

CLEAN

WORKING

DIRTY

Ask the Expert:

Biosafety Cabinet Waste Management



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You may be familiar with the importance of performing work with biohazardous materials in a biosafety cabinet (BSC) to contain potentially infectious aerosols and splashes, but did you know that it is also important to collect and contain all of the biohazardous wastes you generate inside the BSC until work is completed? In this article, we will discuss what categories of biohazardous waste may be generated while working in a BSC, how to safely contain waste within the BSC, how to remove waste containers when work has completed, and options for safe disposal of these biohazardous wastes.

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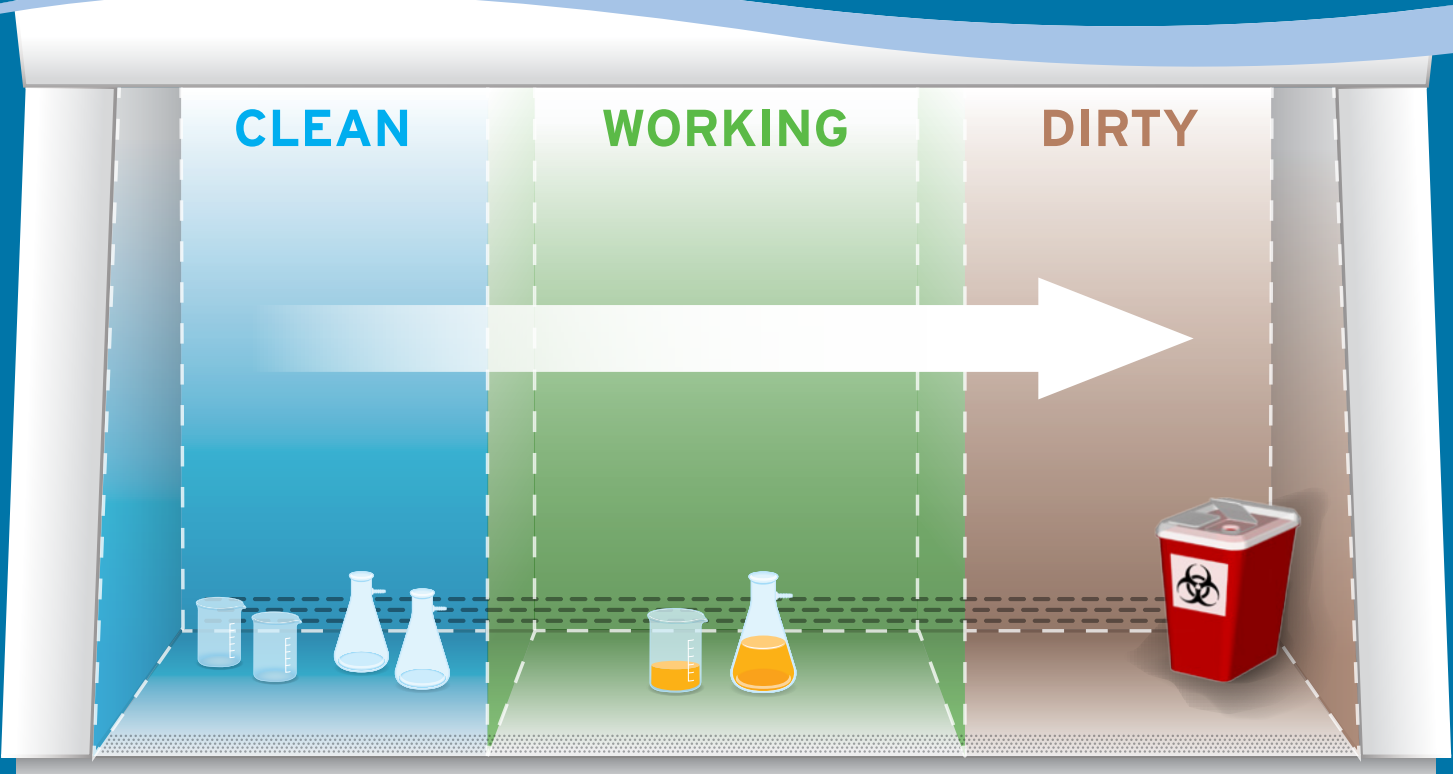
Standard Class II Type A2 Biosafety Cabinet

Categories and Containment of Biohazardous Wastes within a BSC

Class II biosafety cabinets are utilized to protect the user, the environment, and the work product from exposure to, or splashes of, potentially infectious materials generated while working with biological materials.^{1,2} Once these biological materials and the supplies used to manipulate, process, or store them are no longer needed or usable for their intended purposes, they are considered biohazardous wastes. Generally speaking, biohazardous waste is generated in one of two forms, liquid waste or solid waste. Based on the hazardous properties of solid biohazardous waste, it is usually categorized into either sharps waste (needles, glass, scalpels, etc.) or non-sharps solid biohazardous waste. It is possible that while working in the BSC with biological materials, any of these three classifications of biohazardous waste could be generated.

For that reason, it is important to think about the containment of any biohazardous wastes generated during the handling of biological materials and their subsequent decontamination and disposal.³ Many organizations recommend in their guidance documents and videos that one place all materials needed for

work, including biohazardous waste containers, inside the BSC before beginning work.^{1,4-6} But why is it so important to collect all biohazardous wastes generated from work in the BSC within the cabinet? Well, when working with biological materials, potentially infectious aerosols may be created when force is exerted on liquids containing them.² This is the primary reason work that may generate these aerosols should be conducted in a BSC in the first place. However, the air curtain generated by the BSC that protects the user from the escape of these aerosols is relatively delicate and subject to disruption.^{1,2,4} Biosafety cabinet users may compromise the containment barrier by frequently or repeatedly moving or sweeping their arms in and out of the cabinet, such as when discarding wastes in a container located outside of the BSC.^{1,2,4} This movement can both cause potentially infectious aerosols to exit the cabinet and also allow for non-filtered room air to enter the BSC's work area, which may impact aseptic technique and lead to product contamination!¹ Therefore, to maintain the BSC's personnel and product protection, it is important to contain biohazardous wastes that are generated in the cabinet in containers that remain in the BSC during work.



Collect wastes inside the BSC on the designated "dirty" side of the work zone.

Biohazardous Waste Collection Containers and Removal from the BSC

Since the types of biohazardous waste collection devices and containers depend on the classification of wastes generated, it is important to review your technical procedures so you can anticipate your needs to add these items to the BSC prior to beginning work. Waste containers should be located towards one side of the BSC based upon the principle of working from “clean” to “dirty” within the cabinet.^{1,6}

Liquid Biohazardous Waste Collection

Liquid biohazardous waste should be collected in leak-proof, closable containers. If aspiration bottles or suction flasks are used, they should be connected to an overflow flask that contains an appropriate disinfectant and an in-line HEPA or similar filter.¹ The primary container should contain a sufficient amount of an appropriate disinfectant to achieve the necessary concentration of disinfectant after it has been filled with the biological solution.¹

Sharps Waste Collection

Biologically contaminated sharp waste items should be collected in specially designed biohazardous sharps containers that are puncture-proof, leak-proof, and that permanently close.³ Care should be taken to ensure the smallest appropriate sharps container is selected for use since large sharps containers may impact the downward airflow of the BSC.¹

Non-Sharps Solid Biohazardous Waste Collection

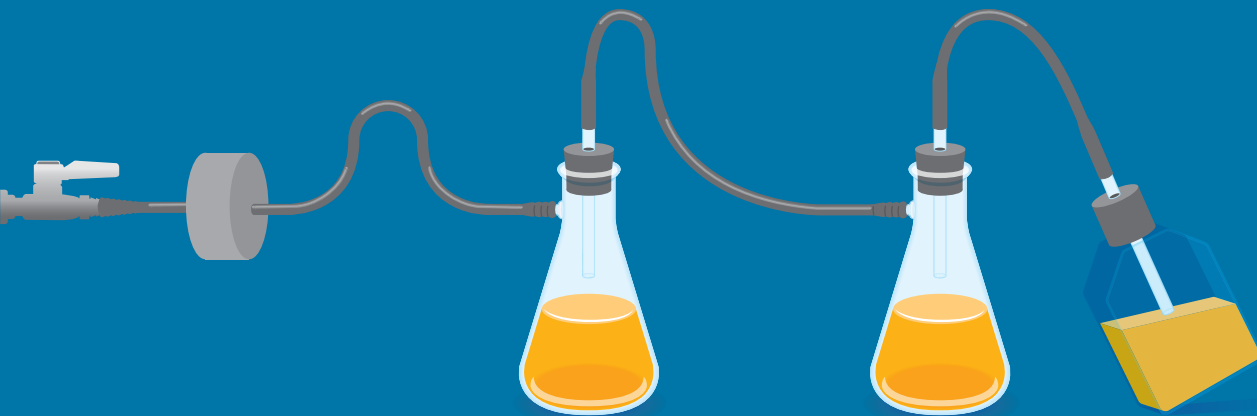
Non-sharps solid biohazardous waste containers can include bags, trays, and other similar leak-proof, closable containers. Much like large sharps containers, other tall non-sharps solid biohazardous waste containers may impact the downward airflow over the BSC’s work surface. Because of this potential airflow disruption, based on their size and orientation, horizontal pipette trays are recommended over vertical trays.^{1,5} These trays or other hard-walled containers may have an appropriate liquid chemical disinfectant placed into them before initiating biohazardous waste collection.¹ When the containers are pre-filled with a disinfectant, the waste items should be added in a way that avoids splatter and the containers should be closed between additions of waste.¹

All of the biohazardous waste collection containers described above should be closed or covered with their appropriate lid and surface decontaminated prior to removal from the BSC.^{1,4,6,7} If the waste is placed into a secondary container prior to removal from the BSC, this container should also be surface decontaminated.¹ The waste and/or secondary containers may then be placed into larger waste pans or biohazardous waste containers outside of the BSC or they may be taken directly for further decontamination and/or final disposal.^{1,7}

Decontamination and Disposal of Biohazardous Wastes

Some organizations are able to effectively decontaminate all of their biohazardous waste on-site, however, some may only be able to decontaminate certain wastes (or none at all) and have to package and send the remaining biohazardous waste to an appropriate facility for decontamination.³ Nevertheless, all laboratories that generate biohazardous waste must ensure that the wastes are either safely and successfully decontaminated prior to release or removal from the facility, or that they are securely and appropriately transported off-site for appropriate treatment and disposal.³ These materials must be properly packaged to ensure the safety of any personnel who may come into contact with them during packaging, transportation, and treatment, including the laboratory staff, the waste pickup vendor, and the waste treatment staff.³

The physical location of the laboratory, federal, state, and local regulations, the authority having jurisdiction over your facility, and the type of biohazardous wastes that are being generated will impact how they are able to be treated and released from the laboratory. The information below is provided as examples of some options for treatment of biohazardous wastes, however, they may not be applicable to your laboratory because of your local conditions, biological agents used, waste pickup vendor, and many other circumstances. **Always ensure you check with your safety office or safety subject matter expert and local regulatory authority before decontaminating and disposing of any biohazardous wastes.** Ideally, you should ensure you know how to appropriately decontaminate and dispose of any biohazardous wastes you will generate before they are created and collected.



Aspiration bottles or suction flasks should be connected to overflow flasks and an in-line HEPA (or similar) filter.

Liquid Biohazardous Waste

Liquid biohazardous wastes may be decontaminated on-site with chemical disinfectants or by autoclaving, or they may be collected and packaged for treatment off-site.^{1,3} After chemical disinfection or autoclaving it may be possible to dispose of these liquid wastes in the sewer system,^{1,3} however, this will depend on the type of chemicals used, the organization's policies, and the local sewer authority's regulations. It is possible that the chemicals used for decontamination or as part of the research protocols may warrant segregation and disposal as chemical or mixed (biological and chemical) wastes. Autoclaving liquid biohazardous waste often avoids the use of hazardous chemicals and the creation of by-products during treatment; however, it is important to note that some liquid biohazardous wastes cannot be autoclaved because of the presence of certain chemicals in them and the hazards caused by autoclaving those materials.³

Solid Biohazardous Wastes

Chemical disinfection is not typically a preferred method of decontamination of solid wastes because ensuring contact with all of the materials' surfaces for the required contact time ranges from difficult to impossible.³ Most often, autoclaving or incineration are the most appropriate methods for treating this waste before disposal^{1,3} since autoclaving is the most effective and reliable process for decontaminating laboratory materials and biohazardous wastes.³ Autoclave cycle validation should be performed on different types of waste to ensure it is being adequately sterilized. Depending on the organization, autoclaving may occur on-site, or the solid wastes may be appropriately packaged and transported to another facility for autoclaving and final disposal. Disposal of solid biohazardous wastes after on-site autoclaving depends on the organization's policies, safety protocols, and local regulations, so be sure to contact your safety office or safety subject matter expert to ensure that these wastes are properly treated before release from the facility. Incineration most often occurs through the use of a waste treatment vendor, so biohazardous wastes must be packaged for transportation to that facility for treatment and final disposal.

“ Ideally, you should ensure you know how to appropriately decontaminate and dispose of any biohazardous wastes you will generate before they are created and collected. ”

Conclusion

Laboratory procedures performed in a biosafety cabinet may lead to the generation of both liquid and solid biohazardous wastes. It is critically important to collect these wastes inside of the cabinet while working to ensure that splashes of biological materials and potentially infectious aerosols are not released from the BSC. This BSC waste collection best practice also helps avoid the introduction of non-filtered air into the work surface and potential contamination of the research product due to the disruption of the cabinet's air curtain through the repeated movement of an individual's hands carrying waste outside of the BSC. Laboratory staff should plan for biohazardous waste collection needs prior to beginning work in the BSC and all waste containers should be both leak-proof and closable. Selection of biohazardous waste

containers should match the hazards of the waste (e.g., sharps devices) and not impact the BSC's airflow. Prior to removal from the cabinet for decontamination and disposal, these waste containers should all be closed and surface decontaminated. The method(s) of decontamination for both liquid and solid biohazardous wastes depend on a number of factors including the biological materials in use, chemicals present in the waste, the organization's policies, their safety procedures, and the federal, state, or local regulations for the disposal of biohazardous wastes that apply to your laboratory. When in doubt on how to properly decontaminate and dispose of your laboratory's biohazardous wastes, ensure that you check with your safety subject matter experts before you begin generating and collecting these wastes.



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References:

1. CDC/NIH Biosafety in Microbiological and Biomedical Laboratories (BMBL) 6th Edition: <https://www.cdc.gov/labs/bmb/>
2. WHO Biological Safety Cabinets and Other Primary Containment Devices monograph: <https://www.who.int/publications/i/item/9789240011335>
3. WHO Decontamination and Waste Management monograph: <https://www.who.int/publications/i/item/9789240011359>
4. NSF/ANSI 49 -2022 Biosafety Cabinetry: Design, Construction, Performance, and Field Certification Informative Annex 1: <https://webstore.ansi.org/standards/nsf/nsfansi492022annex>
5. WHO Biological Safety Cabinet (BSC) 2: Preparatory Steps: <https://www.who.int/activities/strengthening-public-health-laboratory-services/videos> AND <https://www.youtube.com/watch?v=4DoHJS8JL4U>
6. WHO Biological Safety Cabinet (BSC) 3: Best Practices for Safe Usage: <https://www.who.int/activities/strengthening-public-health-laboratory-services/videos> AND <https://www.youtube.com/watch?v=18QEJUA9XBs>
7. CDC Fundamentals of Working Safely in a Biological Safety Cabinet (BSC): Completing Work in a BSC: <https://www.youtube.com/watch?v=ZrD3BPYwwG8>



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