Roofing Contractor

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Tech Viewpoint: Observations from the Field

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There were very few revelations in the roofing industry last year – perhaps even none. But there are enough leftovers to fill most plates and new caveats of which to be aware. TPOs still are the hot topic of conversation, with virtually every major supplier of roofing materials (excepting possibly Johns Manville) investing in new manufacturing facilities to produce the material that they feel will replace all others in the sheet membrane lines of roofing membranes.

The National Roofing Contractors Association (NRCA) made a conscious decision to monitor the evolution of TPOs in the U.S. roofing market. The association felt it missed the opportunity to monitor the evolution of EPDM, and the NRCA's database, Project Pinpoint, has tracked EPDM problems through the years. But without reasonable initial data, much of the "crystal ball" effect from input to Project Pinpoint is lost among other potential problem contributors to the EPDM roof systems. In the NRCA's test program, available TPO membranes are purchased on the open market and regularly subjected to testing to evaluate compound components and to trace formulation changes in the materials produced by various manufacturers. Only time will tell how valuable this monitoring will be to roofing contractors, but it is the first time that the NRCA has become involved in regular testing and tracking of the evolution and consistency of a roofing material.

The association-sponsored testing of available TPO roofing membranes has produced some surprises. The decision to make test results available to NRCA members was recently made by the NRCA executive committee. Members will receive the information for their use in evaluating material for potential purchase and to maintain in their records on current projects.

The introduction of TPO sheets 12 feet wide for mechanically attached roof membrane systems is of some major concern. The 12-foot wide sheets with fasteners 6 inches on center at sidelaps have apparently passed current static uplift tests, but the question is, how long will the sheet edges survive the cycling of thermal and wide loads without coming apart? There are obvious economies in manufacturing and installing wider sheets, but longevity of the sheet may be compromised by force/loads imposed on the roof membrane and fasteners by environmental conditions.

TPO material, like most other plastics, loses its tensile properties at elevated temperatures, making it susceptible to "stretching" away from points of restraint. Wind flutter at roof-surface temperatures under sun-load eventually may cause polymer separation at fasteners and welded lap edges. The wider the sheet, the more likely this phenomenon will occur. Separation of the polymers means a breach in the integrity of the waterproofing membrane. How long will it take? It will be dependent on the chemical formulation of the TPO, the type of reinforcements used in the sheet and the environment to which the roof membrane is subjected. Under severe exposures, it would appear that "less is better," meaning the 6-to 7-foot wide sheets may perform better than wider sheets in the long haul.

Since TPO compounds are all heat sensitive, the manufacture and installation of black TPO membranes makes no sense.

It also makes no sense to manufacture a TPO roofing membrane without UV stabilizers (which are critical to the weathering properties of TPO compounds) under the premise that aggregate ballast is sufficient protection for the TPO roof membrane against UV exposure. Anyone who has ever walked a roof knows that wind displaces even large aggregate, leaving the roof membrane open to UV exposure (not to mention the removal of aggregate ballast by maintenance personnel who don't like to stand on rocks, or by repair crews who leave the aggregate off the membrane until they are sure they have corrected the problem). Most contractors know that even using the best available aggregate, the roofing membrane will not be covered completely using 10 pounds per square foot of aggregate ballast. But the material can be manufactured and sold more inexpensively, which certainly should compensate for the relatively short anticipated life expectancy of the non-UV-stabilized TPO roofing membrane.

There have been some relatively serious material-related problems with several of the TPO membranes, but most of the problems appear to be caused by a lack of understanding by mechanics that TPOs handle and work differently – even on the same job, depending on changes in ambient temperature. Mechanics who are good at EPDM applications have some serious adjustments to make in understanding the application of TPO roofing membrane systems. If you plan to get your feet wet in TPO applications, update your heat welding equipment and plan to spend some time on the floor of the shop determining what you can and can't do with this product. Pay particular attention to installation of pre-formed flashing — they are heavier than the membrane and will require proportionately more heat during the welding process. Also get used to a stiff, boardy sheet.

With everybody getting into the TPO business, competitive sales pressures will force manufacturers toward compound formulation changes to produce the material less expensively. Either less or less-expensive compound components will be introduced, and the TPO roofing membranes will be "improved" until they no longer work. It would be nice to think that some expensive lessons have been learned and heeded, but that is not the American way.

Isocyanurate Foam Roof Insulations

Polyisocyanurate Insulation Manufacturers Association (PIMA) recently issued Technical Bulletin No. 107, which addresses the issue of dimensional stability of isocyanurate foam roof insulation products. PIMA has agreed to tighten the dimensional stability limits listed in ASTM C1289 from 4 percent to 2 percent in the length and width directions, and changes to the ASTM Test Method are pending. The concession is clearly an improvement, but in Technical Bulletin No. 107, PIMA is claiming –0.28 percent to +0.28 percent dimensional stability values when the material is tested at 200 degrees F (although the usual comparative test is 158 degrees F at 97 percent relative humidity), and the isocyanurate foam products look better when compared to polystyrene insulations. With such "sterling" test results, it would appear that isocyanurate foam roof insulations could be produced to even tighter dimensional stability tolerances.

A roofing contractor cannot be expected to test all materials submitted to be installed, but by providing submittals to specifiers, the contractor is representing that materials submitted to be installed meet the intent of the specifications. And most specifications contain the intent to provide a fire-resistant roof system. Again the caveat – do not guarantee materials on any project — including the performance properties of any material.

Isocyanurate foam roof insulations produced with the current popular blowing agents have the potential to not perform well under low temperature conditions, i.e. cold storage and freezer facilities. Reversion of the insulating gasses to liquid under cold temperatures will affect the insulating properties of the isocyanurate foam roof insulations and potentially affect the structural integrity of the insulation boards themselves, given long periods of cycling.

Isocyanurate foam roof insulations typically perform well as the only high-R insulation material in the roofing industry, but, like any material, they have their shortcomings. Twenty years ago, the NRCA recommended that a cover layer of perlite, wood-fiber or glass-fiber roof insulation be installed over polyurethane and isocyanurate foam roof insulations to minimize the effects of moisture release from the insulation and blistering of hot applied built-up roofing membranes. That recommendation compensated for one of the shortcomings of isocyanurate foam roof insulations, and the problem of blistering of built-up roofing membranes used in conjunction with isocyanurate foam roof insulation virtually disappeared.

Last year, confronted with numerous instances of "crushing" of isocyanurate roof insulation under both ballasted and mechanically attached sheet membrane roofing systems, the NRCA extended its recommendation for a cover board over isocyanurate foam roof insulation to all roof systems to compensate for the fact that cellular plastic foam cells are relatively friable and are damaged permanently by continuous or heavy traffic over low-sloped roof systems. Such damage still will occur even if compressive resistance of the foam insulation is increased.

These recommendations merely attempt to compensate for the inherent properties of isocyanurate foam roof insulations — that they potentially release sufficient moisture on contact with hot asphalt to cause blistering in built-up roofing membranes applied directly to the foam insulation surface; and that the relatively friable cell structure can be damaged by heavy and/or continuous concentrated traffic over the roof surface. Simple physical facts.

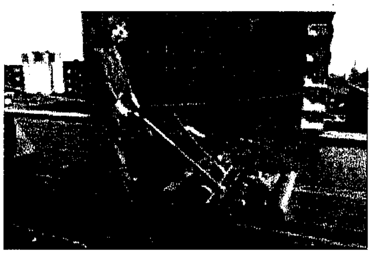
Before the federales dictated a change in blowing agents, isocyanurate foam roof insulations were a nearly mature product. The industry had come to expect relatively trouble-free and predictable performance, and compensations for the product's shortcomings were fairly simple and straightforward. The isocyanurate foam roof insulation industry has been forced to alter its product and manufacturing processes to eliminate the original CFC blowing agent, even though there is no positive proof that God didn't originally intend for there to be a "hole" in the ozone layer. The changes have been painful and costly for manufacturers, and the properties of the finished product have been, and will continue to be, affected by the variables introduced with such drastic product changes. One of the variables has become a major issue: that of the inherent fire resistance of the present isocyanurate foam roof insulation products. The manufacturers may or may not be able to correct this deficiency permanently and consistently, and some compensation for this potential shortcoming in isocyanurate foam roof insulation may be in order.

It is clear that the fire-related issues with presently manufactured isocyanurate foam roof insulations have not been resolved effectively by the isocyanurate foam insulation manufacturers. Some of the problems may be attributable to forced changes in flowing agents, and some may be production of material "on the edge" of the acceptable envelope. In either case, contractors should be pro-active in protecting themselves from installing isocyanurate foam roof insulations that may not meet the advertised (and even "listed" or "approved") fire properties.

Given the uncertainties in the fire performance of some presently manufactured isocyanurate foam roof insulation, it would be prudent of the roofing contractor to 1) require certification from the insulation manufacturer that the product will perform as represented, or 2) recommend the installation of an approved thermal barrier under all isocyanurate foam roof insulation installed over steel roof decks. Factory Mutual Research lists 5/8-inch Type X mineral board or 1-inch perlite roof insulation as acceptable thermal barriers.

It would appear to be prudent for the industry to recommend a thermal barrier over steel roof decks over which isocyanurate foam roof insulation is to be installed so that there is no question as to the fire resistance of the completed roof system. If, or when, the question of fire resistance of isocyanurate foam is (or isn't) satisfactorily resolved, the recommendation can remain, be modified or be rescinded without jeopardizing the integrity of current projects.

Dens-Deck



Following last year's comments about the potential shortcomings of Dens-Deck, Georgia-Pacific Corp. launched a relatively thorough testing program. The company sought to better understand the effects of hot asphalt and torches on Dens-Deck used in roof systems, and to assess the long-term effects of calcination of the mineral board under dark-surfaced roofing membranes. The testing included new wind uplift evaluations using mechanical fasteners. Coinciding with the evaluation and testing was the introduction of a new acrylic surface for Dens-Deck in a product called Dens-Deck Prime.

The original FMR listings for density of mechanical fasteners to secure Dens-Deck stipulated 16 fasteners per 5/8-inch by 48-inch by 96-inch board. The new approvals require only eight fasteners for 5/8-inch by 48-inch by 96-inch board; 10 fasteners for 1/2-inch by 48-inch by 96-inch board; and new listings for 11 fasteners per 1/4-inch by 48-inch by 96-inch Dens-Deck Prime, and 12 fasteners for 1/4-inch by 48-inch by 96-inch Dens-Deck. Approvals use Olympic 3-inch round metal stress plated with No. 12 screw-type fasteners. FMR Wind Uplift Classifications range from 1-60 to 1-90 (including 1-75 for some tests). Check the new FM Global Approval Guide for new listings, or get information and certifications from Georgia-Pacific for specific applications.

The acrylic surface on Dens-Deck Prime should make the application of both contact and asphalt adhesives much more expedient and positive than the original glass fiber mat facer. The jury still is out as to whether or not to torch directly to the acrylic facer, so torch with caution.

Application recommendations for hot asphalt and torching directly to Dens-Deck and Dens-Deck Prime are forthcoming from Georgia-Pacific. The preliminary recommendations for application of hot asphalt to Dens-Deck are not particularly user-friendly, and some dramatic changes in asphalt application habits may be required in order to comply. One recommendation limits heating of asphalt to 425 degrees F and recommends against the use of ASTM D-312 Type IV asphalt — a problem for most SBS modified asphalt systems specified to be installed in hot Type IV asphalt. For continuous mopping applications, recommendations are for an initial sheet to be "permeable." Also, "no membranes or fully asphalt-coated felts should be used as the first sheet in full-mopping applications." This is not particularly practical for SBS modified asphalt base sheets or for the use of Type VI glass fiber roofing felts.

For torch applications, recommendations read, "Limit the heat applied to the Dens-Deck substrate. Maintain a majority of the torch heat directly on the roll. Proper torching will differ from standard torching methods used for APP and SBS modified bitumen membranes, but is necessary to avoid calcination, blistering and damage to the glass fiber facer," among some not so relevant others. Applicators beware — some additional torch training will be essential!

Kudos for Georgia-Pacific for paying attention, but some of the recommendations will limit severely the use of Dens-Deck with many polymer modified asphalt roof membrane specifications and a number of built-up roofing membrane specifications. It would be prudent to pay close attention to the interim recommendations for application and to get written variances from those recommendations when the specifications and the application recommendations don't match.

Georgia-Pacific is using two moisture-resistant additives — silicone and a proprietary wax emulsion. If your customers have any heartburn with silicones in your proposed products, specify the non-silicone version of Dens-Deck now available.

Remember, Dens-Deck is moisture-resistant, not waterproof. It remains susceptible to moisture absorption from high humidity ambient conditions. Under some conditions, moisture gains by the boards may make other application compensation necessary to minimize the effects of moisture release from the Dens-Deck boards during the time of application of hot asphalt or torch-applied polymer modified asphalt sheet applications.

The issue of long-term effects of calcination on in situ roof membrane systems is as yet unresolved, and there does not appear to be sufficient data on the matter to determine whether or not continuous high-temperature exposure of the Dens-Deck may result in some surface degradation of the mineral board and a partial (or total) release of the roof membrane from the top surface of the Dens-Deck. Georgia-Pacific indicates that it will continue work on this issue.

The millennium passes, and lo and behold, things are different . . . and the same.