PtD & P²
Eliminating VOC Emissions

A brief overview of the Prevention through Design (PtD) and Pollution Prevention (P²) initiatives and how they can help facilitate in lowering emissions of volatile organic compounds (VOC) and thus reduce the risks for workers and their families.

Prevention through Design (PtD) is an initiative administered by the National Institute for Occupational Safety and Health (NIOSH), a division of the U.S. Centers for Disease Control and Prevention, to reduce worker illness and injury by designing out hazards. The principles of PtD apply to all processes, tools, and methods of doing work and can be broadly applied. Ergonomic solutions are considered PtD, but PtD goes beyond ergonomics to the root cause of injuries and illness.

According to the American Industrial Hygiene Association’s Hierarchy of Controls, the most effective way to manage risk is to eliminate exposure. This can be most easily accomplished during the design phase of the capital project planning process. We all learn from experience. Over time, a company accumulates an incident record, and a record of solutions. This record forms the basis to manage changes in equipment, processes, tools, and layout. By front-loading lessons learned...
into the earliest discussions of changes in facility design, a company can improve its safety record and avoid costly retrofits.

Pollution Prevention (P²) is an initiative administered by the U.S. Environmental Protection Agency (EPA). EPA defines pollution prevention as “reducing or eliminating waste at the source by modifying production, the use of less toxic substances, better conservation techniques, and re-use of materials.” This can be accomplished through new technology, changes in processes, using a different feedstock, reformulation, better industrial hygiene, and recycling. The ideal disposition of waste products is to sell them as feedstock for another process.

Reduction of volatile organic compound (VOC) emissions can be accomplished through the use of more precise equipment, such as low-flow paint nozzles that reduce overspray, or through the use of alternatives (e.g., thermoset enamels, vegetable oil-based paints, ultraviolet- and electron beam-cured [UV/EB] inks, and plastics) to solvent-based paints for some applications. Graphics printed under climate-controlled conditions onto vinyl film can be applied to smooth surfaces; when humidity is controlled, water-based glues may be substituted for solvent-based ones. Each of these solutions reduces the amount of VOCs emitted (P²) and improves working conditions (PtD). Changes in the way companies do business may also prove more profitable by improving customer satisfaction, reducing energy demand, and eliminating waste.

P² Workshop Success Stories

In 2003, I attended a pollution prevention workshop conducted by Bob Pojascek and Cam Metcalf. Each told a story that I still remember today. Pojascek talked about a producer in the sugar beet industry who wanted to avoid the expense of an ammonia permit. An additional process line was added to capture ammonia emissions. This not only saved money in terms of permits and raw materials, but also provided an additional source of revenue through the sale of the ammonia byproduct.

Metcalf talked about a large corporation in the printing industry that wanted to eliminate solvent-based metallic inks. He described the transition from solvent-based inks to soy-based inks. One global customer used cadmium red in its logo. A vote by its Board of Directors to accept the non-metallic red facilitated the transition. This reduced exposure to solvents and to metallic inks throughout the entire supply chain and customer base. Both printer and ink technologies continue to evolve.
Greener Inks = Fewer VOCs
A leader in green ink technology is Mutoh Industries Inc. Christopher Brown, engineering manager for Mutoh’s Advanced Engineering Group, says, “Tightening environmental and worker safety regulations here in the [United States], as well as in Europe and Japan, combined with growing demand from our end-users have accelerated our development of ‘greener’ inks.”

Brown explains, “Mutoh currently has two inks aimed at lowering VOC emissions for improved worker comfort and environmental safety. Our Eco Ultra® inks are a virtually odorless low-VOC solvent ink designed for printing on plastic films and other flexible plastic substrates. They offer the same high abrasion resistance and outdoor durability of legacy solvent inks, while eliminating the odors and harsh fumes that were once considered part-and-parcel of solvent-based inkjet printing.”

Brown continues, “Mutoh also offers a UV-LED ink, which is a relatively new technology. It is entirely solvent-free, so there are no potentially harmful VOCs or hazardous air pollutants. It uses the energy from UV LEDs operating in the safer deep violet range of the spectrum to cure, converting from liquid to solid almost instantly. And, these inks can print on virtually any substrate, including rigid and non-white materials, and provide an optimal worker environment. Going forward, Mutoh will continue to develop ever more environmentally conscious inks.”

Low-Flow Paint Sprays = Fewer VOCs
Some auto body shops have found ways to reduce VOC emissions, while having a positive impact on their business. Chris Sterwerf, of Fairfield Auto & Truck Service Inc., says his company uses an ionized, heated, nitrogen fluid carrier to spray Axalta Coating Systems™ (formerly DuPont Performance Coatings) Imron® polyurethane coatings. This allows them to use lower air pressures and smaller atomizing spray gun tips to refinish auto bodies with the lower VOC paint offerings. The nitrogen system increases transfer efficiency, minimizes overspray, reduces paint consumption, and increases quality. The increase in quality means fewer reworks, which in turn, leads to fewer VOC emissions.

Why Do We Care?
VOCs are organic gases emitted from plants (e.g., evergreen species and the products derived from them, such as solvents, glues, and adhesives), solids (e.g., vinyl, coal, and rubber), and liquids (e.g., cleaning supplies, dry cleaning solutions, pesticides, and petroleum-based fuels). The official definition: A VOC is any organic compound having an initial boiling point less than or equal 250°C under
standard atmospheric pressure of 101.3 kPa. Exposure to VOCs has been linked to adverse health effects when used indoors without adequate ventilation. Excessive exposure to VOCs has been correlated with an increased risk of asphyxiation, asthma, and cancer. Affected organs include the central nervous system, eyes and skin, bone marrow, and respiratory system. Common early warning signs are headache, nausea, dizziness, and/or irritation of the eyes, skin or nose.

Outdoors, VOCs react in sunlight with oxides of nitrogen to create ozone at ground level. The National Ambient Air Quality Standards limit the ambient concentration of six criteria pollutants, of which ozone is one. Benefits may accrue when a substance containing VOCs is replaced by a less toxic substance. Chemical substitutions for solvents generally are water-based and require higher temperatures and pressures to achieve the desired results. This may result in a different set of hazards.

The PtD and P² initiatives facilitate a convergence between occupational safety and health and corporate sustainability practices, especially in the area of lower VOC emissions. Lower exposures help reduce the risks for workers and their families.

References
1. Prevention through Design (PtD); National Institute for Occupational Safety and Health (NIOSH). See www.cdc.gov/niosh/topics/ptd.