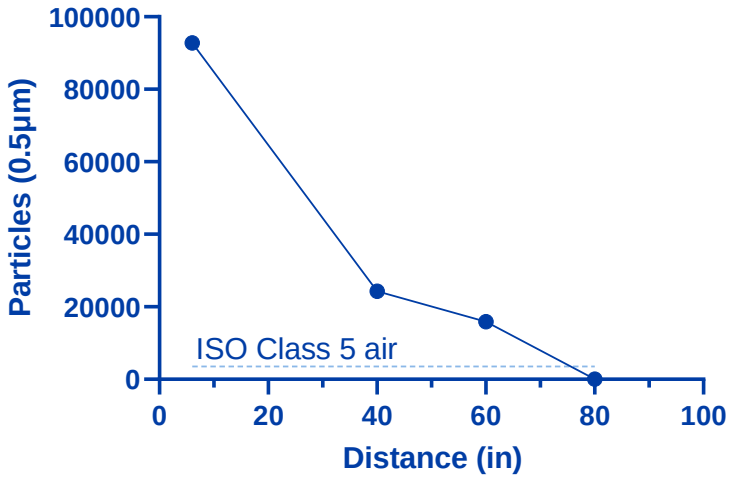


Placing BSCs near doorways is not recommended. If it can’t be avoided, keep 40” from adjacent doorways and 60” from doorways behind the BSC.

Source: NIH DRM, Appendix A

Doors by a BSC: swing side

Door openings can strongly affect the air within the BSC. Gusts and particles were seen up to 40 seconds after the door closed, even 60+” away.





Minimum recommended: more than 60 inches (150 cm)

Doors by a BSC: hinge side

With a door even 6” away, opening and closing it had no effect on air cleanliness within the BSC.



Minimum recommended: 6 inches (15 cm)

Overhead clearance

NSF/ANSI Standard 49: 12 inches
For proper airflow around the hot wire when testing the exhaust HEPA filter

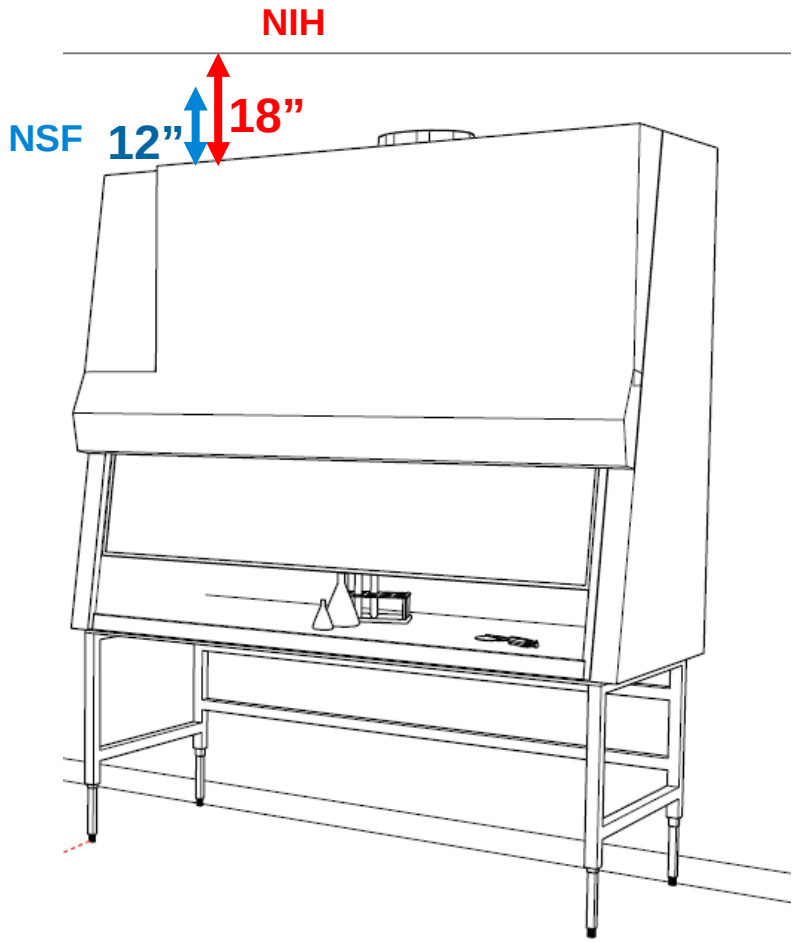
NIH DRM: 14 to 18 inches
To accommodate filter testing, maintenance and access

BMBL: 12 to 14 inches

WHO: 30 to 35 cm
For accurate air velocity readings and filter changes

OSHA 1910.159(c)(10): 18 inches*
**Distance from fire sprinklers*

Required minimum: 12 inches (30 cm)*



Source: NIH DRM, Appendix A

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Several published spacing guidelines can be relaxed, but a door on the swing side needs more room than any of them call for.

Conclusions

Parameter	NIH DRM	NSF/ANSI Standard 49	Baker BSC MythBusters Recommendations
Distance to side wall	12”	6”	**12”**
Side-by-side BSCs	40”	6”	**12”**
Clearance in front of BSC	40”	40”	**40”**
Wall in front of BSC	80”	60”	**60”**
Facing BSCs	120”	100”	**100”**
Door, hinge side	40”	6”	**6”**
Door, swing side	60”	40”	**>60”**
Overhead clearance	14 to 18”	12”	**12”**

Conclusions (metric)

Parameter	NIH DRM	NSF/ANSI Standard 49	Baker BSC MythBusters Recommendations
Distance to side wall	30 cm	15 cm	**30 cm**
Side-by-side BSCs	100 cm	15 cm	**30 cm**
Clearance in front of BSC	100 cm	100 cm	**100 cm**
Wall in front of BSC	200 cm	150 cm	**150 cm**
Facing BSCs	300 cm	250 cm	**250 cm**
Door, hinge side	100 cm	15 cm	**15 cm**
Door, swing side	150 cm	100 cm	**>150 cm**
Overhead clearance	35 to 45 cm	30 cm	**30 cm**

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Thank you, Eagleson Institute

Thanks to the Eagleson Institute for letting us use their space for this testing.



BSC MythBusters: upcoming topics

- Can you use volatile chemicals in a Class II Type A2 recirculating BSC?
- Does heat really affect my protection?
- What disinfectants can I use in my BSC?
- Is a UV light effective?
- Can a HEPA capture DNA?
- Can two or more people work in a BSC at the same time?

Follow Baker on LinkedIn to keep up with all the new science!



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Thank you

Questions, or want a 1-on-1 discussion on the points covered in this webinar?

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https://bakerco.com/science-partnerships/bsc-mythbusters/