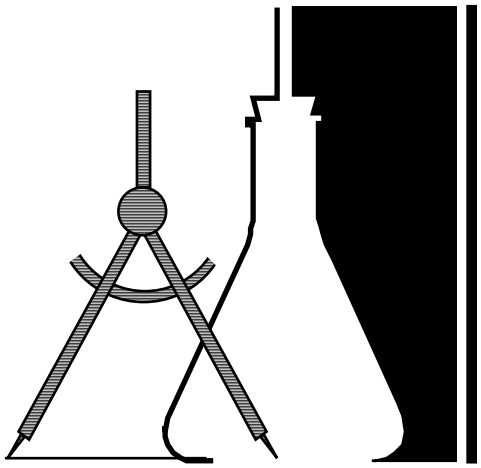

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Fume Hood Scrubbers - Part I

To Scrub, Or Not To Scrub?

by

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LABORATORY BUILDING DESIGN UPDATE

INTRODUCTION

Concern for the environment, environmental health, and increasing government regulations are causing more laboratory designers and facility operators to consider some type of scrubber for some of their fume hoods. This is the first in a series of articles written to familiarize the reader with the aspects of fume hood scrubbers. In this part, we will be taking a classical industrial Hygiene or industrial ventilation approach to this problem by discussing source reduction or elimination in the fume hood before the contaminant is released into the airstream.

These alternatives should be evaluated *before* committing to install a scubber. The types of scrubbers available, and their application will be the subject of future articles in this series.

ELIMINATION:

Most industrial hygienists know that engineering controls, like fume hood scrubbers, are a last resort and will attempt to avoid using them altogether if it is at all possible. Assuming that the contaminant of concern has already been identified, the first step is to see if this hazard can simply be eliminated.

Normally, this is dead end, but if one time out of a hundred you can simply remove the contaminant from the process and not adversely affect the product then you can eliminate a capital expenditure as well as a process waste. Sometimes all it takes is someone willing to ask the researcher, "Why do we need this?" and demand a valid answer. Sometimes the answer is, "I don't know."

Enclosing the procedure to prevent the escape of a hazardous substance can also reduce or eliminate exposure, reduce waste and eliminate an air pollution source. Modifying existing equipment or procedures can also prevent the release or reduce the amount of hazardous material that is released into the airstream.

SUBSTITUTION:

If the source cannot be eliminated altogether, then it may be possible to substitute a non-hazardous or less hazardous material for the agent of concern. This may involve some product research but the results may be well worth the effort. Any substitution resulting in a reduced hazard in the lab will also benefit those in production and application of the product as well.

CONDENSATION/TRAPPING:

The next best alternative is to condense or trap the hazard before it is released into the fume hood. Depending on the substance and its vapor pressure, this may involve simple water-cooled condensers or dry ice/acetone cold traps. Small amounts of high-concentration materials may also be removed or reduced using adsorbents like activated charcoal. In this case the material condensed, trapped or adsorbed will have to be disposed of according to proper procedures for handling hazardous laboratory waste, but the quantity will be 100 to 1000 times smaller than disposing of the liquor from a scrubber or carbon filters in the exhaust airstream.

NEUTRALIZATION/ REACTION:

It is always more efficient to treat a low-volume/high-concentration source right in the hood than treat a high-volume/low-concentration exhaust stream. Sometimes an acidic or basic contaminant can be neutralized or a toxic substance converted into another, less hazardous species before being released into the fume hood. In the case of toxic monomers like acrylonitrile, an initiator may be used to polymerize it. Polymerization will increase the molecular weight of the monomer many hundreds of times and convert it to a solid or gel with a very low vapor pressure. This process effectively eliminates the vapor component of the hazard. For many other hazardous liquids, reagents can be used to form less hazardous products before opening the process vessels and disposing of the contents and/or allowing the vapors to escape into the hood.

COMING NEXT:

If none of these ideas are appropriate for your application then scrubbing may be the best alternative for you. In Part II of this article, we will cover packed bed fume hood scrubbers and their operation.