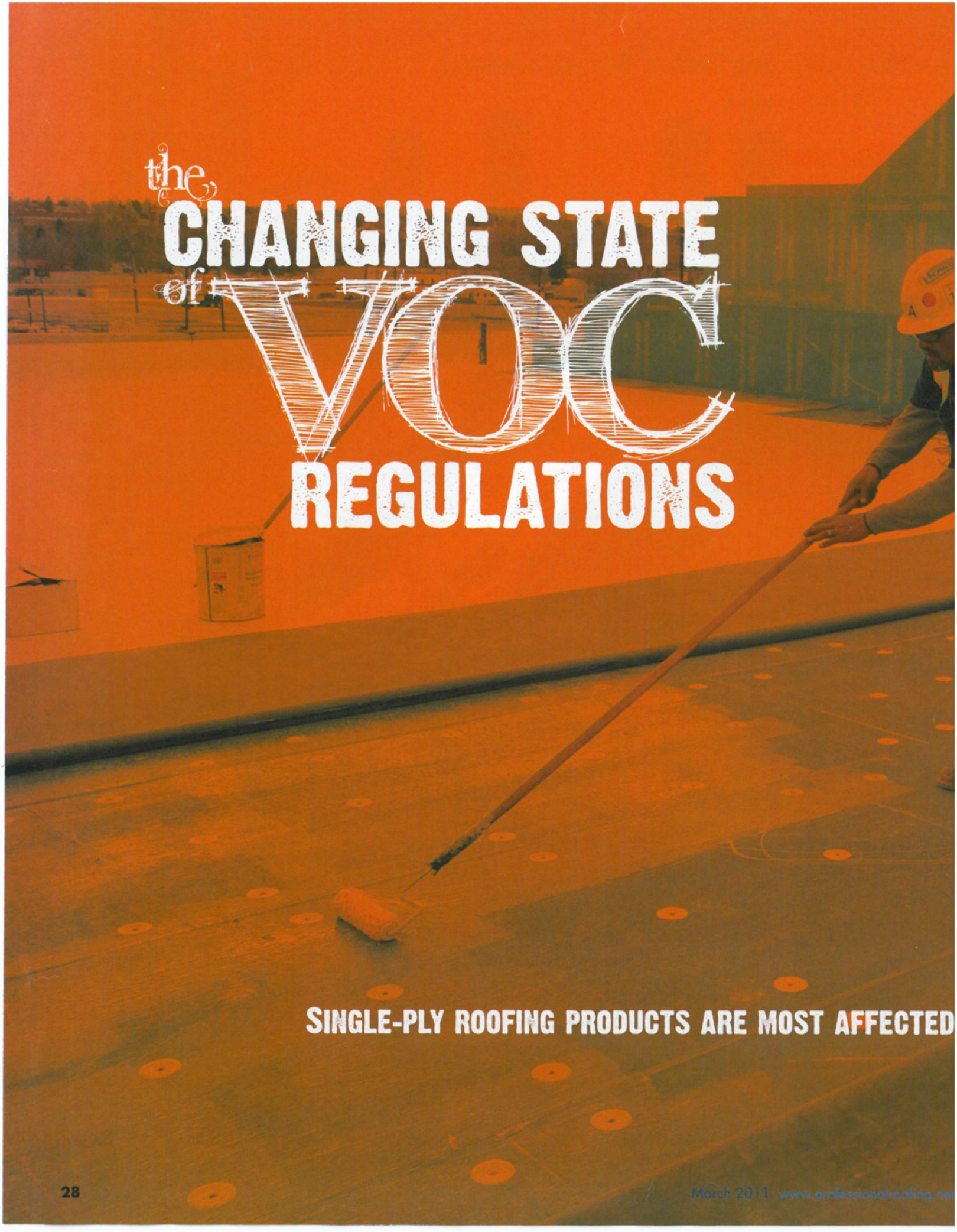


the CHANGING STATE of VOC REGULATIONS

SINGLE-PLY ROOFING PRODUCTS ARE MOST AFFECTED

BY RECENT DEVELOPMENTS

by DWAYNE WACENSKE

Although regulations governing volatile organic compounds (VOCs) are not new to the commercial roofing industry, the most recent changes affecting single-ply roofing adhesives, sealants and primers are a source of concern for many industry professionals. The regulations set maximum allowable VOC content, extend beyond simple odor control and focus on the environmental impact of these chemicals.

Complicating matters is the fact that the new rules are being enacted at the state—and sometimes local—level. It often is difficult to determine the VOC contents of many commonly used roofing products because jurisdictions determine whether a solvent is considered a VOC.

Typically, regulations limiting VOC content of adhesives and sealants apply to people who use, sell or manufacture such products. As a result, many roofing contractors are faced with regulations that may adversely affect product availability, application methods, productivity and, ultimately, installation costs.

WHY ARE VOCS REGULATED?

VOCs are regulated because they contain organic chemical compounds that may produce a strong odor as well as affect the environment. In particular, VOCs have been shown to contribute to smog generation, the primary component of which is ozone. Although "smog" and "ozone" often are used interchangeably, smog is more complex and primarily made up of ground-level ozone combined with other gases and particulate matter.

Ground-level ozone is an air pollutant that is harmful to breathe; damages crops, trees and other vegetation; and is the main ingredient of urban smog. The regulation of VOC content is aimed at reducing ground-level, or "bad," ozone. There are other programs and regulations designed to protect the "good" ozone that occurs naturally in the earth's atmosphere and shields us from the sun's harmful ultraviolet radiation.

Although efforts to reduce automobile emissions are well-known, less obvious are efforts to reduce VOC emissions from solvents. Solvents are used in several industrial processes and many consumer and commercial products. Since 1998, the Environmental Protection Agency (EPA) has regulated the VOC content of many of these products, including automobile refinish coatings, consumer products, architectural coatings, aerosol coatings and portable fuel containers.

The roofing industry uses products that contain solvents, including coatings, adhesives and sealants. Solvents are used to dissolve polymers or bitumen to make materials easier to apply. The solvents then evaporate, leaving the polymer behind. However, the quantity of solvents used in the commercial roofing industry is small compared with other industries.

WHO REGULATES VOC CONTENT?

The first regulation concerning adhesives and sealants was adopted by California's South Coast Air Quality Management District (SCAQMD) in 1989. SCAQMD's Rule 1168 regulates the VOC content of adhesives, sealants and primers. Of concern to the roofing industry are two categories of materials: single-ply roof membrane adhesives and single-ply roof membrane sealants. The SCAQMD limits the VOC content for these two materials to 250 g/L (grams per liter) and 450 g/L, respectively.

SCAQMD is one of 35 air districts in California. Another 11 of California's air districts have adopted rules similar to those of SCAQMD. Unfortunately, there are differences in their rules, meaning materials that may be compliant in one air district may not be compliant in another. California's remaining 23 air districts do not have rules governing adhesives at this time.

The Ozone Transport Commission (OTC) recently created a model rule to regulate the VOC content of adhesives, sealants and primers that was largely based on Rule 1168. Created under the federal Clean Air Act Amendments of 1990, OTC consists of 12 Northeastern and Mid-Atlantic states and the District of Columbia. It is responsible for advising EPA regarding transport issues and for developing and implementing regional solutions to the ground-level ozone problem in these regions.

Ground-level ozone and other pollutants can travel long distances by wind, creating air-quality problems far from the pollution's source. This migration of pollutants is known as transport and has led to the regionalization of air-quality matters.

Although OTC developed a model rule to reduce ozone levels in the region, the member states may opt to promulgate rules based on the model rule or modify the model rule. Member states have agreed in principle to what constitutes a VOC and the permissible VOC content of products; however, not all the states have enacted the regulations. Others have enacted laws with different enforcement periods.

An important consideration for the OTC states is the climate in the Northeast is quite different from southern California. To comply with the regulations in California, many manufacturers developed water-based materials. The climate in California allowed these materials to be used yearlong in most of the state. However, using water-based materials in some OTC states will severely limit the roofing season because such materials do not install well in temperatures below 40 F.

The EPDM Roofing Association worked with several state environmental agencies to make them aware of the consequences of these new regulations for the roofing industry. In response, states have decided to phase in the regulations for roofing applications. This has provided manufacturers with additional time to develop products to meet these unique requirements.

To allow for successful development of compliant solvent-based and non-solvent-based alternatives, the regulations for the VOC content of single-ply roofing adhesives, primers and sealants were first phased in beginning in 2009 in most of the OTC states. This year, the regulations in many OTC states will be in effect from May 1 to Sept. 30. During these months, adhesives, primers and sealants used with single-ply roof membranes must comply with VOC content limits. These limits will be implemented year-round Jan. 1, 2012.

The figure summarizes the regulations in the OTC states at press time. Because several states have not acted on this issue yet, I recommend roofing contractors consult the environmental protection agency that has jurisdiction in their areas to ensure products they use comply with current local regulations.

HOW TO COMPLY

To comply with VOC content regulations, manufacturers must reduce or eliminate

solvents that contribute to VOC content. But for many polymer systems, simple replacement is not an option. Rather, complete product reformulation is needed.

One option is to replace solvent-based products with water-based products. Some polymer systems are water-soluble and have zero or little VOC content. Unfortunately, because water freezes at a much higher temperature than most other solvents, water-based coatings and adhesives cannot be applied when the ambient temperature is near freezing. Many of these adhesives and coatings will be irreparably damaged if they are allowed to freeze before installation and curing.

Therefore, water-based adhesives should be stored at temperatures greater than 45 F. Manufacturers usually recommend adhesives be brought to room temperature before and during application.

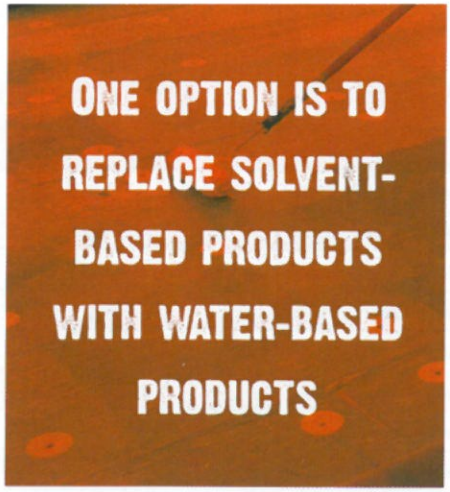
Moreover, at low temperatures, it can take an inordinate amount of time for these adhesives or coatings to dry. Water has many shortcomings as a solvent for adhesives, sealants and coatings that are to be used outdoors. For some applications, there may be the option to eliminate solvents completely. Examples include 100 percent solids systems, such as polyurethane sealants and adhesives, and epoxy coatings.

BONDING ADHESIVES

Bonding adhesives are most affected by VOC regulations. They are a critical part of fully adhered, single-ply roof systems and are available in solvent- and water-based formulations.

Most solvent-based bonding adhesives use synthetic rubber as the polymer matrix. Although the polymer provides excellent physical properties and good fire resistance and is stable throughout the entire service temperature range experienced on a commercial low-slope roof, it is difficult to dissolve.

Typically, xylene, toluene or a combination of the two are used as the main solvents.



Acetone (a VOC-exempt solvent) can only be used in small quantities. Acetone has a relatively low flash point (1.4 F), which may cause water to condense on the adhesive's surface as the acetone evaporates, causing the surface to cool. This sometimes is referred to as blushing and can lead to poor bonding when the two surfaces are mated.

Manufacturers have been able to reformulate bonding adhesives using exempt solvents. However, there are trade-offs. The drying time with these solvents can be considerably longer, reducing productivity. Some exempt solvents can produce a strong odor, and some may cause EPDM membranes to swell, resulting in solvent blisters or areas that are not adhered properly. In addition, some exempt solvents are relatively scarce and, therefore, considerably more expensive than the more readily available xylene and toluene.

Water-based bonding adhesives have been available for single-ply roofing applications for several years. Latex acrylic technology is used as the polymer matrix in most water-based bonding adhesives. These acrylic polymers are heat-resistant, flexible and strong.

As noted, the use of water-based bonding adhesives is limited by ambient temperature. Most manufacturers recommend these adhesives only be used when the temperature is 40 F and rising. Additionally, the adhesive must be maintained at temperatures above 40 F for 48 hours following application for it to cure fully. In many U.S. areas, this will limit the use of such materials to six months of the year.

Although water is an inexpensive solvent, many water-based materials are relatively expensive compared with traditional solvent-based materials. Water-based bonding adhesives may be 1½ to two times more expensive than solvent-based adhesives. Some of this expense may be offset by increased coverage rates.

The drying time of water-based adhesives highly depends on ambient conditions, such as temperature, humidity, wind speed and cloud cover. Also critical is that the drying time needs to be consistent because shaded areas may remain wet while areas in the sun dry much faster. This may cause sunny areas to dry completely, preventing the surfaces from bonding completely. Typically, the drying time of solvent-based adhesives is much less sensitive to ambient conditions.

POLYURETHANE ADHESIVES

There are some polyurethane adhesives used in the commercial roofing industry that contain no VOCs. These adhesives typically require the use of a fleece backing on membranes. A backing is needed because the polyurethane adhesives usually do not bond well directly to the single-ply membranes and fleece provides an excellent bonding surface for polyurethane adhesives.

Typically, these are two-part polyurethane adhesives that foam, or rise, before a fleece-backed membrane is placed into the adhesive. The adhesives are available in drums and are applied by a spray rig or in smaller packages that are applied with simple, low-pressure equipment. A spray rig can apply adhesive as a full coverage spray or as extruded beads. The small packages can only apply beads of the adhesive.

A polyurethane adhesive system is appropriate for re-cover situations because many types of existing roofs can be recovered without being torn off.

Summary of rules regarding adhesives and sealants			
Jurisdiction	**Status**	**Phase-in periods**	**2011-12**
Connecticut	Effective Oct. 3, 2008	May 1 – Sept. 30	After Jan. 1
Delaware	Effective May 1, 2009	May 1 – Sept. 30	After Jan. 1
District of Columbia	Regulation drafted	May 1 – Sept. 30	After Jan. 1
Maine	Effective Jan. 1, 2011	May 1 – Sept. 30	After Jan. 1
Maryland	Effective Jan. 1, 2009	May 1 – Sept. 30	After Jan. 1
Massachusetts	Under consideration	N/A	N/A
New Hampshire	Under consideration	N/A	N/A
New Jersey	Effective Jan. 1, 2009	May 1 – Sept. 30	After Jan. 1
New York	Effective Sept. 30, 2010	May 1 – Sept. 30	After Jan. 1
Pennsylvania	Pending	N/A	After Jan. 1
Rhode Island	Effective July 1, 2009	May 1 – Sept. 30	After Jan. 1
Vermont	Under consideration	N/A	N/A
Virginia – D06 (northern Virginia)	Effective Aug. 1, 2010	May 1 – Sept. 30	After Jan. 1
Virginia 1 – J07 (Richmond)	To be finalized soon	May 1 – Sept. 30	After Jan. 1

Regulations' effective dates in the OTC states

ADHESIVE PRIMERS

VOC rules and regulations either include primers under the definition of an adhesive or give them their own category; their VOC content typically is limited to 250 g/L. The same approach to lower the VOC content of solvent-based bonding adhesives has been used with primers: solvent substitution. Primers may have solids content as low as 5 percent, meaning the remainder of the material will be solvents. A primer's solids portion typically includes butyl-based rubbers, hydrocarbon tackifying resins and, sometimes, curatives.

Similar to solvent-based bonding adhesives, exempt solvents can be used with primers that comply with VOC content limits. However, these primers may require longer open times than standard primers. There also is the potential for EPDM membrane swelling to a greater degree than for primers that use VOC-containing solvents. Because primers typically are applied in thinner coats than bonding adhesives, that possibility is minimized. But puddling or excessive application rates can lead to membrane blistering and extended open times.

SEALANTS

The definition of a sealant in SCAQMD's Rule 1168 is any material that is used to fill, seal or waterproof gaps or joints between two surfaces. The definition also includes many sealant primers and caulks.

As noted, sealants' VOC contents also are regulated in many areas. When regulated, the VOC content limit for sealants is 450 g/L. This is considerably higher than the limit for adhesives (250 g/L).

Additionally, the amount of sealant used on a job site is small compared with that of bonding adhesives. Most roofing sealants have a much higher solids content than adhesives and primers and, therefore, contain much less solvent. As such, most roofing sealants meet VOC content regulations.

WHAT LIES AHEAD?

Since 2008, when EPA significantly strengthened air-quality standards for ground-level ozone, the roofing industry has faced many changes in the rules and regulations regarding the environment.

Looking ahead, more U.S. areas may be required to implement plans to reduce ground-level ozone levels. This will lead to more regulation of VOCs, possibly including those found in adhesives and sealants used in the commercial roofing industry.

The roofing industry needs advocates who can express the industry's concerns to legislatures and rulemaking bodies to ensure other issues are not compromised in the name of the environment. For example, if adhesives do not work properly and the integrity of a building's roof system is compromised during a storm, the safety of the people in that building may be at risk.

Most important, roofing contractors must be aware of the current regulations and how they will change in 2012. The phased-in, seasonal implementation schedule that many states already have incorporated will end in 2012.

Environmental issues are a top priority throughout the construction industry and can best be addressed through collaboration, cooperation and ongoing communication among state and federal regulatory bodies, roofing product manufacturers, specifiers, consultants, owners, installation contractors and others.

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