

Computational Fluid Dynamics Uncover Hidden Influences on Laboratory Benches



In laboratories the safety of employees strongly depends on the successful operation of the built-in fume cupboards. For this reason, we tested fume cupboards for their containment according to EN 14175 in a customer's new laboratory. During these measurements we detected that contaminated air left some of the fume cupboards, although a higher air volume was exhausted than given by the manufacturer's specification. Therefore, the reason for this outbreak of pollutants had to be found.

By the means of numerical calculations, we could proof a strong influence of the temperature of the fresh air inside the laboratory:

Both in case the temperature of the fresh air and the room temperature inside the laboratory were equal and the temperature of the fresh air was higher than the room temperature, the fume cupboard worked perfectly, due to a favorable inflow through the sash opening. However, when the fresh air was cooler than the room air, the air flow changed its direction completely, so that the inlet flow got very unfavourable and thus contaminated air escaped from the fume cupboard.

These results were verified experimentally in the customer's laboratory: We could reproduce the numerical simulated influence of the room air flow on the function of the fume cupboard and thus on the safety of the employees, also by our measurement. So our client was able to ensure the correct function of his fume cupboards by making appropriate constructional amendments.

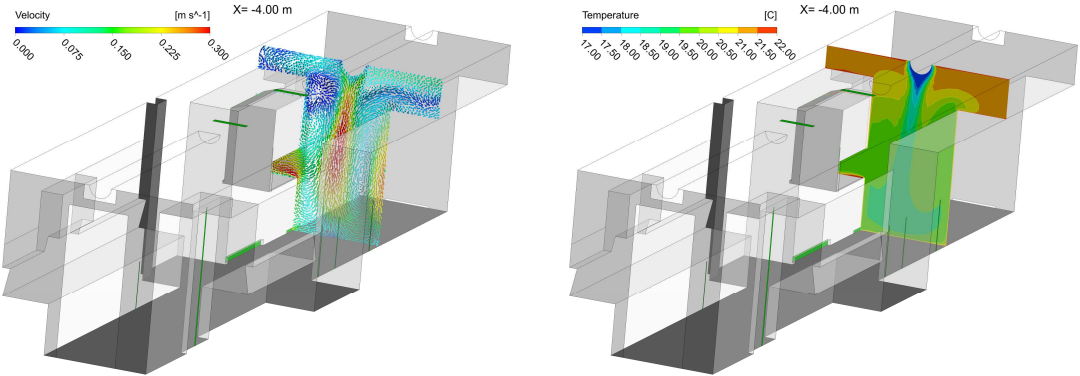
This project excellently demonstrates how the room airflow may heavily influence the function of ventilated enclosures. In the case described above even a partial loss of functionality of the fume cupboard could be shown, although all requirements for the installation and for the operation of the fume cupboards had been fulfilled. Due to our ventilation examination of the fume cupboards, we were able to detect the negative influence on the air flow conditions inside the fume cupboards. Computational Fluid Dynamics allowed for uncovering the reason for the functional disorder and for initiating appropriate countermeasures.

Pictures of the Project

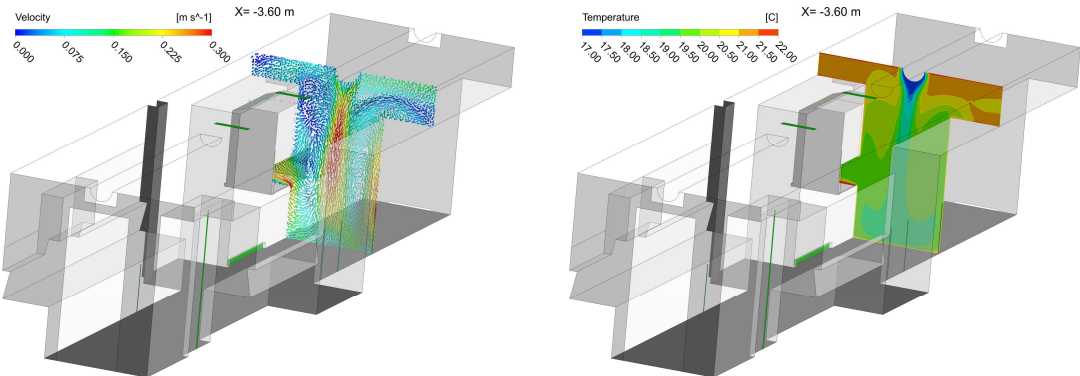


The Figures below show velocity vectors on the left side and pressure planes on the right side.

Plane near the right edge of the fume cupboard



Plane in the centre of the fume cupboard



Plane near the left edge of the fume cupboard

