

# FIELD Versus FACTORY:



WHERE  
SHOULD A  
MEMBRANE  
BEGIN?

By Dustin Brooks

Photo 1 – Liquid-applied membrane over existing 18-year-old PVC membrane.

**A**ll membranes begin as a liquid at some point. Recently, the popularity of liquid-applied membranes or—as I like to refer to them, field-manufactured membranes—has risen substantially in the roofing industry. Though the market is currently dominated by factory-manufactured or rolled membranes, it is important to understand the specific liquid technologies changing the market and the pros and cons of each. It must be noted that liquid products currently are primarily used for retrofits and restoration in the roofing sector. In the overall waterproofing market (plaza decks, below-grade, etc.), the percentage of liquid products utilized on new construction projects is a much larger figure.

To start, what are the basic benefits of choosing a field-manufactured (liquid) ver-

sus a factory-manufactured (sheet) membrane?

- It is fully adhered directly to the substrate with no glues or adhesives, which can fail with time or exposure to moisture. Full adhesion eliminates horizontal migration of moisture underneath the membrane in the instance of a puncture or open lap or failed termination.
- It avoids drilling thousands of fasteners through the deck to hold the membrane down. Over time, as insulation settles, fasteners often start to protrude through membranes. In the event of a leak, fasteners can rust over time and also wick water into the deck and building.
- It has no seams or overlaps, and most liquid-applied systems are self-terminating, meaning no termi-

nation bars, boots, or caulking.

- Maintenance and repairs are quicker with most liquid products, as the need for cutting, welding, torching, or gluing is eliminated.
- Many liquid membranes can be applied directly over an existing roof membrane without the need for a separation layer such as is required with single-ply re-covers.
- Under most building codes, liquid-applied roof re-covers are recognized as a maintenance item and not a capital expense, allowing the entire expense to be written off the following year.
- There is no product waste with self-terminating liquid membranes, and the remaining product in the container can be reused with many systems. Sheet membranes can





Photo 2 – Rust damage on metal roof with permeable acrylic/emulsion system.



Photo 3 – Exposed spray polyurethane foam with moisture absorption.

produce a lot of waste, and rolls must be cut to fit, with leftover portions thrown away or occasionally recycled.

## THE GREEN SUSTAINABILITY MOVEMENT

The sustainability advantage of applying a liquid-applied membrane over an existing roof membrane is important. Obviously, no existing insulation should be left saturated—meaning, in some instances, the only option is to tear the entire roof off. But in many situations, this isn't the case. So let's play this out a bit.

At one point, the building owners made an investment in their current roof membrane. Now that the membrane has worn down, is no longer under warranty, and is starting to fail, requiring constant maintenance, another investment must be made. Traditionally, the first investment was just ripped off and tossed out, and an investment in a new one took its place. What if the first investment could still be salvaged and utilized? That original membrane (think existing modified-bitumen, built-up, or single-ply roofs) still has some use in its remaining thickness and durability. By installing a membrane directly over the old

one, the old membrane may actually be used rather than wasted (*Photo 1*).

Most liquid products can be recoated over time as they wear down, greatly reducing the need to ever tear off the roof. Taking that one step further, roof coatings can be used as a "sacrificial layer" on top of a membrane. A few manufacturers are now offering warranty programs that will essentially renew for the life of a building if that sacrificial layer is maintained on top of the membrane to preserve the membrane's integrity and sustain it indefinitely. Annual maintenance costs and life cycle capital costs related to roofs can be lowered, saving literally millions of dollars for property managers.

## THE DOWNSIDE OF LIQUIDS

All of this sounds great, but what are the cautions and concerns with using a field-manufactured (liquid) membrane?

- Consistency of the membrane's mil thickness is controlled by the contractor, whereas with roll goods, the thickness is guaranteed and consistent from the factory.
- Many liquid-applied roof systems are permeable and do not last long in areas of ponding water, breaking down quickly.
- Choosing the right technology or product for the specific project is difficult, as the liquid-applied market is very convoluted. There are at least 45 manufacturers actively compet-



ing in the market.

- Many liquid systems require extensive surface preparation, multiple coats, and lots of detail work.
- There are varying cure times. There are solvent-based and water-based products with widely divergent cure times. Each is also affected differently by weather, with many limited to seasonal installation.

#### LIQUIDS FLOODING THE MARKET

As a professional roof consultant, you have taken on the responsibility to be aware of and knowledgeable about liquid-applied technologies available as more and more clients express an interest in these solutions. Here are the main technologies available and some important tips regarding each one.

#### ACRYLIC ELASTOMERIC COATINGS

This family of products is basically high-grade paints often promoted for use to obtain cool-roof status or for existing roof restoration. It is critical to understand that acrylic elastomeric products are permeable. Moisture will absorb into and through the coating, especially in areas of ponding water. They are "water-resistant" but not truly waterproof. Many times these permeable products are used on existing metal roofs. What we've seen is moisture vapor pass through the coating and cause extreme rusting of the metal underneath (*Photo 2*).

Acrylics also require fabric reinforcement when used as liquid-applied membranes. Because the tensile strength of acrylics is low, fabric is used to add strength and body at transitions and around penetrations. While the elongation of acrylics is relatively good, once fabric is embedded within the material, that elongation property is eliminated. As the underlying structure expands and contracts, the stress on the fabric often results in tears or splits in the acrylic coating.

Acrylics are a good choice for use as a topcoat or "sacrificial layer" to extend the life of a waterproofing membrane and for added reflectivity. However, their use as roof membranes is a concern. With regard to the solar reflectance of acrylics, there are more advanced acrylics being developed for longer-lasting energy benefits by using the thermal properties of ceramic and glass materials to maintain energy-efficiency properties over time as the roof becomes dirty and less reflective. It is important to

note energy benefits from reflective roof systems vary greatly, based upon many factors not limited to climate zone and underlying insulation.

#### POLYURETHANE FOAM

Like acrylic elastomeric systems, polyurethane foam roofing has been around for quite some time. It gained rapid success due to its high R-value and fast installation. However, the industry learned spray polyurethane foam (SPF) is not UV-stable,

requiring a topcoat to protect the membrane from changing to open-cell. Often, acrylic and silicone coatings are used as the topcoat and must be heavily maintained to protect the foam. SPF is also susceptible to punctures and damage from minimal surface impact. We've learned that in most locations, birds like to peck holes in the foam, looking for insects and food inside. SPF installation is very sensitive, and if ratios of Part A and Part B are off just slightly, it will result in failure (*Photo 3*).

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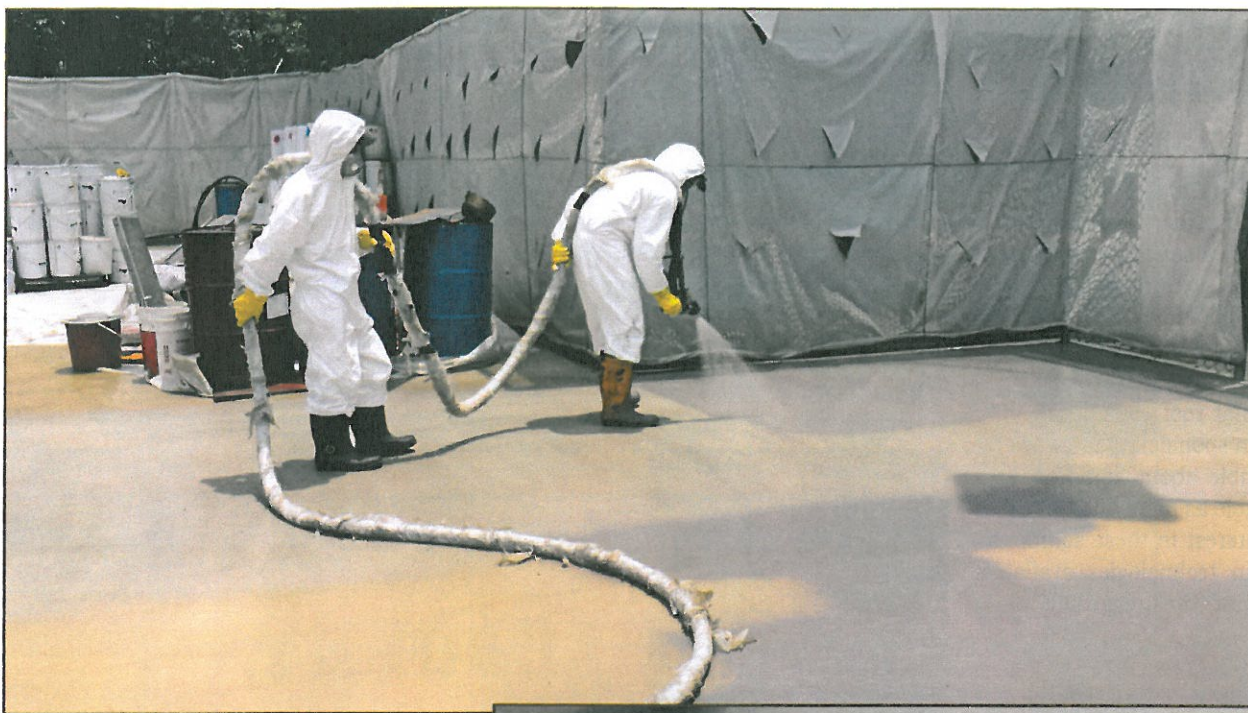


Photo 4 –  
Spraying plural-  
component  
polyurea  
membrane.



Photo 5 –  
Blisters and  
pinholes in  
polyurea  
membrane.

## POLYUREA AND PMMA

Polyurea and polymethyl methacrylate, with the latter known as PMMA, are technologies that have recently risen in popularity. Their main uses are in waterproofing decks and parking garages and as durable flooring systems. Most polyurea and PMMA membrane systems are two-component, requiring Part A and Part B to be applied at a specific temperature and ratio (Photo 4). Like SPF, if the temperatures and ratios are just slightly off, failure can occur.

The advantage of using a polyurea or PMMA system is how quickly it cures, with many products rain-ready in less than an hour. These products are also impermeable and will withstand ponding water indefinitely. Since they are also used for floors and parking decks, they are extremely durable and have high abrasion resistance.

The disadvantages of these technologies include highly disruptive odor and the sensitivity of installation and substrate preparation. Installers are required to wear respirators due to the toxic and strong fumes created from these products. In liquid form, these products are highly flammable, and extreme caution must be taken at all times. Substrate preparation is critical; absolutely no dirt, debris, or dust can be present, as adhesion on the membrane depends upon this (Photo 5).

Polyurea and PMMA-type membranes are not low-cost options and cannot be applied over some types of existing roof membranes; but they provide a good option

for waterproofing plaza decks, parking garages, and walking surfaces. Even though most of these products are solvent-based, some newer water-based solutions are available, though their long-term performance is still in question. The advantage to using a solvent-based membrane is the ability to install in lower temperatures.

## SILICONES

Silicone may be considered a “step up” from acrylic elastomerics due to its ability to withstand ponding water and provide a nonpermeable membrane. The cost is much higher than acrylic, but it can be applied to an existing roof and provide long-term waterproofing.

Like acrylic, silicone systems require fabric reinforcement around all penetra-

tions and at all transitions. Silicone is much stronger than acrylic and has good flexibility, but fabric is required to prevent splitting and to “hold” the membrane at 90-degree transitions. Again, any expansion or contraction can cause the fabric to split or pull from within the silicone membrane. Silicone is not easy to repair, as it is a very slick and smooth product, making it nearly impossible for any product other than silicone to adhere to it after it is cured.

Most silicone products have high reflectivity and are chosen for this reason. However, we’ve seen that silicone membranes do not work well in areas of the country that go through many freeze/thaw cycles. These products work best in the Southwest U.S. and more tropical climates.



## LIQUID ASPHALTS

Hot-applied asphalt has been around for generations, and asphalt in general has been used in waterproofing for over a century. Most roofing professionals have gone away from hot-applied asphalt, as it is dangerous for installers. Asphalt has little tensile strength or elongation and requires many redundant coats with fabric reinforcement in between, which is labor-intensive and heavy. However, fluid-applied asphalt systems provide excellent waterproofing and are very durable.

Some manufacturers are creating liquid-applied membranes that combine asphalt emulsion with premium rubber polymers (Photo 6). There are many names for these, including everything from rubberized asphalt to liquid rubber or liquid EPDM. It is critical to analyze the technical data and testing when considering one of these. Most of these are nonpermeable membranes, able



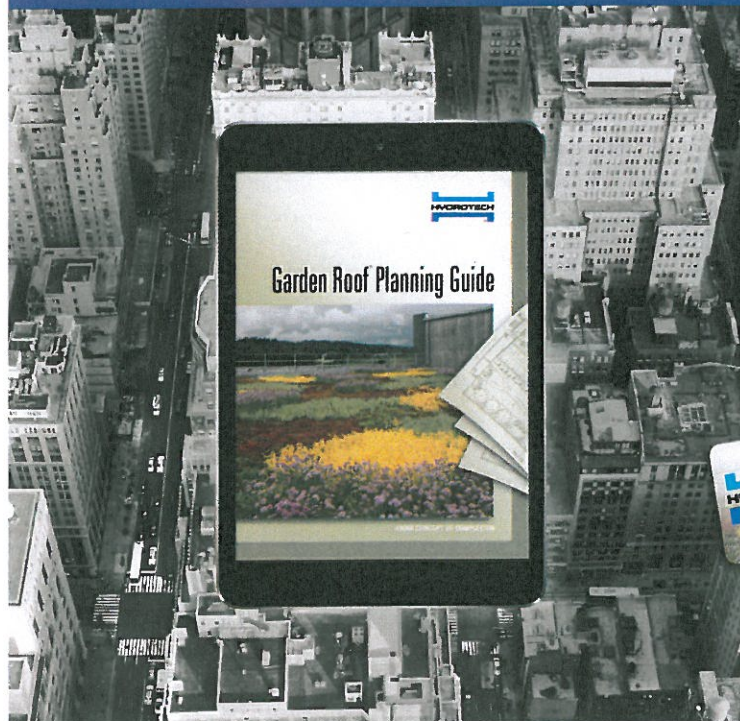
Photo 6 – Spray-applied instant-set liquid rubber membrane.

to withstand ponding water indefinitely.

Of the available modified-asphalt coatings, “liquid rubber” technology is rising in popularity due to its extremely high elongation (Photo 7) and ability to be applied at any thickness in one coat. Like other liquid-

applied membranes, it is a two-component system; but unlike all of the others, these two components mix in the air, outside of the gun. A catalyst is used to activate the liquid product (which is typically water-based with no volatile organic compounds

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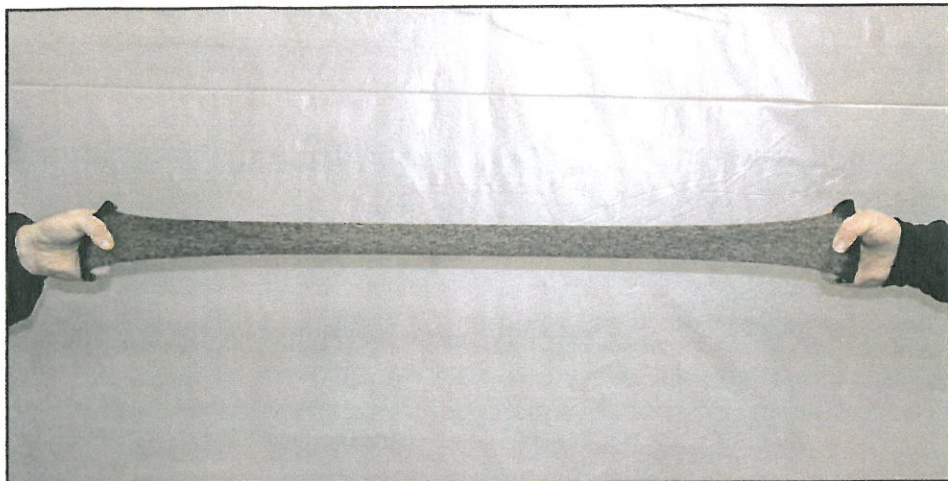


Photo 7 - Elongation of a rubber polymer-modified emulsion.


or VOCs) to create an instant build, meaning it can be sprayed vertically or even directly overhead. Often these products are used over existing roofs (especially metal), due to good adhesion, high elongation, and ability to withstand ponding water.

One downside to using modified-asphalt membranes is the color. Asphalt and rubber, like EPDM, is black and gets very hot on the roof. With modified-asphalt coatings that are nonpermeable and don't allow moisture to pass through, when it heats up in the

sun, any moisture inside the substrate will try to evaporate out and can cause blistering in the membrane. Though they can be UV-stable, these instant-set liquid rubber membranes are typically top-coated with a reflective acrylic.

#### LIQUIDS ARE THE FUTURE

New products will continue to emerge, and liquid technologies will continue to advance, gaining greater share of the market due to ease of use and self-adhering

advantages. The key for roofing and building envelope professionals is to know which new technologies truly provide the best long-term, cost-saving solutions for building owners. The industry is gravitating more toward liquid-applied, field-manufactured membranes because the product technologies have advanced greatly over the last couple of decades, and successful steps have been realized. 



Dustin Brooks

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*world and continues to learn from Triton's team of industry veterans. While working to keep buildings watertight, he also volunteers to help bring clean water to those in need through the Clean Water Movement.*

## Trade Groups to Study Research on Thermal Insulation and Cool Roofing

A coalition of trade groups is funding a research project on the advanced roofing systems that were installed on an upstate New York correctional facility to evaluate the benefits of thermal insulation and cool roofing in Northern climates.

The Asphalt Roofing Manufacturers Association (ARMA), the EPDM Roofing Association (ERA), and the Polyisocyanurate Insulation Manufacturers Association (PIMA) are sponsoring continued analysis of a reroofing project at the Onondaga County Correctional Facility in Jamesville, New York. The Onondaga County Department of Facilities Management identified a need to study building energy use and storm water runoff from roof systems.

Temperature and rain data from the project, which includes vegetative roofing, increased insulation levels, and "cool" roofs, will provide information on building performance and roof covering selection.

When the correctional facility needed a new roof in 2009, employees worked with Ashley-McGraw Architects and CDH Energy to design and install a field-monitoring system to collect data on thermal performance, weather conditions, and roof runoff from four buildings at the facility. CDH Energy's resultant report laid the groundwork for future roofing projects in the county. "The use of vegetative roof systems as a storm water control mechanism was the most important takeaway from the first years of the project," said Hugh Henderson, PE, of CDH Energy. With the instrumentation still in place, the decision was made to continue evaluating the roof coverings over a longer period of time to better see how they interact with weather conditions. Of particular interest are the effects of accumulated snow on roofs that may affect the buildings' thermal performance.

"Roof insulation is an integral part of the design strategy for a building's energy-efficiency footprint, and this study will help building owners, contractors, and architects assess a roof's performance from a broader basis and ensure that the best energy-efficient components are used," said Jared Blum, president of PIMA.

"Our members produce both reflective and absorptive roof coverings; this study will provide meaningful data that can help designers select the right products for their particular project, regardless of where in the country the roof will be installed," said Ellen Thorp, associate executive director for the ERA.

The project is expected to run through 2015.