



Asphalt Health and Safety Issues

Changing values and guidelines will affect applications

May 2014

Asphalt has been one of the fundamental products used in the manufacture and construction of roof systems in the U.S. Even with the development and maturation of single-ply membrane roof systems and other alternative products, asphalt use continues to be widespread in the U.S. Asphalt is used in the manufacture of asphalt shingles, polymer-modified bitumen sheet products and certain roof coating products. In field applications, hot-applied asphalt is used for adhering base sheets, vapor retarders, insulation layers and polymer-modified bitumen sheets; interply moppings between ply sheets in built-up membrane construction; and as a membrane surfacing, commonly with aggregate.

Although asphalt has been used in the U.S. roofing industry for years, health and safety concerns when using hot asphalt and changes to asphalt's physical properties are issues of which users need to be aware.

HEALTH AND SAFETY

Roofing professionals have long recognized many of the health and safety concerns relating to using hot asphalt, and asphalt's odor when heated to elevated temperatures is objectionable to some people.

For more than 20 years, NRCA has worked closely with asphalt suppliers, product manufacturers, the United Union of Roofers, Waterproofers & Allied Workers, the Asphalt Roofing Manufacturers Association (ARMA) and the Asphalt Institute through an informal partnership to represent the roofing industry to government bodies studying health and safety aspects of hot-applied asphalt. This has included individual and joint research and outreach efforts.

An important combined effort includes development of the National Institute for Occupational Safety and Health's document "Asphalt Fume Exposures During the Application of Hot Asphalt to Roofs—Current Practices for Reducing Exposures" that provides industry guidelines for the safe use of hot asphalt. Its provisions have been incorporated into most asphalt suppliers' and product manufacturers' installation guidelines and their safety data sheets (SDSs).

In October 2011, the World Health Organization's International Agency for Research on Cancer (IARC) issued a conclusion stating occupational exposures to oxidized bitumens and their

emissions during roofing applications probably are carcinogenic to humans (Group 2A). Oxidized bitumens include mopping asphalt used on roof systems.

In May 2013, IARC issued a report of its findings and conclusion, IARC Monograph Volume 103, "Bitumens and Bitumen Emissions, and Some N- and S-Heterocyclic Polycyclic Aromatic Hydrocarbons." Although the timing of this report was not surprising, NRCA believes IARC's research is not definitive.

With the IARC determination, in the coming years U.S. government and scientific groups such as the National Toxicology Program and the American Conference of Governmental Hygienists will make their own assessments.

ASPHALT TESTING

Originally published in 1929, the U.S. product standard for oxidized asphalt used in roofing is ASTM D312, "Standard Specification for Asphalt Used in Roofing." The current edition was published in 2000 and reapproved in 2006.

ASTM D312 provides for four types of asphalt—Types I, II, III and IV—based upon the asphalt's physical properties. An asphalt's tested softening point, hardness (penetration) and ductility properties dictate its type.

ASTM D312 also requires asphalt to have a minimum 500 F flash point (FP). The standard currently does not prescribe minimum or maximum values for an asphalt's equiviscous temperature (EVT); it simply requires asphalt suppliers report the asphalt's EVT on the package labeling or bill of lading.

In 1989, NRCA conducted a temperature-viscosity data study of 26 asphalt samples procured from around the U.S. EVT data from the samples are provided in Figure 1. The 1989 study was limited to EVT testing and did not include FP testing or testing of other physical properties to determine compliance with ASTM D312.

In 2000, NRCA conducted a limited study of 19 lots of Type III asphalt procured from around the U.S. EVT and FP data for these samples are provided in Figure 2. Ten of the 19 samples analyzed did not meet the physical property requirements of ASTM D312, Type III.

This year, NRCA conducted limited testing of 14 lots of Types III and IV asphalt obtained in late 2013 from roofing contractors'

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Asphalt type	EVT at 75 cps ¹ (Mechanical spreader)		EVT at 125 cps ² (Mop)	
	Minimum	Maximum	Minimum	Maximum
III	400 F	470 F	400 F	430 F
IV	445 F	485 F	420 F	455 F

¹ EVT at 75 cps represents the recommended temperature for asphalt at a mechanical spreading device immediately before application to the substrate.
² EVT at 125 cps represents the recommended temperature for asphalt in a mop cart immediately before application to a substrate.

Figure 1: EVT data from NRCA's 1989 temperature-viscosity study

Asphalt type	EVT at 75 cps (Mechanical spreader)		EVT at 125 cps (Mop)		Flash point	
	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
III	390 F	440 F	415 F	475 F	585 F	640 F

Figure 2: EVT and FP data from NRCA's 2000 study

Asphalt type	EVT at 75 cps (Mechanical spreader)		EVT at 125 cps (Mop)		Flash point	
	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
III	424 F	462 F	452 F	486 F	630 F	655 F
IV	455 F	482 F	480 F	506 F	615 F	660 F

Figure 3: EVT and FP data from NRCA's 2014 study

on-hand supplies. EVT and FP data for these samples are provided in Figure 3. Ten of the 14 tested samples did not meet the physical property requirements of the asphalt type of which the product was labeled.

Comparing EVT results from NRCA's 1989, 2000 and 2014 tests show EVT values have increased notably over the years. Also, comparing FP results from the 2000 and 2014 studies show FP temperatures also have increased notably and currently are well in excess of the minimum 500 F value prescribed in ASTM D312.

These increases in EVT and FP temperatures undoubtedly have resulted in increases in asphalt kettle and tanker temperatures in the field to provide the asphalt EVT at the point of application.

REVISING ASTM D312

Based upon NIOSH's document and IARC's research, it is apparent asphalt fumes and the possible detrimental effects of overheating asphalt are best mitigated when asphalt kettle and tanker temperatures are kept to a minimum. To facilitate lowering of asphalt heating temperatures, NRCA and ARMA have proposed a revision to ASTM D312 that currently is being balloted.

The current ASTM D312 ballot includes establishing a 550 F maximum heating temperature for asphalt. This requirement is intended to supersede the current roofing industry guideline that

calls for a maximum asphalt heating temperature 25 F less than the asphalt's FP temperature. Some asphalt suppliers recommend in their SDSs a maximum asphalt heating temperature 50 F less than the asphalt's FP temperature.

In conjunction with prescribing a maximum heating temperature, the ballot also establishes maximum EVT values based upon the maximum tested values from NRCA's 1989 study. These EVT values follow:

- Type III mop application: 430 F maximum
- Type III mechanical spreader application: 455 F maximum
- Type IV mop application: 470 F maximum
- Type IV mechanical spreader application: 485 F maximum

The ballot also includes adding a requirement that asphalt suppliers provide lot-specific EVT mop and mechanical spreader application values on their asphalt packaging or bills of lading.

The closing date for the ballot is in early June, and any comments received will be discussed during ASTM Committee D08's June meeting.

NRCA will keep its members apprised of the ballot outcome and the timing of asphalt suppliers' implementations of any new application guidelines.

INTERIM RECOMMENDATIONS

Until ASTM D312 is appropriately revised, NRCA recommends you do the following:

- Consult asphalt suppliers and product manufacturers for specific installation instructions and SDSs—be aware some suppliers' and manufacturers' installation instructions are not consistent with their SDSs.
- Carefully select asphalt—be aware of the asphalt's actual EVT and FP temperature; do not rely on preprinted package labeling and consult asphalt suppliers for lot-specific EVT and FP temperature values.
- Make your field personnel aware of changing EVTs, FP temperatures and maximum asphalt heating temperatures.

NRCA members with questions regarding the health and safety of using hot asphalt are encouraged to contact NRCA's Risk Management Section. Questions about asphalt application, testing or ASTM D312 can be directed to NRCA's Technical Services Section. NRCA staff can be reached at (800) 323-9545.

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