Biological safety cabinets

## Question: Where is the highest risk of contamination in your biological safety cabinet (BSC): the HEPA filters or the airflow balance at the front opening?

**Answer:**

HEPA filters used maintain a high level of efficiency at capturing 99.995% of the particles most likely to penetrate (between 0.1 and 0.2 micrometers), with even greater efficiency at sizes both larger and smaller. The area of the cabinet that is often overlooked when there are concerns about containment and cleanliness is the front opening. The most effective way to decrease contamination in a BSC is not through HEPA or ULPA filters with greater efficiency, or even additional filters, that only offer a slight improvement in BSC performance, but through balancing the inflow and downflow air and real time adjustment of this balance through the front opening.

The air barrier at the front access opening in all BSCs is significantly less effective than the HEPA filters and equally effective for all sizes of airborne particle. With up to 99% of the airborne particles in unfiltered air being smaller than 0.1 micrometers, Thermo Scientific™ Class II, Type A2 Biological Safety Cabinets strengthen the air barrier with Thermo Scientific™ SmartFlow™ Technology, benefiting the user where it matters most.

| Particle size range | No. of ambient particles per $m^3$ | Average no. of particles reaching active work zone through downflow filter at any one time | Average no. of particles reaching active work zone through front access opening at any one time |
|---|---|---|---|
| 0.01 – 0.1 µm | 23,700M | 81 | 12,300 |
| 0.1 – 0.5 µm | 192M | 479 | 99 |
| 0.5 – 1.0 µm | 5M | 5 | 3 |
| 1.0 – 5.0 µm | 2M | 0 | 1 |
| **Total** | **23,900M** | **565** | **12,400** |

* Derived using typical levels of airborne particles measured in non-cleanroom laboratory environments and the distribution of particle sizes assumed in ISO 14644-1.

## Why the most vulnerable point on a biological safety cabinet is the front opening

When we consider the filters' higher efficiency for particles both larger and smaller than the most penetrating sizes of 0.1 to 0.2 micrometers and that 99% of the airborne particles are smaller than 0.1 micrometers, we believe improved control of the airflow at the front opening is more critical than greater filter efficiency in further reducing the potential for circulating room contamination to reach the BSC work area.

Derived from the criteria for biological containment testing, the table below shows the estimated penetration of particles from a laboratory environment whose air cleanliness class is between ISO Class 8 and 9.

Out of the airborne concentration of 23.9 billion particles sized 0.01 micrometers and greater per cubic meter, less than 0.0006% of those particles are in the active BSC work area at any one time. The table illustrates that of those particles, over 95% would be expected to have come from the front opening, with most of those being smaller than 0.1 micrometers.

## Building a better BSC

Hardly any airborne contamination from the laboratory reaches the work area of a Class II BSC. But when we compare the filters and the front work opening, the air barrier is a Class II BSC's more vulnerable point contributing over 95% of the particles reaching the active work zone.

Thermo Scientific Class II, Type A2 biological safety cabinets strengthen the air barrier with SmartFlow airflow compensation which uses intelligent DC motors to sense restrictions to the airflow and maintain air balance. Thermo Scientific™ DAVe™ (Digital Airflow Verification) Technology monitors both inflow and downflow separately to signal the BSC user in case either downflow or inflow varies from the set velocities by more than twenty percent, protecting you and your cultures.

## Summary

The highest risk to contamination in your biological safety cabinet is not the limits of the HEPA/ULPA filters, but the airflow barrier. Thermo Scientific SmartFlow and DAVe technologies benefit you where it matters most.

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