The ABC’s About VOC’s (PART I)

Increasingly, consumers seeking building products with lower inherent toxicity are looking more closely at ingredients and asking tough questions. In the architectural coatings industry, those ingredients that have the potential to be hazardous are commonly classified as volatile organic compounds, or known better by their acronym, VOCs.

Increasingly, consumers seeking building products with lower inherent toxicity are looking more closely at ingredients and asking tough questions. In the architectural coatings industry, those ingredients that have the potential to be hazardous are commonly classified as volatile organic compounds, or known better by their acronym, VOCs.

In the workaday world of bucolic upstate New York, the term VOC seems unfamiliar to most consumers and even most construction industry personnel. But just as ignorance of the law does not exempt one from it, ignorance of the effects of VOCs doesn’t exempt one from their effects. Additionally, products that are either touted as “Low-VOC” or even “Zero VOC”are not necessarily free from potentially harmful ingredients. Some contain what are classified as Hazardous Air Pollutants or HAPs, and these chemical compounds can differ from VOCs.

In this article, Andy Pace, of The Green Design Cnter in Waukesha, WI and I will take a brief, focused look at what VOCs and HAPs are, and how they are formed. Because the subject of VOCs and HAPs is so massive and the science of their effects is so young, our discussion will focus on just a few of the main elements that can contribute to lowered indoor air quality (IAQ).

Understanding the effects of HAPs and VOCs on human health is important because we spend about 90% of our time inside increasingly tight structures where accumulations of interactive chemicals can cause concentrations of pollutants that can be as much as 50 to 100 times greater than outdoor air.

The importance of this in the paint and coatings industry was brought sharply into focus for me as I was writing this month’s column. I was referred to a couple who were building a spacious new luxury home. They had made it a point to investigate, specify, and ensure that all the materials that were used throughout the process were as non-toxic and free of harmful chemicals and the potential for outgassing as possible. In this process, they repeatedly surpassed the knowledge base of their architect and design-build team. The possibility that during the completion phase of the project they could sabotage their vigilant work by installing paints and finishes that could degrade the quality of their indoor air was a thought that never crossed their minds. This is ironic, because architectural coatings can be a massive source of indoor pollution given the surface area that they occupy. We must also remember that they are routinely used for recoating.

When I began to educate them as to how the dynamics of toxicity work when many conventional products are applied to absorptive substrates such as gypsum board, they became eager to learn of alternatives and anxious to learn how to correct mistakes that they had already made.

What are VOCs, exactly, and why all the fuss?

The Indoor Environment Department (IED) Staff of the Environmental Energy Technologies Division at Lawrence Berkeley National Laboratory (a division of our EPA) defines VOCs broadly as “chemical compounds based on carbon chains or rings with vapor pressures greater than 0.1 millimeters of mercury at room temperature. These compounds typically contain hydrogen and may contain oxygen, nitrogen and other elements.”

Prior to this century, US government tests that examined chemicals and passed laws that restricted their inclusion in architectural coatings, focused primarily on the damage that these chemicals created in outside air.

During the second half of the 90s however, the EPA’s National Risk Management Research Laboratory (NRMRL) began to investigate how architectural coatings could contribute to indoor air pollution and harm human health. They began compiling research from tests of conventional alkyd and latex products, as well as Low-VOC and Zero-VOC latex coatings. An important aspect of their research was simply to devise tests that would be meaningful. Interestingly, a solution to this question became apparent when they applied coatings to different substrates and then monitored their behavior.

What they learned was that the emission behaviors of chemicals were very different when coatings were applied to non-absorptive substrates such as glass, aluminum, and stainless steel, than they were when they were applied to the absorptive surfaces that they are typically used on such as wood and gypsum board. Naturally, they concluded that to be meaningful their tests needed to reflect the behavior of coatings on the surfaces that they are normally applied to.

Part of the reason why this research is important, is that architectural coatings are commonly deployed in commercial spaces such as schools, hospitals and medical facilities, day care centers, offices, hotels, and other public spaces in which continuous occupation is the rule. Especially in the case of medical facilities, patients with compromised immune systems may be subjected to hazardous air pollutants that can pose a threat.

A few key points summarized from recent government research are as follows:

• Alkyd coatings can contain as many as 100 different VOCs.

• The majority of emissions from latex paints occurs after the coating has dried.

• It may take as long as 3.5 years for some VOCs to be released from gypsum board.

• Some paints marketed as “low-VOC” may still emit significant quantities of HAPs.

• In addition to VOC content data, consumers need emission information and performance evaluation results to make wise and completely informed purchasing decisions.

The ABC’s About VOC’s (PART II)

Assessment criteria

Many criteria can be used to assess the relative level of toxicity in the coatings that are sold, purchased, and applied. Government regulations have increasingly restricted the presence of chemicals in paints and coatings that might have a negative impact on the atmosphere (regarding smog creation), but strict regulations for chemicals that might have an impact on human health have yet to be implemented. We would like to stress the fact that coatings which carry a “low” or “zero VOC” label aren’t necessarily free from Hazardous Air Pollutants (HAPs) or toxins. This a critical point that is often misunderstood. “Zero VOC” does not mean non-toxic.

What follows in this article is a thumbnail sketch of a few HAPs that are classified by the Environmental Protection Agency (EPA) as potential sources of both acute and chronic irritants or carcinogens. They may be present in low-VOC latex paints and represent a risk to painters and susceptible consumers.

Because human immune system responses can differ by orders of magnitude (factors that increase in 10-fold steps), it is impossible to state with consistency what effect a given chemical, combination of chemicals, or coating will have on any individual. But perhaps better safe than sorry. In his editorial “Life as a used paint can”, veteran painter and Professional Painter magazine editor Bruce MacKinnon laments about a list of personal woes including Chronic Obstructive Pulmonary Disease (COPD), and raises the fuzzy issue of responsibility as it relates to HAP exposure.

It may be difficult to ascertain what ingredients are in a finish if a manufacturer chooses to not disclose the information willingly. Material data safety sheets (MSDS) need only list information relevant to the physical, chemical, and toxicological makeup of a substance where the ingredients constitute more than 1% of the total volume and are not considered part of a "proprietary blend".

We list below a group of common chemicals that may be included in paints and coatings, and which have been implicated to have potentially toxic effects for human health.

The Glycols Paints may contain several forms of VOC-forming glycols that are commonly added as wetting agents. Although there is a general movement away from ethylene glycol (EG) as an additive in paints, it is still a commonly used toxin. Alternatively, propylene glycol (PG) is a replacement for EG, and while it is still a VOC, it is also an FDA approved food-grade additive.

Ethanol Classified by the EPA as a major VOC, ethanol (BEE) is a form of alcohol that can deter the body’s processing of other toxic chemicals.

Ammonia The EPA has exempted this chemical from classification as a VOC when used as a paint additive, and its presence need not be disclosed on MSDS sheets.

Acetone A solvent whose vapors are a respiratory tract irritant and which may cause coughing, dizziness, dullness, headache, central nervous system depression, narcosis, and at high concentrations, unconsciousness.

Biocides Added to inhibit the growth of microorganisms in the can and on the coated surface, biocides may contribute significantly to the formation of formaldehyde. Products with biocides intended for exterior use can become sources of HAPs if used indoors.

Formaldehyde One of a group of HAPs in the Aldehyde family. Although it hasn’t been used as a paint additive for many years, it is commonly created by two or more mutually reactive chemicals (formaldehyde precursors) during the application and curing process. It is considered a probable human carcinogen.

Other Aldehydes: Acetaldehyde, Benzaldehyde, and Propanol These chemicals can be respiratory irritants and bind to cells such as liver and lung cells to create autoimmune responses.

Crystalline Silica Otherwise known as quartz, it is considered one of the most dangerous occupational dusts and a carcinogen, and is commonly found in paints and coatings, especially exterior latex paints. While it can become airborne during paint application, the primary risk is from dust exposure through abrasion or the sanding of dry films.

Pigments These may be glycol and VOC-free, or they may contain glycol, VOCs, and formaldehyde-forming biocides.

Odor Masking Agents These are chemical additives that conceal the odors of offensive chemicals. They may function as irritants in and of themselves.

Summary

The suggestion by the EPA that consumers need emission information and performance evaluation results to make informed purchasing decisions is an idea that involves a different way of thinking. For those of us who place indoor air quality high on our list of building objectives, responsibility must begin and end with ourselves. For those inclined to move in this direction, we would like to cite a thought-provoking book that is becoming a classic for reorganizing our thinking: Cradle to Cradle by William McDonough and Michael Braungart.

Andrew J. Pace, CSI, is the owner of The Green Design Center in Waukesha, WI. GDC is a residential and commercial supplier of safer and more natural building materials. Mr. Pace is also past president of the Milwaukee Chapter of the Construction Specifications Institute. He can be reached by calling 800-697-5371 or email to andy@safebuildingsolutions.com.

Michael Fallarino is a professional journalist and writer, building contractor, and holistic health consultant. You can download a sample of his eclectic book, Contemporary Relationships between Wood & Finish, at his website: www.FINISHandPAINT.com. He can be reached in the Capital Region of New York at 518-828-5670.