

## Clean Air in the Lab – no Utopia but Common Practice



Most people associate topics such as staff security and occupational safety in laboratories to special work clothing, skin and eye protection, or explosion risks. In fact, in most countries there are a number of legal regulations controlling a subject matter, which

is rather viewed lapidary but is of essential importance: air purification.

### Three practical examples

1 A French company develops, verifies and evaluates electronic assemblies for military purposes in its laboratory sector. Here electronics components are glued on circuit boards, at which point solvents and adhesives are utilized.

2 In a Czech enterprise's research laboratory, various grain types are grinded and inspected for their quality and consistency. During the milling and refill processes grain dusts arise.



*Image 2: Research lab of a Czech enterprise*

3 Wax, plaster, ceramics and several synthetics are materials worked within a German dental lab. Due to the laboratory size and facilities, various processes are executed at different workplaces. Particularly fine dusts occur in the material processing.

### **Standardization of ventilation technology**

It is applicable for labs: They must be equipped with sufficient and effective ventilation systems. In certain cases, supply air has to be either warmed or cooled and draught free.

The standard DIN EN 14175-1 determines, defines and requires that ventilation systems, must prevent gases, vapors or dusts entering laboratories from the fume cupboard in any dangerous concentration or volume.

Standard DIN EN 14175-2 defines protective goals and demands to safety and performance capacity of fume cupboards. It determines waste air's exhaust ability to efficiently restrain and evacuate harmful substances from a source in the internal workspace in a controlled matter. Thereby, the consideration and minimization of potential impacts, e.g. air streams in the lab or staff movements, are important.

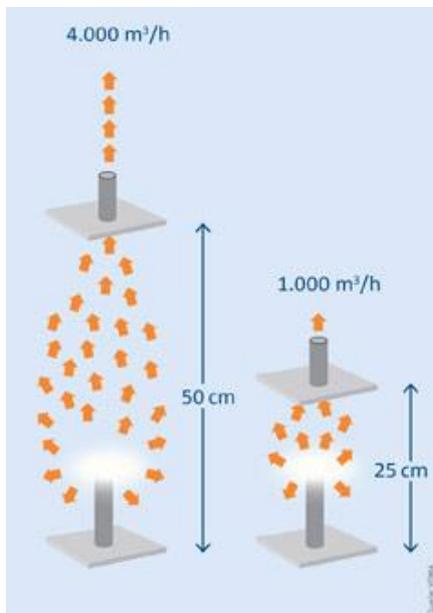
Air pollutants of any source and size do not remain at the place of their origin but spread into the entire room because of existing air movements. Hence, they become risks for humans and material. Ventilation systems might counteract but cannot prevent a remaining pollutant concentration. In order to remove all particles from a lab, a ventilation system would have to have enormous extraction power. However, the personnel would suffer from direct airflow and exhaust noises. Furthermore, practical experiences have proven the necessity of an additional solution.

### **Spot extraction**

Alternative solutions are fume extraction systems, equipped with accordingly optimized capturing elements, such as extraction arms, hoses or hoods. They however, have to be utilized in a proper way.

Quality of pollutant collection is the linchpin of extraction and filtration technology. In order to remove airborne pollutants, such as dusts, fumes, vapors, gases or odors efficiently, capture at the source of the pollution generation is of critical importance. This is the only way to guarantee that the maximum number of particles are captured.

A general rule says that twice the distance between emission source and capturing element requires four times the exhaust performance in the extraction and filter system. The degree of capture rate forms the basis for subsequent high-grade filtration, finally providing high overall efficiency and low residue in the returned clean air.



*Image 3: Influence of distance to the required air flow*

### **Characteristics of a fume extraction system**

In many labs, lack of space is a real issue, on the one hand due to a variety of tasks, on the other hand due to statutory conditions on laboratory facilities. That is why attributes such as 'space-saving', 'portable' and 'low-noise' are critical in terms of selecting a suitable fume extraction system. Filtration technology must not be annoying – it should never disturb work routines, neither physically nor acoustically.

Fume extraction system differs from fume extraction system. It must be ideally configured with regard to dimension, extraction performance and usage of

appropriate filter media. For example, in refilling, gluing or cleaning processes primarily vapors and odors occur, which can be eliminated by so-called sorbents such as activated carbon. Sorbents provide a very high separation efficiency and enormous storage capacity that result in maximum filter lives – reducing, in turn, operating costs of a fume extraction system.

An alternative to utilizing activated carbon filters is chemisorption, in which an adsorbate connects with the substrate (adsorbent) by chemical bonding.



*Image 4: Mobile extraction unit JUMBO Filtertrolley LabCat – quiet and flexible*

Moreover, there are various opportunities in running a fume extraction system. It can be utilized as stand-alone solution for workplaces as well as central suction element. In the latter case, several workplaces can be equipped with capturing elements connected to the extraction system via hoses or pipes.

### **Capturing elements**

Capturing elements are critical factors in airborne pollutant removal. They are roughly classified as closed, half-open and open.

Closed systems are workspaces, hermetically sealed off environment, with connectors for air pipes.

Half-open systems are enclosures with one open side for handling with connectors for air pipes.

Open systems are form elements, offered in many variants. Their utilization is determined by shape, geometry and material.

Dependent on particle amount and composition, all three versions are used in laboratories.

The following two practical examples shall illustrate this:

1 In the French lab, rather low volumes of adhesives are produced, less toxic to prevent them from entering the ambient air. In this case, suction hoods, connected with a central suction station, are utilized for vapor removal.



*Image 5.1: Utilization of suction hoods in a French lab*



*Image 5.2: Central extraction system for several laboratory workplaces*

2 During mixing various powdery and liquid substances – particularly for the preparation of plasters and investments – in a German lab, a half-open capturing system is deployed. It prevents the release of dangerous particles. Also called working cabinets, these capturing elements contribute to safe and clean workplaces.



*Image 6: Half-open system as capturing element – connected to a fume extraction system via a hose*

### **Air purification is crucial**

Fume extraction systems protect employees from the impact of hazardous substances, more precise from airborne pollutants in the form of vapors, gases, odors, or dusts. They can have considerable health effects. Airborne contaminants are basically determined by particle size. Their classification is primarily based on the emission impact on the human organism. Airborne pollutants are either differentiated causing brain, nerve or airway damages, or being inhaled (E-fraction) or alveolar (A-fraction). A-fraction pollutants overcome the so called air blood barrier, i.e. finest particles may embed in the human organism.

Depending on the load and type of contaminant as well as the spatial situations, serious vendors of fume extraction technology configure the proper and suitable system for air purification in order to guarantee efficient and sustainable employee protection.

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