

How to Control Air Pollutants Released without Original Velocity – Characteristics, Concepts, Measurements and Results

Kolank F

Universität Stuttgart, Lehrstuhl für Heiz- und Raumluftechnik (IKE-LHR), Stuttgart, Germany

In workplaces there are several situations where pollutants are released without original characteristic velocity. These operations produce no thermal air flow, e.g. like welding or there is no high velocity like it is in milling, drilling or grinding to transport the pollutants. The spread of contaminants is essentially dominated of environmental influences. This is the reason why the spread of contaminant is not defined and cannot be predicted. Examples for pollutants released without original velocity are evaporation from tanks, lamination, painting, powder handling (e.g. weighing) and grinding by hand. Because the spread of contaminants cannot be predicted the well-known design principles for local ventilation systems cannot be used. These systems are normally installed in the mainspread of contaminants. At the moment there are no design methods for local extract systems to capture contaminants released without original velocity.

The target of a research project was to investigate the fundamental relations and to gain a knowledgebase, which allows to design a local extract system depending on the specified boundary conditions at the workplace. Therefore typical industrial applications with such pollutants were analysed and presented systematically. The large variety of workplaces was reduced to two standard-workplaces. One of these is a working table. Therefore concepts for local exhaust systems are developed. With CFD and experimental investigations (tracer-gas-technic was used) the efficiency of the developed systems was proved. The measurements were done under controlled conditions in a test room. The capture efficiency was quantified depending on the collected air volume flow. Additionally the exposure in the breathing zone was measured. Different locations and shapes of hoods and the suitable use of local supply air to control the contaminant were investigated. In the experiments four different air supplies were studied. The cases were:

- Local supply air above the workplace and the worker
- Local supply air limited above the worker
- Air curtain between the workplace and the worker to limit the spread of contaminants
- Air jets to induce and transport the pollutants to the hood

The best results were achieved with an air supply limited to the area above the worker. Tracer-gas-concentration in the breathing zone could be essentially reduced without decreasing the capture efficiency of the local extract unit. The supply air velocities were fairly low. Air curtain and air jets cause uncomfortable draughts and reinforced the exposure of the breathing zone.