## Your health and opinions matter!

## Let's make laboratories safer...

Is dilution ventilation the concept employed in your laboratory? It is if you hear plant and safety people routinely say: "the solution to pollution is dilution." Are fugitive emission concentrations as great inside the laboratory workspace as they are in the fume hoods? Does your laboratory air flow system work on the basis of containment ventilation, i.e., capture of toxins or flammable gases within the hoods and then transporting them out with discharge to the atmosphere?

**If you laboratory depends upon dilution ventilation of work spaces and hoods rather than containment ventilation in hoods, you may find yourself being needlessly exposed to carcinogens at levels that may cause permanent damage, which can produce debilitating disability, or even deaths later on.**

We are here to tell you that cost effective remedies and solutions exist!

## Tests, concept and "tell-tell" signs of dilution ventilation...

### The Good Smell Test

The human nose is an excellent detection device, often allowing an individual to be able to detect chemical concentration in parts per million (ppm). For example, the sensory threshold limit of the human nose is about 5 ppm with hydrogen sulfide. Unfortunately, the problems with this test are: (1) some chemicals, including many carcinogens in the ppm level, do not give off a detectable odors, (2) how do you calibrate someone's nose to give consistent, measurable results, especially aimed at identifying a source of a fugitive gas omission?

There are two meaningful ways of applying this "test." The first method is to have some individual, normally a visitor to your plant and laboratory, enter the laboratory and see if he can detect chemical odors. This sniffing should start in the laboratory building hallways and then progress into the laboratories. The problem with this method of course is that one's sensitivity to a smell diminishes with exposure; it is for this reason that this test is best done by someone who does not routinely work in or around the laboratory or with any chemicals associated with the laboratory.

The second test involves the placement of a trace amount of a very pungent material inside a fume hood. The material is slowly released within the hood (or similar capture device). Individuals sniff the air and attempt to detect it. Excellent choices of tracer materials that can be used for this test are dilute mixtures of pyridine or methyl or ethyl mercaptan in some form of a carrier gas such as nitrogen or compressed air. Attempt this test cautiously, however, as either of these materials can be dangerous when released at concentrations above trace levels.

### The Green Brass Test

This is another way of determining if materials, especially corrosive materials in trace amounts, have been present in a dilute form in a laboratory. The tell-tell evidence is the corrosion of metal surfaces, typically electrical wall plates, brass or chrome plated facet fixtures, or other similar material surface degradations. If found, then it is obvious that undesirable chemical concentrations have leaked into the workplace. And, if corrosion of metal work surfaces has occurred, what impact, if any, has this had in the lungs of those working in the laboratory?

## Keeping the Fume Hood Sash at Minimum Position

It is a logical conclusion that the smaller the opening into a hood cavity, the greater the containment of materials within the fume hood. This conclusion follows regardless if the hood is being exhausted or not. This can be illustrated by igniting a smoke bomb in a room and watching the smoke move toward the door into the room. If only a minimum amount of smoke is to be allowed to exit the room, the more the door is closed, the greater the containment of smoke in the room.

H. W. Alyea, Chief Field Engineer, Johnson Service Co. (now Johnson Controls, Inc.) was the first to publicize this conclusion. He stated, in a reference to a Johnson control system that controlled the velocity through the hood doors within a close limit, the following in "Reducing Air Exhaust of Laboratory Fume Hoods," Heating Piping & Air Conditioning, February, 1951, pp. 79 and 80.

*The amount of air introduced into the laboratory is only that required to maintain the desired face velocity through the hood doors. Since the hood doors are kept closed as much as possible for reasons of safety, this results in a considerable saving in the amount of air supplied with proportional reduction in heating and cooling demand and considerable longer filter life.*

## The Wind Tunnel Effect

This is another gross way of determining if the air flow/ventilation system serving a laboratory is dilution or containment based. If a building is pressure negative to ambient pressure, when entry doors into the building are open, high velocity air flows into the building. The greater the differential pressure between the building and the outside, the greater the velocity of the air though the opening. Best containment unfortunately depends upon maintaining a constant low level air velocity, typically at about 100 fpm, through an opening, be it across a door opening or across a sash opening in a fume hood, i.e., a constant "laminar" type air flow that is independent of opening size. As the velocity across any opening such as a fume hood gets higher, the flow transitions from a laminar state to a turbulent state, and with this transition more and more eddy currents of greater strength occur. Turbulence and eddy disorders give rise to fugitive emissions, in the form of outflows from devices such as a hood or other containment devices. The amount of outflow from a fume hood also depends upon the size of opening through which the capture flow must occur. For instance, if the hood face velocity is maintained constant and uniform across a hood's sash opening at 100 fpm, regardless of hood sash position, the greater the hood sash opening the less the level of containment. It is for this reason that the sashes on a fume hood should be kept closed at all times or kept at a minimum opening when one is performing some operation within the fume hood.

## The Re-entry Problem

Elimination of the re-entry of fugitive emissions from a fume hood exhaust system, gained or single stack, can only be accomplished by dilutions, where the "solution to dilution" concept must prevail and be utilized. While emission concentration can be reduced by dry or wet scrubbing a contaminated hood exhaust air stream, ultimately the effluent must be discharged to the atmosphere. Where and how that discharge takes place and where the outside make up air intake into a building is situated are critical factors if re-entry is to be minimized. Exhaust stack height and discharge point location and proximity to building intake are the critical factors affecting these problems. A building where the flow rate into the building is always balanced and equal to the flow rate from the building also aids in elimination of this problem, i.e., no wind tunnel effects occur with the building.

*Factors that work to defeat the application of the MITCO/Phoenix/Air Precision Devices type "spring and cone" valves and their concept in laboratory and other air flow systems -*

*Factors that work to defeat the use of the "through the [fume hood] wall face velocity" concept in fume hood exhaust flow vs. sash position control -*