



Cutting Through the Maze of Clean Air Regulations:

A Guide for Solvent Users

Solvents are an essential component of a wide range of products – from cosmetics and health care products to cleaners and adhesives. For example, solvents have long been an important part of the paints and coatings that protect and enhance the appearance of buildings, structures, and durable goods.

There are several programs designed to reduce air pollution that impact solvent users. The most far reaching of these programs was created by the federal Clean Air Act Amendments of 1990. Solvent users also may be subject to the Emergency Planning and Community Right-to-Know Act (known as EPCRA).

This booklet is designed to help solvent users better understand these programs and their effect on a number of common solvents, as well as the various options that solvent users have for complying with regulations developed under these programs. This booklet focuses on federal issues and highlights a few state programs. Note that some solvent users will be affected by additional state specific programs.

To learn more about specific requirements in your area, you should contact your state or local air quality control agency.

The Regulatory Programs

The Clean Air Act

The Clean Air Act creates dozens of regulatory programs to deal with a variety of environmental concerns, including acid rain, hazardous air pollutants, visibility in national parks, depletion of the stratospheric ozone layer, and formation of ground-level ozone. The Clean Air Act programs designed to address two of these concerns – ground-level ozone and hazardous air pollutants – can have a significant impact on solvent users.
Most industrial solvent users, like most industrial producers, are required to obtain federal operating permits. Although the permitting program is not discussed in this booklet, solvent users should be aware that this program can impose substantial record keeping and reporting requirements.

Regulation to Control Ground-Level Ozone

It is well known that the impact of ozone is different depending on where in the atmosphere it is located. Ozone in the upper atmosphere, or stratospheric ozone, absorbs UV light and protects the earth from harmful ultraviolet radiation. Ground-level ozone, or tropospheric ozone, on the other hand, is the main component of smog, and can have adverse effects on human health.

Ground level ozone, which is the main component of urban smog, is formed in the atmosphere when UV light from the sun reacts with oxides of nitrogen (NOx) from automobiles, manufacturing plants, power generating facilities, or other emissions even when volatile organic co pounds (VOCs) are not present. When VOCs are present, the overall equilibrium between ozone and NOx is shifted and more ozone may accumulate.

There are many contributors to VOCs in the atmosphere, including natural or "biogenic" sources, such as trees and vegetation. Man-made sources such as vehicle emissions, petroleum refining and combustion also contribute to VOC levels. The use of organic solvents contributes to VOC emissions if they evaporate into the air. In most rural areas of the country, biogenic VOCs predominate over man-made VOCs. These areas often have limited NOx concentrations, due to the presence of fewer automobiles, manufacturing plants, power generating facilities, and other sources. Thus, reducing man-made VOCs in rural areas is not expected to provide the same benefit as in urban areas.

Some areas of the country do not meet national standards for ground level ozone and are referred to as "ozone non-attainment areas."

Under the Clean Air Act, these areas generally are required to reduce VOC emissions (not including vehicle emissions) by 3% each year until the national standard is met. To achieve these national standards and reach ground-level ozone attainment levels, virtually all sources of man-made VOC emissions are regulated, including solvent uses.

Traditionally, VOCs have been regulated using a mass-based control technology approach, by limiting the mass percentage of VOCs in various products or formulations, such as in paint. Under this approach, VOCs are either considered reactive, and therefore subject to VOC regulation, or negligibly reactive, and thus exempt from regulation. 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) was established by EPA and is modified by regulation.

This mass-based approach treats all non-exempt VOCs alike in their ability to contribute to ozone levels. However, scientists concur that VOCs vary significantly in their potentials to impact ozone levels (i.e., the higher the reactivity, the greater the potential to contribute to ozone levels). For example, alkenes (olefins) are more photochemically reactive than aromatics, which in turn are more reactive than both aliphatic hydrocarbon and oxygenated solvents. Therefore, two formulations that meet mass-based limits can have very different potentials to contribute to ozone levels, depending on the solvents used.

After years of scientific study, a new paradigm is emerging in the approach to improving air quality and reducing ground-level ozone – namely, using relative photochemical reactivity as a way to differentiate between VOC molecules.

California Aerosol Coatings Reactivity Regulation

Difficult reformulation challenges led the California Air Resources Board (ARB) to conclude that it may not be feasible to achieve additional VOC reductions using a traditional mass based approach for aerosol coatings. Working with industry and scientists, ARB developed a reactivity-based aerosol coatings rule, which was approved by EPA in September 2005. The ARB rule encourages reductions in the use of higher reactivity VOCs in aerosol coatings yielding greater reductions in ozone levels than would have been achieved by traditional mass-based regulations. ARB estimates this new rule will achieve the equivalent of 3.1 tons per day of VOC reductions in California, as compared to a mass-based approach.

EPA Interim Guidance Policy – Sets Direction for Future VOC Control

In September 2005, EPA published new guidance encouraging states to pursue reactivity based approaches in their State Implementation Plans for ozone attainment. In this guidance, EPA endorsed photochemical reactivity as a sound-science based approach for VOC control, and encouraged states to "consider how they may incorporate VOC reactivity information to make their future VOC control measures more effective and efficient." (www.epa.gov/ttn/oarpg/t1/memoranda/27601interimguidvoc.pdf).

Regulation of Hazardous Air Pollutants

In addition to being regulated as VOCs, some solvents are also regulated as "hazardous air pollutants" (or HAPs). EPA has developed regulations that apply to "major sources" of HAP emissions. A major source is any facility that has the potential to emit, on an annual basis, 10 or more tons of any single HAP or 25 tons of all HAPs combined. These regulations often are referred to as "MACT standards" because they are based on "maximum achievable control technology" (MACT).

EPA has developed MACT standards on an industry-by industry basis, including standards for numerous coating operations. MACT standards for the following coating operations are in effect:

- Boat manufacturing
- Large appliances
- Metal coil
- Metal furniture
- Miscellaneous metal parts and products
- Wood building products
- Metal can

Additionally, EPA has set compliance dates in April 2007 for plastic parts and products and automobile and light duty trucks.

There are two important differences between HAP regulations and VOC regulations:

First, HAP regulations apply nationwide to any facility that has the potential to emit, on an annual basis, 10 or more tons of any single HAP or 25 tons of all HAPs combined. VOC regulations on the other hand, generally apply only to emitters in nonattainment areas. Most emitters located outside those areas will not be subject to VOC regulations unless they build a major new facility or make a major change at an existing facility.

Most HAP regulations are set by the EPA. Most VOC standards are set by state or local regulatory agencies – often based on guidance from EPA.

In addition to the federal HAP program, most states have their own airtoxics programs. For example, the California Air Toxics "Hot Spots" Information and Assessment Act of 1987 requires facilities to report annual emissions of several hundred listed chemicals. Facilities are prioritized based on the potency, toxicity, and quantity of their emissions and their proximity to sensitive receptors. High priority facilities must conduct risk assessments. Facilities that are deemed to pose a "significant risk" must notify the public and implement a risk reduction and audit plan.

The Emergency Planning and Community Right-to Know Act

The Emergency Planning and Community Right-to Know Act (EPCRA) was enacted in 1986 to "inform communities and citizens of chemical hazards in their area."

Unlike the Clean Air Act, EPCRA does not require solvent users to make any changes in their operations. It simply requires facilities to report their "releases" of certain chemicals to air, water or land. These reports must be filed each year and are publicly available through the Toxics Release Inventory (www.epa.gov/tri).

Under Section 313 of EPCRA, EPA and states collect data on releases of a number of compounds from industrial facilities. To date, EPA has issued rules to include approximately 650 compounds that are listed as "toxic chemicals." This list has been controversial because it contains a number of chemicals, including several common solvents, that have relatively low toxicity.

Several states have similar programs. Examples include the Massachusetts Toxics Use Reduction Act and the New Jersey Worker and Community Right-to-Know Act.

Options for Complying with VOC and HAP Regulations

While specific options depend on the language of the regulations themselves, solvent users generally have three choices for complying with VOC and HAP regulations: (1) switch to an alternative technology; (2) reformulate;(3) install control or recovery technology.

Alternative Technologies

In some cases, a company may be able to switch to a water-based or high-solids system or a non-solvent technology such as powder coatings or radiation cure. These alternatives, however, are not practical for many applications, and many water-based or high-solids coatings still contain VOCs and/or HAPs.

While each of these technologies must be evaluated individually, they all have general advantages and disadvantages that should be considered:

Advantages

- Alternative technologies often provide substantial reductions in both VOC and HAP emissions.
- Switching to an alternative technology may reduce a company's record keeping and paperwork requirements.

Disadvantages

- The up-front capital costs required for new equipment can be high.
- Switching to an alternative technology may have a negative impact on product performance.
- Water-based systems can require higher energy usage for drying.
- Non-solvent coating technologies can only be used with certain types and shapes of substrates.
- The materials used in non-solvent
- technologies may have relatively high toxicity compared to the solvents they replace.

Reformulation to Reduce HAPs and/or VOCs

Reformulation may be an option for some companies – especially for those located in attainment areas. Because most companies in attainment areas will not be subject to VOC regulations, they have more flexibility to reformulate using solvents that are not listed as HAPs. Whether in an attainment area or not, choosing the appropriate solvent or solvent blend for a particular application is often not easy. Many variables must be considered, For example, reformulating an existing product is not as simple as substituting one solvent for another. The function of the solvent in the final formulation and the performance of the product, as well as regulatory requirements and product safety, are all considerations when making formulation decisions.

And in the case of reformulation to meet VOC requirements, it is not always possible to find a non-VOC replacement for a VOC solvent. The interactions of all the materials in the final product are complex, and VOC solvents may be needed to achieve the required formulation performance characteristics. not as simple as substituting one solvent for another. The function of the solvent in the final formulation and the performance of the product, as well as regulatory requirements and product safety, are all considerations when making formulation decisions. A company should carefully weigh the advantages and disadvantages of reformulation when choosing a compliance strategy:

Advantages

- Reformulation often involves the lowest up-front cost because, in most cases, it does not require new technology.
- In most cases, reformulation does not require significant operational changes.
- Reformulation may reduce emissions that must be reported under EPCRA.
- Reformulation may allow a company to avoid HAP regulations by reducing its HAP emissions below levels at which such apply.

Disadvantages

- Product performance may be compromised as a result of reformulation.
- Information about the safe handling and use of alternative substances may be more difficult to acquire.

In particular, reformulation may be difficult or impossible for companies that are required to control both VOCs and HAPs. In that case, a company must reformulate not only to reduce emissions of solvents on the HAP list, but also must reduce total solvent VOC emissions. Although this may be accomplished in some cases, for example, by switching to a high solids content, this may lead to unacceptable product performance. Moreover, because some HAPs are very efficient solvents, reformulating to reduce HAPs may actually increase VOC emissions.

Control Technology

Some businesses – especially larger solvent users in nonattainment areas– may choose a compliance strategy of installing control technology (including recovery systems). Technology controls such as incineration or carbon absorption control both VOCs and HAPs. As noted earlier, HAP regulations generally apply only to facilities that have the potential to emit 10 tons or more a year of any single HAP or 25 tons or more a year of all HAPs combined. By installing (and permitting) control technology to comply with VOC regulations, a company may be able to reduce its potential HAP emissions below those levels and avoid HAP regulations and possibly other requirements.

As with the decision to reformulate or switch to alternative technologies, companies must weigh the advantages and disadvantages associated with technology controls.

Advantages

- Control technology allows the continued use of proven solvents and existing application equipment.
- For large solvent users, control technology may be more efficient than reformulation.
- Use of control technology may allow a company to avoid HAP regulations by reducing its HAP emissions below levels at which such regulations apply.
- Control technology may result in less record keeping and reporting requirements.

Disadvantages

- Installation of control technology usually requires significant upfront capital investment.
- It may be difficult to get regulatory approval for certain control technology.

Solvent users should contact their solvent or coating supplier, or one of the companies listed on this page for further information about specific solvents. They should contact their supplier or trade association to identify current or upcoming regulations that may apply to them. And to learn more about specific requirements in their area, solvent users should contact your state or local air quality control agency.

Legal Notice

The information contained in this brochure is offered in good faith and believed to be accurate and reliable as of the date of publication. However, neither the American Chemistry Council nor the Solvents Industry Group assumes any liability resulting from the use of, or reliance upon, the information provided in this brochure. All persons involved in handling, storing, or using solvents have an independent obligation to ascertain that their actions are in compliance with current federal, state, and local laws and regulations, and should consult with legal counsel concerning such matters.

Please visit www.americanchemistry.com/solvents for more information about other solvent topics.

Solvents Industry Group Members

The Dow Chemical Company

www.dow.com

Eastman Chemical Company

www.eastman.com

ExxonMobil Chemical Company

www.exxonmobilchemical.com

Shell Chemical LP

www.shell.com

MODERN SOLVENTS MAKE IT HAPPEN®