Learn more about fume hoods

Today's lesson: Face Velocity, Containment and ASHRAE Standard 110-95

Below is an excerpt from the *How To Select The Right Laboratory Hood System* booklet. The topic of discussion is the performance of a fume hood — what's important and how to test for it.

The laboratory's degree of exposure to toxic contaminants is an important consideration when selecting a fume hood. The concentration of contaminants in the actual breathing zone of the operator should be kept as low as possible. Two fume hood issues that impact the concentration of contaminants are face velocity and containment.

Regulatory compliance agencies and other advisory groups have established guidelines relating to the exposure limits of various chemical reagents. These exposure limits are identified as American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLV) or Occupational Safety and Health Administration (OSHA) Permissible Exposure Limits (PEL). Threshold Limit Values refer to airborne concentrations of substances and represent conditions under which it is believed workers may be repeatedly exposed day after day without adverse effect.

Until recently, general thinking was that the lower the TLV number, the higher the face velocity required to ensure adequate protection for the operator. Face velocity is still regarded as an important parameter for assessing a hood's performance. However, present views focus on containment rather than face velocity alone. The emergence of high performance hoods is evidence of this trend. Higher velocity is not necessarily better. A face velocity that is too high can cause turbulence within the hood and actually decrease the hood's ability to contain contaminants.

Factors that affect the performance level of the laboratory hood that are not easily monitored by simple measurement of face velocity include: 1) type and location of air supply; 2) location of laboratory hood in relationship to the laboratory itself; 3) air disturbances caused by overhead air diffusers, heat registers, fans, open windows or doors, or personnel movement; 4) hood sash configurations; 5) location of the worker in relation to the hood; 6) location and types of emission sources; 7) apparatus loaded or stored in the hood; 8) use of apparatus such as machine tools, grinders or centrifuges that generate aerosols and/or high velocity particles; and 9) thermal drafts due to extreme temperature conditions. Watch a video on Basic Fume Hood Airflow and Operation for tips on proper work procedures.

Because of these external demands, the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Standard 110-95 was developed to demonstrate the laboratory hood's ability to contain and exhaust contaminants released inside the hood.

ASHRAE Standard 110-95 is a performance test, not a performance specification. It describes how to evaluate a hood's performance, but it does not specify the performance level required. It remains the responsibility of the user, industrial hygienist, safety officer or applications engineer to specify the performance level requirement for a laboratory's individual situations.

ASHRAE Standard 110-95 gives a relative and quantitative determination of the efficiency of the hood to capture contaminants under a set of strict conditions. This test is used to evaluate hoods, both in the manufacturer's facility (as manufactured, AM), and on site (as installed, AI, or as used, AU). Briefly, ASHRAE Standard 110-95 is a three-part test. First, the average face velocity is calculated. The sash opening is divided into one-foot squares. Velocity readings are taken in each grid area and averaged.

Second, the hood is tested for its ability to contain fumes. Titanium tetrachloride, which emits a white smoke, is released at prescribed locations within the hood's interior and work surface. Smoke is observed and any air movement toward the face of the hood and any areas of no air movement are noted. Titanium tetrachloride is also passed under the air foil and any smoke flowing out the front is noted.

In the final part of the test, a tracer gas is released at an established rate and at various positions within the hood. The gas is monitored in the breathing zone of a mannequin placed at various positions in front of the hood. Based on the average exposure in the breathing zone, a performance rating is determined. The complete standard is available from ASHRAE.

It is recommended that laboratory hoods be tested at the time of installation to verify the AM test results. Initial testing provides a baseline for future maintenance checks. Hood performance should be monitored and maintained as part of the laboratory's chemical hygiene plan.