Using Safer Solvents

Volatile organic compounds (VOCs) are chemical compounds that evaporate into the air, generally from liquid solvents. Since the middle of the nineteenth century, solvents derived from petroleum have been a part of many everyday products that people use in homes and businesses. For example, from the 1800s until fairly recently, most commercially available paints were based on oil. Paintbrushes had to be cleaned using organic solvents such as mineral spirits (distilled from petroleum) or turpentine (distilled from pine resin).

Many other products that you use regularly contain organic solvents. These include cleaning supplies, glues, cosmetics, aerosol sprays, and even air fresheners (Figure 1). Some of the VOCs in these products are, like mineral spirits, derived from petroleum. Others, such as methanol and propan-2-one (acetone), are manufactured in chemical plants. Volatile organic compounds are often used in products from which they are expected to evaporate, such as paint, floor wax, or adhesives. Even the highlighting pen you use when you take notes needs some sort of solvent for its ink.

Figure 1 Droplets of aerosol spray evaporate, filling the air with volatile organic compounds.

Unfortunately, many VOCs are extremely toxic and easily absorbed into the human body through the skin or lungs. When people use the products, particularly indoors, they expose themselves to the vapours of the organic compound as it evaporates. Regulatory agencies have identified indoor air pollution as a major health hazard. Exposure to VOCs can cause irritation to the eyes, nose, and throat, as well as headaches and nausea. Severe symptoms from frequent exposure or exposure to high concentrations of VOCs can even cause damage to the kidneys, liver, and central nervous system. In addition to health concerns, VOCs can cause environmental damage, polluting air and water resources.

For several decades, as the hazards of VOCs have become better understood, government and industry researchers have worked to develop alternatives to using VOCs in home and office products. Because they are so widely used indoors, paints were one of the first products to be addressed (Figure 2). Paint forms a polymer coating on a wall that is embedded with inorganic particles and dyes. By switching to compounds that are soluble in water, manufacturers have designed paint products that do not release organic vapours as they dry. Almost all indoor paints and most outdoor paints for home use are now water-based solutions of latex or alkyd resins. As the paint dries, only harmless water vapour evaporates.

Figure 2 Low-VOC paints are available in every colour that you can imagine. These paints do not use organic solvents, so they release only water vapour into the room.

For some household applications, the VOC has a different purpose. Many cleaning products, particularly those designed for removing grease and oil, are organic compounds. Switching to a low-VOC cleaner will reduce your exposure to volatile toxins. Many “green” products substitute non-volatile natural oils or their derivatives for more volatile ingredients. Less volatile compounds evaporate less readily, so are less likely to be inhaled.

One challenge in creating low-VOC products is that the replacement must meet the same performance requirements as existing products. For example, customers expect a water-based paint to be as durable as an oil-based paint.