

Sensors and Actuators
Dr. Hardik J. Pandya
Department of Electronic Systems Engineering
Indian Institute of Science, Bengaluru

Lecture - 16
Introduction to Cleanroom Equipments: Biosafety Hood and safety

There are three kinds of Bio Safety Levels (BSL)

- Level 1, also called BSL1
- Level 2, also called BSL2
- Level 3, also called BSL3

We will be studying about BSL 2 in this module. If you go for infectious diseases like HIV, Aids, you need to go for level safety 3. Level 2 can be used with Cancer cells and also, we can use, let us say, E coli, sudden change of E coli. Level 1 is another class.

Some of the laboratories go for 12 to 24 hours of UV exposure. When UV is on, you need to be a little bit away from the biosafety hood.

The environment why the fume hood is designed is when you are working with chemicals, there could be volatile gases. For example, let us take silane gas. It could release harmful gases. When we are working with such vapor or such chemicals which release vapors are fumes and, in such cases, we are supposed to use the fume hoods.

When we are making MEMS based sensors, our focus here is to integrate biology with the micro engineered devices. Our focus is more about making device such that it can enhance the diagnosis or repeatability of making multiple tests.

Mostly, we will be working based on cell and tissue culture samples. We will be making microfluidic devices and we will be making MEMS based devices which are targeted towards making a diagnostic tool. these devices would be integrated with such work environments which deal with cell and tissue cultures, biological blood samples, etc.

Anything related to biology like the tissue samples, the cell culture; when we have them in a petri dish, or we might extract some sort of sample layers. So that could be harmful, it could have bacteria, it could have virus. When we are using such samples and working

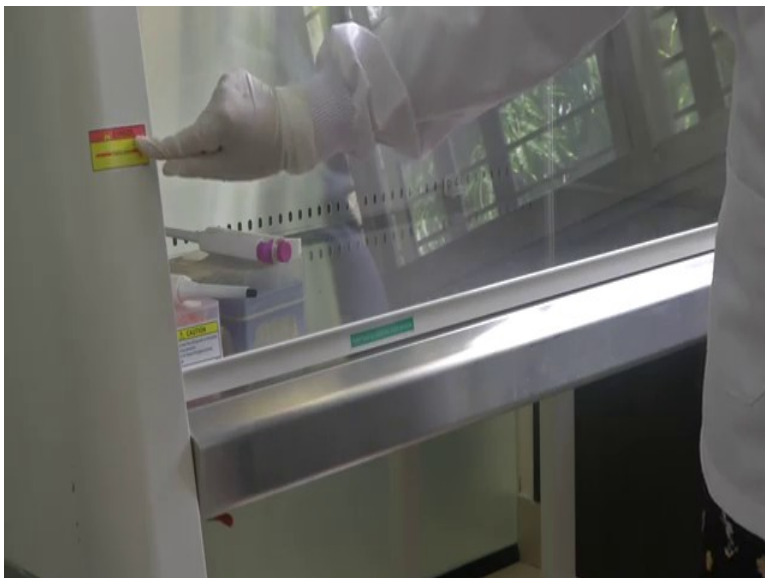
in an open environment, they release the pathogens in them, the bacteria and virus could be harmful to the person who is working with them. In such scenarios, we talk about working in a safety cabinet like this, the biosafety cabinet.

Class 1 BSL does not protect the product, it protects the personnel and the environment where we are working. The construction of the device is such that it has a HEPA filters and pump such that the air which flows in and the air that gushes out are always filtered and it is such that it protects the environment. There is no exhaust, the air which is being circulated inside this environment will not be released into the working condition. So, it will be filtered and released through a proper exhaust chamber and it provides protection to the personnel.

The class 2 BSL provides product, personnel and environmental protection.

BSL class 3 is for really sophisticated environments like when we are working with hazardous pathogens and chemicals and when we are very stringent about containing the pathogen within the environment where we are working.

The sliding glass is called the sash. The sash is to protect the person. Here, it protects us from any sort of aerosols, pathogens and other biological spills. The sash level should be maintained at or below the warning label and do not impact the glass to avoid damage as shown below.



The sash line has been designed to protect the person from any contamination.

Ensure you are seated in a proper comfortable chair such that you could have your hands easily accessible to the devices where you are working. Do not put a lot of your equipment around the air grill as it would restrict the air grill.

The air filtration system is such that HEPA filters, the air from the gap is sucked in because of the pumping system and then the air that is blown from the HEPA filters, which are situated at the top of this device, will flush air. Then, they are sucked through these chambers from the bottom, refiltered and part of it flows through your sample and the remaining goes as the exhaust.

The filtered air is being split in such a way that the pure air, the filtered air which is free from all sort of particulate contamination, would fall on the sample and then the rest gets recirculated, pumped out of this chamber. Blocking the air grilles would not solve the purpose of using the biosafety cabinet. Ensure these grilles are free.

Before working, we follow a personal protective equipment which include hand gloves, the face mask, the hairnet and eye gears.

Always ensure that all the equipment or the things what we need while we work are available even before we start working using the BSL hood.

The UV lamp is mainly provided, the switch at the top is to turn on the light source which is inside to sterilize the entire work environment when that device is kept idle. We can turn on the UV light and leave the cabinet so that the cabinet remains sterilized while it is not in operation. When you have the UV light on, ensure you do not use the cabinet because UV light is hazardous.

We are not supposed to put your hands or use a workstation while the light sources on as a safety measure. In case the UV light is on and we have the sash up, it is programmed to turn the light off. While we are not using the workstation and it is idle and we want to sterilize it after our work is done, we turn on the UV light for around 15 minutes and leave it.

There is a light source with white light and now, the workstation is illuminated with white light and we can use the workstation. While we use the workstation, we sit in a

position such that we get the sliding sash up to the safety line and can reach to all the equipment without moving much.

Once we're done using the workstation, we can clean up the workstation with ethanol. We also have a fan for proper recirculation of air.

There are many rules which must be followed even before we start using the equipment for a proper efficiency or in order to serve the purpose for which this equipment has been designed.

We can keep the fan running for 15 minutes even before you use the safety cabinet.

Once we finished using the workstation, we can turn on the UV light and leave the cabinet for sterilization. And when we come back, we can use the fan so that we could clean up the environment and if there is any sort of contamination, that would be pumped through the circulation system and the HEPA filters which are inside and there is clean air.

Ensure there are not multiple people near the workstation; we do not want any sort of disturbance; they could even increase the particulate contamination around us. We finish our work and then have the workstation cleaned and then move out of the safety cabinet. The UV light can only be on when the fan is stopped, and the sliding sash is closed.