What Is A VOC?

One of the most common terms used in the solvents industry is "VOC" — as in "reduced-VOC," "non-VOC," and "VOC content." Most people in the industry know that "VOC" stands for "volatile organic compound." But many do not fully understand what VOCs are and why they receive so much attention. This bulletin briefly outlines some of the basic concepts associated with VOCs. Subsequent bulletins will explore specific VOC-related issues.

VOCs and Ozone Formation

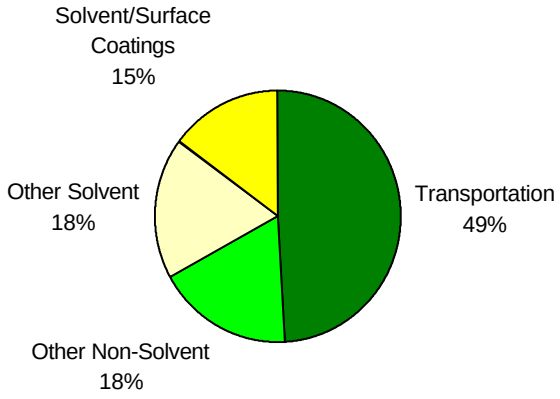
With certain important exceptions discussed below, the solvents used in products such as coatings, inks, adhesives, and consumer products are generally classified as VOCs. Unless they are controlled (by an incinerator on a painting operation, for example), these solvents are emitted into the air after they perform their function. Thus, solvent emissions from products and industrial operations are one of several significant sources of VOC emissions.

The accompanying pie chart, which is based on data from the U.S. Environmental Protection Agency (EPA), shows the relative contribution of all man-made sources of VOC emissions. Vehicles are the largest source of VOC emissions nationwide, and other significant sources include petroleum production and distribution, and industrial combustion. There are also significant VOC emissions from natural or "biogenic" sources such as trees and other vegetation.

Emissions of VOCs, in and of themselves, do not necessarily give rise to health or environmental concerns. In many areas, however, they react with oxides of nitrogen (NOx) in the presence of heat and sunlight to form ground-level ozone — the primary component of "smog." For that reason, they are regulated as "ozone precursors" under the federal Clean Air Act and similar state laws.

In order to reduce ozone levels, federal and state agencies have developed regulations to reduce VOC emissions from a variety of sources, including products that contain solvents. In some cases (for major coating operations, for example), these regulations require the installation of a control device such as an incinerator or a solvent recovery system. In other cases, they limit the amount of solvent that can be used in products. They do not prohibit the use of solvents, because of the essential role solvents play in a variety of products and processes.

US Man-Made VOC Emissions



Source: EPA, National Air Pollutant Emission Trends, 1900-1996 (December 1997)

Definition of a VOC

Because VOCs are subject to regulation, the question "What is a VOC?" is a crucial one. The EPA has established a general definition of a VOC that is very broad. In effect, it states that "any volatile compound of carbon" is classified as a VOC for regulatory purposes, unless it appears on a list of compounds that have been specifically exempted. *See* 40 CFR 51.100 (s). This list of VOC-exempt compounds is discussed below.

EPA's regulations also provide, however, that the question "what is a VOC?" may have different answers depending on what is being regulated. For example, the Agency has recently proposed VOC-content limits for certain consumer products such as hairsprays and air fresheners. Under this proposed regulation, any solvent with a vapor pressure of less than 0.1 millimeters of mercury at 20^{O} C would not be regulated as a VOC.

For regulations involving paints and coatings, there is a specific test method, known as Test Method 24,

that generally determines what is a VOC. *See* 40 CFR part 60, Appendix A. Test Method 24 is a collection of ASTM test methods that collectively define the VOC content of a coating formulation. Except as discussed below, any compound that is "picked up" by these test methods is considered a VOC for regulatory purposes.

Individual states have their own VOC definitions, including their own list of exemptions. Although state definitions (including exemptions) are generally the same as the EPA definition, a solvent user should be aware of the precise definition that applies in his or her state.

VOC-Exempt Solvents

EPA regulations include a list of compounds that are explicitly exempted from regulation as VOCs, even though they are "compounds of carbon." In fact, there are two lists: a short list of compounds such as carbon monoxide and carbon dioxide that historically have not been regulated as VOCs; and a longer list of compounds that EPA has classified as "negligibly reactive." Negligibly reactive compounds are compounds that, based on EPA studies, have been found "not to contribute appreciably to ozone formation." This list of compounds (often referred to as "VOC-exempt compounds") is established and modified by regulation.

Although there are only a small number of VOC-exempt solvents at this time, they can be useful in a wide variety of products because they function as solvents but are not counted as VOCs for regulatory purposes. Where such solvents can be used, they provide the formulator with latitude and flexibility in designing solvent blends.

Product formulators, however, must obviously consider the characteristics of all product components, not just whether they are VOC-exempt. Careful selection of all components, including VOC and VOC-exempt materials, will help formulators to develop effective, efficient, and economical products that meet applicable regulatory requirements.

The Solvents Council serves as a forum for addressing health, safety, and environmental issues that affect producers, distributors, and users of hydrocarbon and oxygenated organic solvents. For more information about this bulletin or the Council, please contact Barbara O. Francis, Manager of the Solvents Council at 703/741-5609.

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