A growing concern

Water-based adhesives face product limitations and reports of problems

by Mark S. Graham

Water-based bonding adhesives are being increasingly specified and used as replacements for conventional solvent-based bonding adhesives in an effort to reduce volatile organic compound (VOC) emissions. However, water-based bonding adhesives have notable temperature and condition limitations, and NRCA has received a number of reports of problems related to such adhesives.

Regulations

As part of an effort to achieve federally mandated standards in the Northeast and Mid-Atlantic, the Ozone Transport Commission (OTC) developed model rules for adhesives and sealants that regulate VOC content. Specific states' regulations and implementation timetables vary slightly, but they generally require adhesives, sealants and primers to contain a maximum of 250 g/L of VOCs by Jan. 1, 2012.

Similar VOC limits occur as targets in some voluntary sustainability programs, including LEED.®

These limits generally exclude the use of most solvent-based adhesives and primers, which have VOC contents two to three times the OTC allowed limit. As a result, manufacturers have been forced to offer alternative adhesives, sealants and primers to achieve the targeted VOC level.

Product limitations

The development and use of water-based bonding adhesives in the roofing industry are causes for some concern.

Water-based bonding adhesives have notably more restrictive limits on their transportation, storage and use.

Review of manufacturers' product literature reveals water-based adhesives need to be protected from freezing during transportation and storage. Manufacturers' recommendations vary; some recommend storing water-based adhesives at ambient temperatures between 60 F and 90 F. Such limits likely necessitate transportation in enclosed trailers and storage in enclosed warehouses. During summer and winter, temperature-controlled trailers and warehouses may be needed to maintain such a temperature range.

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Manufacturers' storage temperature recommendations also appear to apply to job-site storage. As a result, storing water-based adhesives on roofs may be significantly restricted.

Most manufacturers also place low-temperature application limits on their products—such as 40 F and rising at the time of application—in recognition that installed adhesives should not freeze during drying and curing. It needs to be noted nighttime roof surface temperatures can be somewhat cooler than ambient temperatures because of radiative cooling, which will affect curing.

Adhesive rates and cure times for water-based adhesives appear to differ from solvent-based adhesives. In addition to being temperature-sensitive, water-based adhesives are humidity-sensitive. Generally, water-based adhesives take longer to reach adequate initial "green" strength compared with solvent-based adhesives, and this time will vary based on temperature and humidity.

Reports of problems

Water-based bonding adhesives have been available in the roofing industry for several years. NRCA is aware of limited, though significant, reports of problems attributable to the use of water-based adhesives.

The reported problems generally involve the loss of adhesion of flashings or membranes in single-ply membrane roof systems from multiple manufacturers. Most of the reported problems became evident six months to two years after installation.

From the reports where NRCA has more detailed information, adhesion and cohesive failures of adhesives have been observed. In many reports, the adhesive appears to have "re-wetted," meaning it reverted to a consistency similar to when it initially was installed.

Relatively high internal building pressures or a predominant vapor drive from the building's interior to its exterior are common factors in several reports.

If you are involved with a project where the use of water-based bonding adhesives appears to be problematic, I encourage you to contact the specific roof system manufacturer and NRCA's Technical Services Section for assistance.

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