

ENVIRONMENTAL INFORMATION

U P D A T E

Volatile Methylsiloxanes and Volatile Organic Compounds (VOCs) Regulation and Application

What are VOCs?

An organic compound is generally defined as one with a molecular structure that includes carbon, often in combination with other elements. A *volatile* organic compound is a carbon-containing material whose molecular weight and vapor pressure cause it to evaporate into the atmosphere.

The term "VOC" lacks a precise scientific meaning; instead, in the United States it is defined by law as any carbon compound which reacts photochemically in the atmosphere. In Europe, under the proposed Solvents Directive, a VOC is described as any organic compound with a vapor pressure greater than or equal to 0.01 kPa at 293.15° K (equivalent to 20° C). In Asia, there is no precise definition.

Where are VOCs found?

VOC emissions commonly result from organic compounds being used as fuels, feedstocks or solvents. Solvent applications include paints, inks and adhesive formulations, from which VOCs evaporate during application and drying. Other industries use VOCs as process aids, diluents and carriers, where emissions can occur from processing equipment, storage tanks, and pumps.

Why are VOCs regulated?

The main reason for VOC regulation is to improve air quality. VOCs contribute to smog formation, helping to prevent adverse effects on the environment and public health. Most VOC legislation refers to organic compounds that reacts in the presence of sunlight and air to form ground-level (tropospheric) ozone, a primary component of smog. This type of ozone should not be

confused with the protective ozone layer which blankets the earth's upper atmosphere (stratosphere), blocking out much of the sun's harmful radiation.

How are VOCs regulated in the U.S.?

In the U.S., VOCs are regulated under federal, state, and local laws, which serve to limit emissions from motor vehicles, industrial sources and consumer products. At the federal level, the Environmental Protection Agency (EPA) controls VOCs under the Clean Air Act and its subsequent amendments. The EPA has established a series of Control Technique Guidelines for industrial VOC sources, recommending control methods and emission limits.

At a minimum, state and local regulations must comply with federal standards, and many take them a step further. The most stringent regulations in the country are in the Los Angeles area, where development and enforcement are managed by the South Coast Air Quality Management District. The agency was created by state law, and is likely to serve as a model for other regions.

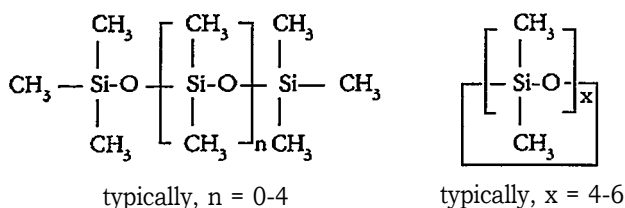
How are VOCs regulated in Europe?

The European Commission serves to initiate legislation and harmonize standards throughout Europe, although individual member states of the European Union may have additional legislation in place to limit VOC emissions (the Netherlands and the U.K. for example). Currently, a proposal for Council Directive 97/C99/02 is being considered for final adoption to limit VOC emissions from the use of organic solvents in certain industrial activities. VMS fluids are not mentioned

specifically in the Directive, but may fall within its jurisdiction if used in any of the approximately 20 different industrial processes for which emission limits have been established.

What are VMS fluids?

Volatile methylsiloxanes (VMS) fluids, are low viscosity liquids with a molecular weight under 600. These organosilicon materials have significant vapor pressure under ambient environmental conditions, and typically consist of $-(CH_3)_2SiO-$ units in either linear or cyclic structures.



The largest application for VMS fluids is their use as intermediates in the production of silicones. Since they are made and used in closed systems, any unreacted liquid is recycled back into the manufacturing process. As a result, emissions are very limited.

Some VMS fluids are also used as carriers for ingredients that remain in place after the fluid evaporates. For example, most anti-perspirant products use a type of VMS fluid to transport the active ingredient to the skin. The fluid quickly evaporates, leaving the actives behind. Other types of VMS fluids are being used or considered as carriers in a wide range of applications. Some VMS liquids are also used in precision cleaning of high-value parts, as in the aerospace and aviation industries.

Status of VMS fluids as VOCs

In the U.S., VMS fluids were originally classified as VOCs. Their status changed when the EPA issued a formal ruling in 1994 (59 Federal Register No. 192, October 5th. Their status changed with the agency's ruling of Oct. 5th, 1994, pp.50693-50696), exempting VMS fluids from regulation as VOCs. The action was taken in response to a Dow Corning petition submitted in 1992, which requested the exemption based on work conducted by the University of California and

substantiated by Harwell Laboratories in England and the University of Kassel in Germany. After reviewing the cumulative data on atmospheric fate and effects of VMS fluids, the EPA concluded that these materials demonstrate negligible potential for ozone formation. The agency granted the exemption as being consistent with its goal of improving air quality.

Because the European legislation does not use the same criteria for classifying VOCs, no general exemption is possible as in the U.S. However, Dow Corning is working closely with regulatory agencies and industry associations to ensure that VMS fluids are not included within the scope of the VOC Directive.

What difference does the exemption make?

The EPA exemption applies to air quality only. Other factors should be considered when evaluating VMS fluids as possible substitutes for VOCs, including performance in the application, equipment compatibility, and worker / consumer safety. Dow Corning continuously monitors workplace exposure and end user safety data on VMS products to ensure safe performance in their intended uses.

The EPA's exemption is an important step toward greater acceptance of VMS products. The ruling serves as an indication that these fluids are acceptable substitutes for VOCs in many applications, especially those in which VOC emission reductions are difficult. VMS fluids may also be valuable alternatives to chlorofluorocarbons (CFCs), which have been found to deplete the earth's protective ozone layer in the upper atmosphere. The EPA has listed VMS compounds as acceptable substitutes for ozone-depleting substances under the agency's Significant New Alternatives Policy (SNAP).

What happens next?

Dow Corning has petitioned the individual state agencies and regional authorities to take action similar to that of the U.S. EPA. The petitions referenced the EPA's findings and ask that the states follow suit by agreeing to the federal government's VOC definition. To date, 47 states have granted the exemption. Similar activity is underway with regulatory agencies in Europe, and other action will be taken as appropriate in other parts of the world.

**More information is available
from Dow Corning**

We hope this brief overview of a complex issue will be of interest and help to you. Much more detail is available from Dow Corning, and we welcome any questions you may have. Please contact your Dow Corning sales representative for more specific information.



Environmental Information Update sheets from Dow Corning will be issued as new or updated information becomes available. Please direct questions or comments to Ed Hutchison, Dow Corning, 517-496-4578.

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