



VOCs and Solvent Cements

The role of VOCs in solvent welding thermoplastic pipes & fittings

By Matthew Chang

June 8, 2018

Introduction

Volatile Organic Compounds (“VOCs”) are found in a wide variety of everyday products including solvent cements, which are used to weld thermoplastic pipes and fittings. The use of solvent cements will inadvertently release VOCs, which cause smog and indoor air pollution. This has led agencies such as southern California’s South Coast Air Quality Management District (“SCAQMD”) and the California Department of Public Health (“CDPH”) to develop and establish VOC guidelines to improve air quality for the environment. This white paper will define what VOCs are and explain the different VOC guidelines used to reduce their impact on the environment. Finally, the white paper will discuss the future of VOC regulations and solvent cements.

What are VOCs?

VOCs are carbon-containing compounds that easily evaporate at ambient temperature and pressure from solids or liquids. In indoor environments, excessive amounts of these compounds can cause adverse health effects. VOCs released outdoors can cause hazardous air pollutants such as airborne particles and ground-level ozone.

Solvent Welding and VOCs

The source of VOCs in solvent cement are the different type of solvents used to help soften the surface of thermoplastic pipes and fittings in preparation for the welding process. During storage, the VOCs in the solvents are safely contained inside the solvent cement cans. VOC evaporation mainly occurs during the solvent welding process when the applied layer of solvent cement is exposed to air. However, little to no evaporation occurs once a pipe joint is welded as the remaining VOCs are trapped inside the welded joints.

VOCs and Outdoor Air Quality

The South Coast Air Management District (SCAQMD) Rule 1168 was adopted in 1989 to protect outdoor air quality against smog by setting limits for VOC content in solvent cements.¹ This is one of the most stringent air quality regulations in the U.S., setting a standard adopted by regulatory agencies in many other states across the country.

In response, the solvent cement industry has been active in providing products that minimize VOCs. For instance in 1991, Weld-On introduced the first low VOC solvent cement in the market in response to growing air quality concerns. In 2009, Weld-On became the first

company in the industry to offer a complete Low VOC product line of solvent cements and primers that meets the VOC content limits established by SCAQMD Rule 1168 and phased out products that have VOCs above these limits.

All solvent cements currently in the market must meet SCAQMD Rule 1168 to be considered “Low VOC”. The current VOC content limits set by SCAQMD Rule 1168 are:

Products	Maximum VOC content (gram/liter)
PVC Solvent Cement	510
CPVC Solvent Cement	490
ABS Solvent Cement	325
ABS to PVC Transition Cement	510
Primer	550

VOCs and Indoor Air Quality

To address concerns regarding indoor air quality, the California Department of Public Health (CDPH) created the CDPH Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers.² This is one of the most widely used standards to evaluate products for low VOC emissions in a controlled environment.

In the CDPH test, VOC emissions are measured in a controlled testing chamber after conditioning of the test specimen for 10 days. The gathered emissions results are then compared against a list of allowable concentration limits of different VOCs. LEED v4 currently sets concentration limits for 33 individual VOCs and for total VOCs (TVOCs)³. TVOCs is the cumulative concentration of measured VOCs in a sample.

The following table clarifies the differences in VOC guidelines between SCAQMD Rule 1168 for VOC content and CPDH Standard Method for VOC emissions:

	Outdoor Air Quality SCAQMD Rule 1168	Indoor Air Quality CDPH Standard Method
Purpose	To reduce outside air pollution by limiting the amount of VOC content in a product	To evaluate VOC emissions from low-emitting VOC products in an indoor environment
What is measured?	VOC content of a product in grams per liter	VOC emissions in an indoor chamber test under defined temperature, relative humidity, and ventilation
Who performs the test?	Evaluation is done by the solvent cement manufacturer	Evaluation is done by a 3 rd party laboratory.

Measuring only VOC content is not the most accurate way to evaluate indoor air quality since there is no direct correlation between VOC content in a product and VOC emissions indoor over time. VOC emissions are more difficult to measure as a number of factors can affect the accuracy. The CDPH Standard Method minimizes these variabilities by measuring emission in a controlled environment. For these reasons, LEED v4 of the US Green Building Initiative specifies limit values for both VOC content and VOC emissions in order to obtain LEED credit for Indoor Environmental Quality.³

Future of VOC regulations

New regulations by SCAQMD will further reduce VOC content limits for solvent cement by 2023. Solvent cement manufacturers are already working on new products that can meet the new regulations while ensuring product stability and performance compliance. The following are the new proposed VOC content limits:

	Maximum VOC Contents (gram/liter)	
	Current	2023
PVC Solvent Cement	510	425
CPVC Solvent Cement	490	400
ABS Solvent Cement	325	325
ABS to PVC Transition Cement	510	425
Primer	550	550

Future VOC rules and regulations might phase out specific VOCs that have a much higher toxicity or other potential adverse environmental impact. Not all VOCs are created equal and their impact on the environment depends on several variables such as unique chemical reactivity and volatility. For instance, some VOCs form ozone at a much slower rate and are considered minimally reactive compared to VOCs that react at a much faster rate. This could lead to the development of new products that have reduced emissions of the most reactive VOCs while meeting the performance standards required by the market.

Conclusion

The presence of VOC containing materials in solvent cement is essential to perform its primary function of fusing thermoplastic pipes and fittings. However, a small fraction of VOC evaporation occurs during the application process whenever the solvent cement is exposed to air. Over time, the industry has made considerable effort in minimizing the impact of solvent cement VOCs in compliance with rules and regulations such as SCAQMD Rule 1168 for VOC content and CDPH Standard Method for VOC emissions. In addition, more stringent VOC rules and regulations coming in the near future could lead to the development of a new generation of low-emitting VOC products that can perform as well as traditional products on the market today while prioritizing the reduction of the most harmful VOCs.

References

1. **South Coast Air Quality Management District:** Rule 1168 – Adhesive and Sealant Applications. 2005
2. **California Department of Public Health:** Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers, v 1.2 Sacramento, CA: CDPH, Division of Environmental and Occupational Disease Control, 2010.
3. **U.S. Green Building Council:** LEED v4. Rating System Selection Guide. Washington, DC: USGBC, 2016. <http://www.usgbc.org/guide/bdc>