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Ask the Expert:

Biosafety Cabinet Surface Decontamination Considerations



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You may be very familiar with performing work in a biosafety cabinet (BSC) and the need to wipe down the work surface with a disinfectant after you complete your experiments but what about decontaminating it before you begin working? Have you ever wondered why you have been told to wipe down the BSC surfaces with water or 70% ethanol following disinfection with bleach or how you can reach the back wall of the BSC to decontaminate it without putting your head or upper body into the cabinet? In this article, we will discuss the importance of decontaminating your BSC both before and after use, how to choose an appropriate disinfectant, and techniques and tips that can be used to help you decontaminate the BSC. Although disinfecting the BSC surfaces after a spill of biohazardous materials is a very important topic, it has been covered elsewhere,¹³ so we will focus only on routine BSC surface decontamination in this article.



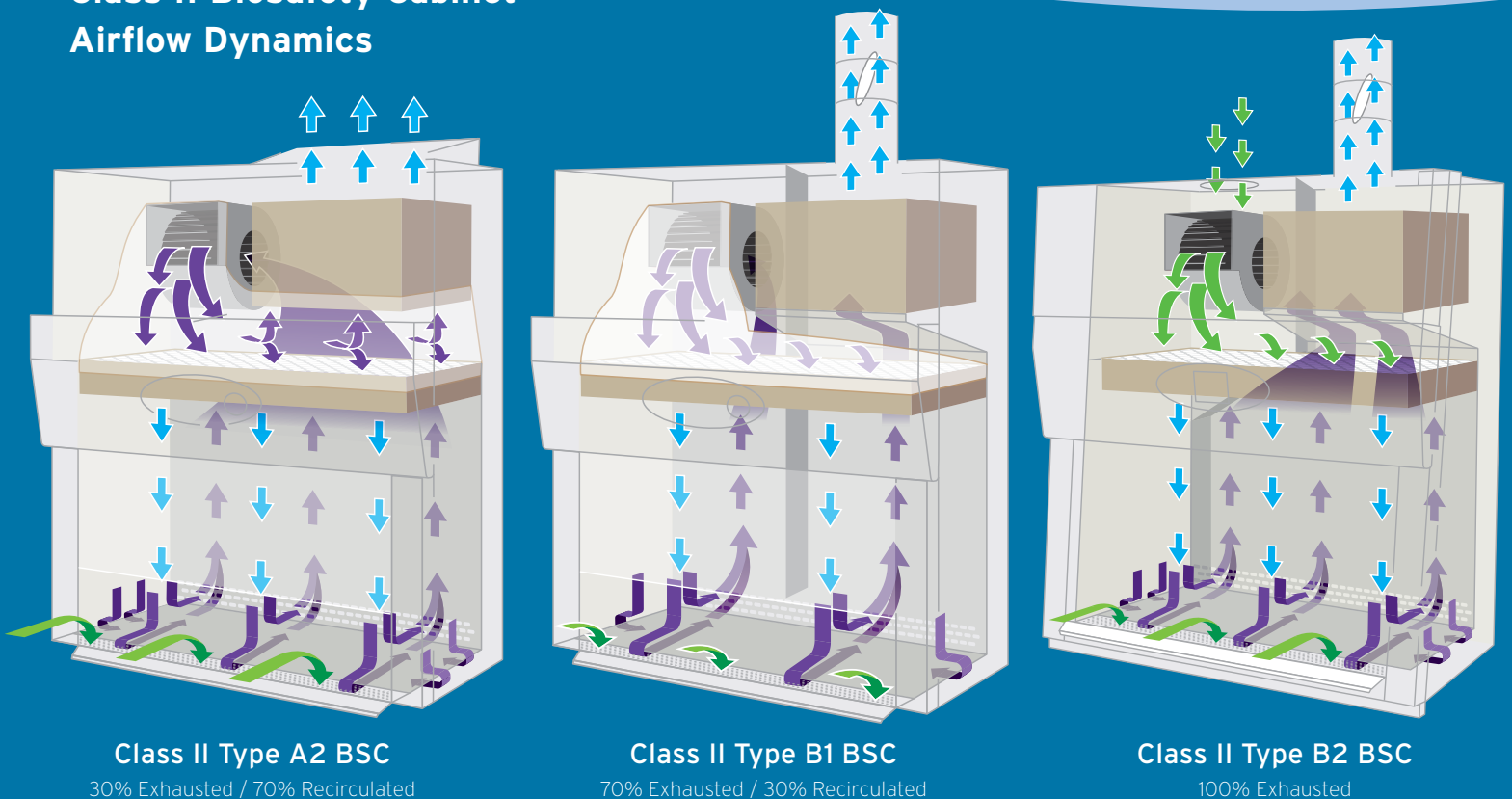
Standard Class II Type A2 Biosafety Cabinet

The Importance of Decontaminating Your Biosafety Cabinet

Decontamination is a process performed to treat surfaces or materials in a way such that they are no longer expected to be able to transmit diseases and are therefore safe to handle or manipulate. Many guidance documents and videos describe the need to decontaminate the inner surfaces (the work surface, sides, back, and inside the glass sash) of the biosafety cabinet after you complete your work session and at the end of the day;⁴⁻⁸ but did you know that these documents also recommend decontaminating the cabinet before you begin your work?^{4-7,9-10} For BSCs that are designed to provide product protection, it is important that the work zone of the BSC is both allowed to purge the existing air inside and is decontaminated with an appropriate disinfectant prior to beginning your work.^{4,5,9,10} This helps to ensure that only HEPA filtered air is provided to the work surface while you are working and that the internal surfaces of the BSC are not a source of contamination for your biological materials.

To allow for easier clean-up and decontamination at the end of your work, several sources suggest that the use of plastic-backed absorbent bench paper on the cabinet's work surface should be considered. However, if you use absorbent bench paper, ensure that it does not block the front or rear air grilles or otherwise impact the airflow inside the work zone.^{4,7,9} After completing work with biohazardous materials in the BSC, you should secure and surface decontaminate these materials and any other lab supplies or equipment (mechanical pipettes, pipette tips, vortexes, etc.) before removing them from the BSC. The absorbent bench paper on the BSC's work surface, if used, and any other wastes should be secured within the BSC and properly disposed of and finally all internal surfaces of the BSC should be decontaminated again.⁴⁻⁸ This post-work decontamination is important to clean-up any potential droplets, small spills, or aerosol deposition of biological materials that may have occurred during your work in the BSC.

Class II Biosafety Cabinet Airflow Dynamics



How to Select an Appropriate Disinfectant

Now that you understand when and why you should decontaminate the internal surfaces of your biosafety cabinet, it is important to understand both the purpose of performing decontamination and material compatibility. Oftentimes, liquid chemical disinfectants are used to decontaminate the internal surfaces of BSCs. The type and concentration of these chemical disinfectants will vary depending on the specific microorganisms that are being used in the work. Based on their cellular structure, different microbes have different relative levels of resistance to chemical disinfectants. These organisms range in order from very resistant to less resistant including prions, bacterial spores, *Mycobacterium* species, non-enveloped viruses, fungi, vegetative bacteria, and enveloped viruses, respectively.⁴ Though, there are caveats to this simplified level of resistance based on the specific organism and the form it takes.⁴ There are three types of chemical disinfection processes outlined by the United States Food and Drug Administration (FDA) including high-level, intermediate-level, and low-level disinfectants that may be used on medical devices in healthcare facilities.⁴ The disinfectants that may be used in the laboratory can fall into these different levels and their use will depend on the resistance of the microbes handled and the types of surfaces or materials that need to be decontaminated. Chemicals that may be used to decontaminate your BSC can include high-level (peracetic acid and chlorine dioxide), high-level to intermediate-level (glutaraldehyde, hydrogen peroxide, and hypochlorites), intermediate-level (alcohols), intermediate-level to low-level (iodophors and phenolics), and low-level (quaternary ammonium compounds) disinfectants.^{4,5} Since the biological materials used in different BSCs will vary, a risk assessment must be performed to select a disinfectant that is effective against the agents regularly used in your particular work.^{6,10}

If using a corrosive disinfectant, such as chlorine bleach, it is very important to consider its compatibility with your cabinet's stainless-steel surfaces and other materials that make up the interior of the biosafety cabinet. It is recommended that you immediately wipe down surfaces again after the corrosive disinfectant's recommended contact time using either sterile water, sodium thiosulfate solution, or 70% ethanol to remove any remaining chemical residues. If this

If using a corrosive disinfectant, such as chlorine bleach, it is very important to consider its compatibility with your BSC's stainless-steel surfaces and other materials that make up the interior of the biosafety cabinet.

follow-up step is not performed, the disinfectant can quickly cause degradation and pitting of the stainless-steel which may allow microorganisms in the pits to avoid contact with disinfectants and survive.^{5,6,8,9} When using any chemical disinfectants, ensure that they are applied safely, including having appropriate hazard communication labeling, donning any required personal protective equipment (PPE), and following the manufacturer's instructions for proper usage, concentration, contact time, and approved surfaces.⁴

To assist you in completing this risk assessment, the United States Environmental Protection Agency (EPA) maintains several lists of disinfectants that are effective against different microbes. These specific antimicrobial products have had laboratory testing performed that shows that they kill the organism(s) specified and have submitted those results to the EPA for official review. These lists can contain a plethora of useful information about the antimicrobials including the active ingredient(s), the contact time to kill the organism(s), whether the disinfectant is ready-to-use or needs to be diluted, and what types of surfaces it should be used on (porous or hard, nonporous surfaces).¹¹

Stainless-steel interior quickly erodes when coated with bleach or other corrosive disinfectants.



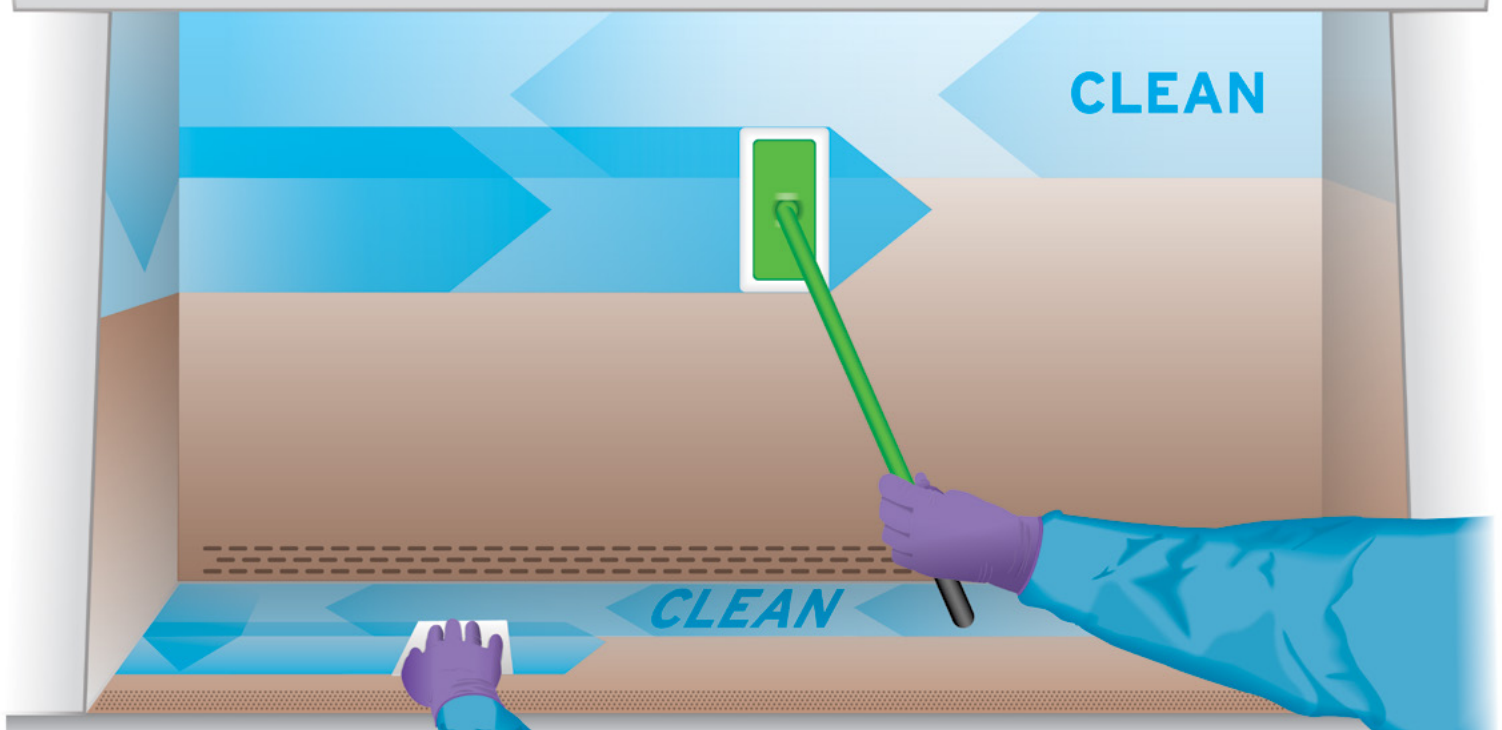
Where and How to Decontaminate Your Biosafety Cabinet

Once you have determined the appropriate disinfectant for the organisms used in your biosafety cabinet and prepared it according to the manufacturer's instructions for use, it is time to decontaminate your BSC. Prior to decontaminating your BSC, ensure there are no equipment or supplies inside the work zone^{5,9} and that the interior surfaces are free of any waste materials such as animal bedding, feed, and their wastes, plastic-backed absorbent bench paper, and sharps (glass cover-slips, needles, scalpels, glass Pasteur pipettes, etc.). It is especially important to check for potentially sharp objects on the work surface and the drain pan underneath the work surface prior to wiping directly with your hand.

Informative videos demonstrating BSC decontamination methods and techniques are available from the Centers for Disease Control and Prevention (CDC) and World Health Organization (WHO).^{7,10} While the BSC is running, all of the internal surfaces of the BSC should be treated with the disinfectant selected during your risk assessment. This includes the work surface, the side walls, the back, and the inside of the glass front sash.^{4,5,7-10} The disinfectant should be used for the appropriate contact time for the agent(s) as recommended by the manufacturer and the EPA.^{5,8,11} If you are unable to reach the side walls or the back of your cabinet to wipe with your arm you can use a mechanical device, such as an extendable mop. **You should never lift the sash to enter the BSC or otherwise put your head or upper body into the work zone of the BSC to decontaminate it.**^{7,9}

The recommended method of applying the disinfectant varies depending on the source of the guidance and ranges from squirting or spraying the disinfectant directly onto the biosafety cabinet's internal surfaces^{8,10} to moistening absorbent materials such as paper towels and then wiping the surfaces.^{7,9} Your BSC decontamination technique should be defined during your risk assessment and may be dependent upon the type of chemical disinfectant that is used. For example, when squirting or spraying disinfectant directly onto surfaces, it is possible that the chemical may get into the air grilles or other internal surfaces of the BSC that may not be accessible for additional wipe down and that damage to the stainless-steel components may occur in places that cannot be reached.⁹ As mentioned earlier, if you are using a corrosive disinfectant such as chlorine bleach, you should follow up with a second wipe down with sterile water, sodium thiosulfate solution, or 70% ethanol to remove the residue that may corrode the stainless-steel components of the BSC.^{4,5,8,9} Make sure that chemical disinfectants are properly labeled, used safely according to the manufacturer's instructions, and are appropriate for your specific application.^{4,5,9}

If a spill occurs while working with biohazardous materials in the BSC, especially if the spill breaches the BSC's front or rear air grilles, the surface decontamination methods described above will not be sufficient to decontaminate the spilled materials. Consult your institution's spill clean-up procedures for additional details on spill response and reporting.



Conclusion

It is important to ensure that you decontaminate your BSC before and after performing work with biological materials. Understanding what microbe(s) will be handled in the BSC and their relative level of chemical resistance are critical pieces of information that are needed to conduct a risk assessment to determine the appropriate disinfectant for use in the BSC. The biological materials will impact the chemical concentration and contact time while the type of disinfectant selected will impact

the need to remove any remaining chemical residues. While performing decontamination, it may be useful to employ a mechanical device to assist you in reaching the sides and back wall of the BSC. The decision to apply disinfectant chemicals directly to BSC surfaces or to apply to a paper towel and then wipe it onto surfaces should be considered as part of your risk assessment and account for the materials compatibility of the selected disinfectant.



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