
SPRAY FOAM ROOFS

POLYURETHANE SPRAY FOAM ROOFS, SOMETIMES REFERRED TO AS SPRAY ON ROOFS, HAVE SEVERAL ADVANTAGES:

Spray Foam Roofs are Seamless

Spray polyurethane foam roofs (SPF) form a seamless roofing system. To be seamless means it has no joints or seams that often allow outside water and air to pass through the roofing system into the building structure.

Spray on Roofs Eliminate Flashing leaks

Because a spray foam roof conforms to the substrate when installed, this seamless system is ideal for flashing parapet walls, equipment, skylights, and cooling towers. Many roof leaks are caused by faulty flashing, and spray foam roofs solves this problem.

Spray Foam Roofs can Eliminate Troublesome Ponding Water

In re-roofing applications, ponding water may be eliminated by adding an increased thickness of roof insulation, called spray foam, in low areas. Building up the low areas and sloping the roof so that it drains properly will eliminate ponding water. It will also help reduce additional weight load caused by this water accumulation.

Spray on Roofs are Lightweight and are Excellent Roof Insulation

The weight of roof insulation is around 3 pounds per cubic foot. One inch of polyurethane foam roofing weighs approximately 60 pounds per 100 square feet. This is considerably less when compared to approximately 600 pounds per 100 square feet for a conventional, four-ply, built-up roofing system. This makes a spray foam roof system ideal for re-roofing, as it is possible to apply over an existing built-up roof without removing it.

Spray Foam Roofs have the Highest “R” Value

Spray foam roofs has an aged “R” value of 6.2 – 6.5, enabling it to provide more thermal resistance with less material than any other roof insulation. In most cases, a spray polyurethane foam roof will pay for itself in 5-8 years in energy savings.

Foam Roof Insulation is Chemically Stable

Spray foam for roof insulation is inert, but this type of roof insulation has to be protected from sunlight by a U.V. resistant elastomeric roof coating system. A spray foam roof is odorless, resists attack by either mildew or fungi and has no nutritional value. There are no bad odors for you or your neighbors while spray foam roofing is being applied.

Foam Roofs Minimizes Thermal Shock

Due to characteristic such as being seamless, having a high “R” value, and being protected by a white elastomeric coating, spray foam roofing is able to greatly reduce the effects of thermal shock on a structure.

Spray on Roofs have Great Versatility

Spray foam roofs can be used on both new construction, as well as to replace old roofs. Spray foam can be applied to flat, pitched, saw-toothed, and domed or having unusual slopes or configurations. Spray foam is also an ideal spray application for tanks, freezers, coolers, piping, ductwork and various other odd jobs.

Spray Foam Roofs are Rigid

While spray foam roofs are very lightweight, these spray on roofs are also strong and will not pack down or sag.

Foam Roofs are Flexible

Spray on roofs have the ability to withstand normal expansion and contraction without affecting the ability to keep the structure protected from the outside elements.

Spray on Roofs are Watertight

Spray foam roofs are composed of billions of minute closed cells which resist the penetration of water and vapors. It must, however, be protected by an elastomeric roof coating or crushed rock for use in an outdoor environment.

Spray Foam Roofs are Long Lasting

The elastomeric roof coating system, which protects the spray roof insulation, can be rejuvenated by the re-application of additional roof coatings. This doesn't take place until the initial coatings system has weathered after many years of service. The normal wear of a quality coating has a life span of about 15-20 years.

Foam Roofs have Little Disruption to Building Owner

A spray foam roof system can be applied in a relatively short period of time with little or no disruption of building operations. This is due to little or no tear off of the existing roof, and little manpower needed to apply the spray foam roof. Tillotson typically uses spray polyurethane foam roofing systems manufactured by BASF Chemical or Conklin Roofing Systems, who are leaders in the field. Tillotson staff are manufacturer trained and certified by both companies.

Spray on Roofs are Easy to Maintain

Minor repairs or modifications to a spray foam roof system can be made by in-house maintenance personnel at minimal cost.

TEXAS A&M CASE STUDY

The main campus at Texas A&M boasts over 7 million square-feet of spray-applied polyurethane foam (SPF) roofing – almost no other system has been installed for the past 30 years. Why? Proven sustainability and energy efficiency.

In 1974, dissatisfied with the performance of their traditional tar and gravel built-up roofing (BUR) systems, the Physical Plant Department at Texas A&M began looking for alternatives. The BURs were leaking constantly after an average of five years of service, and isolating the sources of the leaks was next to impossible. The university selected SPF because it is seamless, monolithic and fully adhered. And because it is lightweight, a complete tear-off of the existing BUR could be avoided.

“We sprayed over the failing BUR for a number of years, mainly due to budgetary constraints,” says Sam Cohen, Construction Project Manager, Engineering Design Services at Texas A&M. “That’s one of the advantages to SPF. And environmentally, it means all that material doesn’t end up in the landfill.”

In 1985, Gerald Scott, P.E., then in charge of roofing and energy conservation within the Physical Plant Department, announced another benefit the university had been receiving from the SPF roofs: energy savings.

Scott monitored energy savings on 27 different buildings on the campus that had received an SPF roof from 1980 to 1984. **The results showed the university was able to cover the complete cost of the roof application through energy savings in an average of 4.5 years.**

The oldest over-BUR SPF roofs on the campus are now approximately 30 years old. According to Cohen, they have received little-to-no maintenance due to manpower restraints, yet remain leak-free and retain their energy-efficiency performance. On newer roofs, SPF was applied direct to the metal deck. Most of these roofs are now 10-15 years old and Cohen says they perform as well as the day they were installed.

The main campus at Texas A&M is a busy place. Roofing installations and repairs simply cannot disrupt classes. Cohen says that the speed of SPF installation is an important consideration. With a little planning, his team – along with the university health and safety committee, the building proctor and the contractors performing the work – is able to schedule installations and repairs for minimal to no occupant disruption.

Sustainability and Lifecycle Cost

As Texas A&M’s experience shows, on top of improved building energy efficiency, the number one sustainability benefit SPF has to offer is its durability.

The university specifies a minimum of two inches of top-quality SPF, with a silicone coating. The final pass of coating includes an aggregate sand to create a non-slip surface and increased tensile strength due to the high volume of foot traffic the roofs are exposed to throughout their service lives.

A lifecycle cost analysis study performed by Michelsen Technologies LLC in accordance to ASTM E 917-02 Standard Practice for Measuring Lifecycle Costs of Building and Building Systems shows SPF offers a cost advantage of 13-56 percent over membrane roofing systems. The study attributed the SPF advantage to several factors:

- Low tear-off and disposal costs
- Annual net energy savings from superior insulation and reflective coatings
- Consequential damages due to leaks: zero
- Re-coating costs less than replacing a membrane system

Seamless and self-flashing, SPF eliminates thermal bridging and adds its superior insulation properties for improved building energy efficiency and indoor environment.

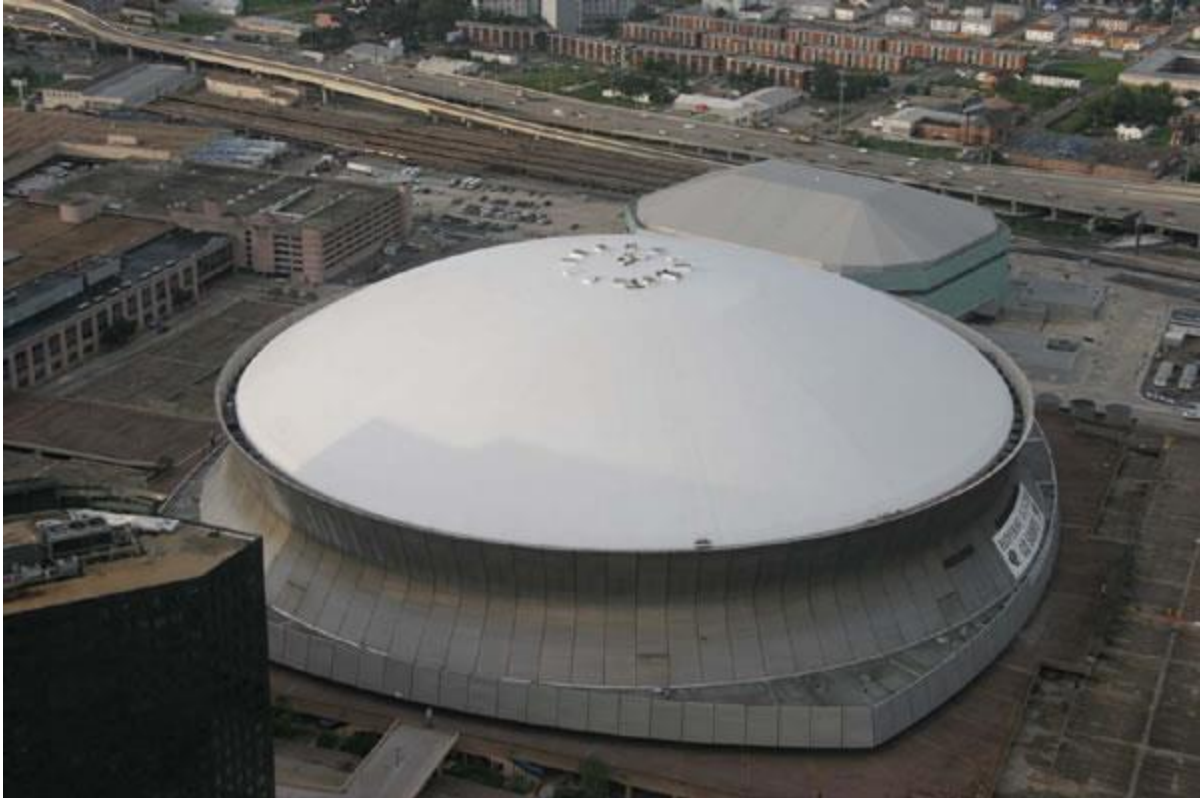
SPF can be applied directly to the existing substrate in most retrofit cases, eliminating the cost of tear-off and reducing waste to landfill. And while traditional roofing systems must be removed at the end of their useful life, SPF can be re-coated and renewed for many more years of service.

LOUISIANA SUPERDOME CASE STUDY

The Louisiana Superdome, Informally Called the New Orleans Superdome

The Louisiana Superdome, sometimes referred to as the New Orleans Superdome, is an exhibition facility located in New Orleans Louisiana. The architectural plans were drawn in 1967 by Curtis and Davis, an architectural firm. Construction broke ground in 1971, and was completed in 1975. The Louisiana Superdome is the biggest fixed dome facility in the world. The New Orleans Superdome is two hundred and ten meters in diameter and eighty three meters tall. The area of the structure totals fifty three thousand square meters (thirteen acres).

The facility is one of a small number of structures capable of hosting the Super Bowl and NCAA final four events. The Louisiana Superdome Is also home to the New Orleans Saints and the Tulane University Football Team.



The New Orleans Superdome is an example of a well known structure with a foam roof.

Louisiana Superdome: Originally Roof Had Polyurethane Foam

The Louisiana Superdome opened in 1975, and was constructed with a polyurethane foam roof. The best foam coating at the time was very brittle, and in the Late 1970's a massive hail storm (with golf ball sized hail) caused small dents in the foam which resulted in small narrow circles of exposed foam (1mm wide). The damaged roof did not leak. Over the next 12 years, the venue management company responsible for the superdome (SMG) spent \$750,000 on research to deal with the small circles of exposed foam and finally decided to recoat the foam at a cost of \$250,000 USD. The roof continued to waterproof and insulate the Superdome.

Louisiana Superdome: Foam Replaced with EPDM (Single Ply Roofing)

Later, in 2003, thinking the foam roof was 'old' the polyurethane foam was torn off and replaced with what they were told was a 'state of the art' EPDM rubber roofing (single ply roofing). Through misinformation SMG was lead to believe that EPDM was a superior roofing material. The manufacturer guaranteed the new roof to

withstand winds up to 130mph. When Hurricane Katrina struck in 2005, sub 100mph winds completely blew off most of the EPDM roof membrane. The single ply EPDM membrane failed after just two years at wind speeds substantially less than promised.

Louisiana Hit By Hurricane Katrina

On August 29th 2005, Hurricane Katrina struck with devastating force, causing an estimated \$81 billion dollars in damage. New Orleans Louisiana was flooded wiping out 80% of the city. During Hurricane Katrina, extensive damage was done to the roof of the Superdome.

Failed Single Ply Roof Replaced with Spray Foam Roofing

After more research SMG decided to re-roof with sprayed polyurethane foam. While EPDM failed around 130mph in a wind tunnel, polyurethane foam did not fail at any speed. In fact, polyurethane foam withstood 200mph winds (the maximum speed the wind tunnel could provide) with flying colors. Polyurethane foam was originally chosen by NASA to self-adhere to the slick aluminum surface of the external fuel tank of the space shuttle and withstand wind shear beyond 1000mph (and it does this while keeping the liquid hydrogen at a very cool -423 degrees Fahrenheit). This foam used on the fuel tank is the very same 2.5 pound density foam used in most roofing applications. The result is a superior, self-adhering, waterproof, insulating membrane. Sprayed foam is the only insulation material that does not soak up water.

A New Foam Roof for the Louisiana Superdome

The 70,000 seat dome stadium was re-roofed with polyurethane foam. The foam was supplied by Bay Systems North America, a subsidiary of Bayer Material Science LLC. Honeywell Enovate was used as the blowing agent.

3,750 roof panels were raised into place one at a time by a crane. After each panel was welded into place, the installation crew sprayed a seamless leak-resistant layer of closed-cell insulating foam into place. Then a layer of elastomeric coating was applied to increase durability. After all sections were secured, the roof was power-washed to remove welding slag and a final layer of coating was applied.



The Superdome has 3,750 metal panels for a total of 9.7 acres in roof area.



The Louisiana Superdome polyurethane foam roof under construction.



Spray foam creates a seamless monolithic barrier, both water-proofing and insulating.



Workers prepare to weld in more roof panels.



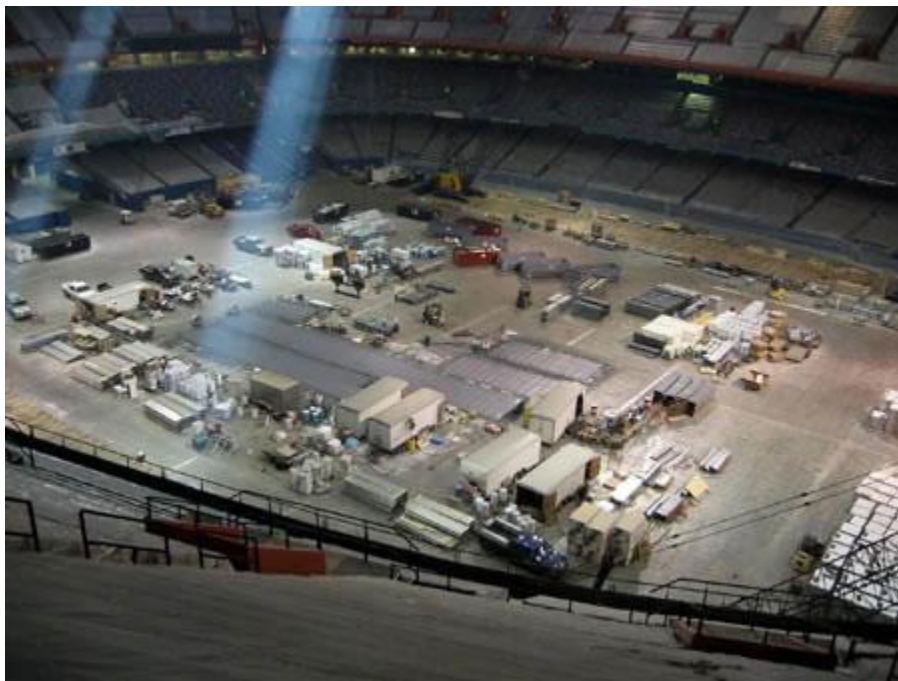
The crew uses highly sophisticated equipment to spray the liquids that become waterproof polyurethane foam in 3 seconds.



The partially complete foam roof of the Louisiana Superdome.



Workers moving a Superdome roof panel.



An indoor view of the New Orleans Superdome.



The foam re-roofing work in progress on the New Orleans Superdome.

US MILITARY TENTS

The US Army Uses SPF Foam to Cool Tents

In the sweltering Iraqi desert temperatures reach highs of 130 degrees Fahrenheit, and US Army tents don't provide much relief, even with air conditioning. In fact, even with air conditioning, the poorly insulated tents were often still over 100 degrees Fahrenheit inside. These were hardly livable conditions for soldiers.



A Honeywell crew applies SPF foam to US Military tents. The foam will seal, insulate, and protect the tents from the severe desert climate. Both cost savings and living improvements are expected with the completion of the \$12.5 million dollar project.

900 Air Conditioned Tents Were Sprayed With Foam

In 2009 the U.S. Military began applying polyurethane spray foam to 900 air conditioned tents. Honeywell completed the 12.5 million dollar project. TerraStrong polyurethane foam was pumped from 55 gallon drums and applied to the surface of the tents. The foam conforms to the surface of the tents, sealing and insulating from the external elements and rays of the sun, keeping the tents substantially cooler. The rigid polyurethane foam also provides structural support as well.

SPF Foam: A Fast, Efficient, Mobile Solution

Joseph Lstiburek, a building scientist and indoor air quality expert, told discovery news: "For the Army, there is no other solution even close to this given speed, flexibility, mobility". "You don't have to ship lots of big pieces of stuff around. Think about it: a big tent insulated on the exterior that acts as a combined water control

layer, air control layer, vapor control layer and thermal control layer that is also structural.”



Soldiers sleep on cots in 8-10 person tents at joint service station Al Sheeb. 2" of polyurethane foam provides both insulation and structural support for the tents.

US Military Anticipates 25% to 30% Cost Savings

The military expects to associated reduce air conditioning costs by at least 25 to 30%. The project is part of 2009-2015 initiative to improve the efficiency of military facilities and improve the quality of life for both troops and civilians.

Many Types of Foam

According to the [polyurethane foam association](#) over 1.8 billion pounds of flexible polyurethane foam (FPF) products are produced annually in North America. There are many different types of foam out there; they are all based on altered forms of plastic filled with micro bubbles.

Some examples of FPF products are: polystyrene foam, polyethylene foam, styrofoam, and polyurethane foam. Polystyrene foam (often blue) is used in rafts, life preservers, and insulation wraps for residential homes. Polyethylene foam is used in cushions, pillows, and beds. Styrofoam is usually white, and typical uses are white foam for coolers, mugs, or cups (e.g. coffee/ or hot chocolate). Finally, polyurethane foam is a yellow type of foam for roofing, insulation, refrigeration warehouses, foam boards. Foam roofing is one of the most common polyurethane foam applications.

Foam Roofing Myths

There are probably as many myths as there are types of foam. Some of these misconceptions may be partly due to the fact that there are so many different kinds of foam. With about three decades of foam roofing experience we have heard some myths so absurd we won't bother listing them here. This article is an attempt to dispel some of the most typical myths and rumors about foam roofing. Without further adieu, here are ten of the most common polyurethane spray foam roofing myths, listed in no particular order.



Picture: A Sprayed Polyurethane Foam roof (SPF) installation on a warehouse. SPF foam roofing is plagued by myths and misconceptions .

Myth #1: Foam Roofing is New

Although the groundwork for polyurethane foam was done by Otto Bayer and his team in 1937, polyurethane foam would not become available until much later. In 1952 polyisocyanates became commercially and commercial production of polyurethane foam began in 1954 based on toluene diisocyanate (TDI) and

polyester polyols. Commercial production of flexible polyurethane foam began in 1954, based on toluene diisocyanate (TDI) and polyester polyols. The invention of these foams (initially called imitation Swiss cheese by the inventors) was thanks to water accidentally introduced in the reaction mix. These materials were also used to produce rigid foams, gum rubber, and elastomers.



Dr. Otto Bayer began working with polyurethanes in 1937. However, it was not until further innovations, and Walter Baughman's discovery of the Blendometer in 1953 that mass production of polyurethane foam began. As a product, polyurethane foam is over half a century old.

Initially polyurethane spray foam was used in the 1960s for refrigeration and industrial insulation projects, although by the late 60s and early 70s polyurethane foam had evolved into exterior roofing applications. The earliest foam roofs are now around 50 years old. So, as a product, polyurethane foam has existed for the better part of a century, and it has been in use on roofing in applications for about half a century. For most of the living world, foam roofing is indeed not new.

Myth #2: You Can't Stop a Determined Bird From Pecking a Foam Roof

This is very much a myth, and if you believe it, you should be ashamed. Now, keep in mind that If you have a sadly deteriorating foam roof, with large patches of exposed foam (where the acrylic coating has worn away), then birds may peck at your deteriorating and exposed foam.



One popular foam roofing myth involves birds pecking a foam roof into oblivion.

However, it's very easy to stop the birds from doing this (i.e. the "can't stop" part is a myth). Simply replace the coating with a fresh layer or use some acrylic caulking to seal up the exposed area. When an added layer of rubberized coating covers the foam, surface toughness increases such that birds tend to stop pecking as they find that their beaks bounce-off the roof surface. Keep in mind that this type of work is best performed by qualified technicians who understand surface preparation procedures and have access to suitable materials. If you do find a bird pecking at your foam roof, think of it as a compliment. Even a bird's brain is smart enough to realize that foam is both lightweight and has great insulating qualities (e.g. for a nest).

Myth #3: You Can't Walk on a Foam Roof

You CAN walk on a foam roof without having the skills of those ninjas that walk on rice paper; just leave your spiked heels and cowboy boots in the closet—its best to use soft rubber sole sneakers. Unless you're walking on a condemned (or soon to be) building, a foam roof is completely capable of sustaining the weight of a normal person.



Employees walk on an SPF foam roof while making an inspection.

Soft sole shoes are advised because an extremely sharp object can damage or penetrate the foam. Since spray foam roofing structure is composed of millions of tiny closed cells, only a hole in the roof that penetrates to the underlying substrate can potentially cause a leak. However, foam can only last forever if it is protected from UV rays (sunlight). If your foam roof has a hole or is damaged, a proper type of coating or caulking should be used to coat the roof again and protect it from UV rays.

Myth #4: Foam Roofing Material is Just Like Memory Foam Mattress Material

Sure, and monopoly money is accepted by your local bank. On a more serious note, memory foam mattresses are very low density and open cell, while foam roofing foam is still flexible, it is relatively much higher density and composed of closed cells. Polyurethane closed cell foam used in roofing applications is a completely different material composition vs memory foam. Polyurethane foam used for roofing applications is exponentially stronger and more durable than the type of foam used in a mattress. For example, Dura-Foam has many roofs approaching the 35 year mark which are still in near perfect condition.

Myth #5: Foam Roofing is Expensive

A foam roof actually costs about the same as a typical BUR or single ply roof. Also, consider that BUR or Asphalt roofs are actually an oil based product. Rising oil prices are driving up the costs of most typical flat roof alternatives, while the cost of foam roofing has remained more constant. An additional benefit to consider, is that a foam roof is the last roof you'll ever need to buy. Furthermore, a foam roof provides exceptional insulation, and we always use reflective cool roof coatings (on completed foam projects) which results in even further reduced energy costs. Cool roof coatings alone can cut down cooling costs by 30 percent or more in warmer climates.

If you're only considering a 5 or 10 year window, a foam roof may or may not be more expensive than a traditional roofing material. However, when you start considering 15, 20 or more years in your evaluation, the foam roof becomes much more cost effective than other alternatives. You won't need to replace the foam roof in 20 years—you can simply maintain a foam roof by periodically adding re-coats to protect the roof from prolonged UV exposure. This is not a viable option with a traditional roofing installation.

Myth #6: Foam Roofing is Not Durable

When you think about 'tough' materials, foam products probably don't come to mind. However, Dura-foam has built many 30 year old (and counting) foam roofs which remain in great condition. Many of the earliest foam roofs are still standing (50 years

and counting). Foam roofing has already stood the test of time, and its a fact; a foam roof can last the life of your building.



Image: This is a pair of polyurethane soled shoes. Polyurethane is often used in the soles of shoes due to its extreme durability.

Myth #7: Foam Boards Insulate as Well as a Sprayed Foam Roof

Not really—whether you DIY (Do-it-Yourself) or have a contractor install a foam board roof, you'll only see a fraction of the benefits possible with sprayed foam roofing. Sprayed foam roofing is manufactured on site, and is sprayed to perfectly conform to your roof as a single monolithic barrier to the elements. A foam board roof is full of seams which allow moisture and vapor transmission, which greatly reduces the insulation capacity.

Although the R-value rating of a foam board roof appears to be on par with a foam roof, the actual performance of such roofs is substantially inferior. In other words, in this case, the R-value of the insulation does not factor air-infiltration with thermal resistance which makes it an inaccurate comparison. One should also consider a sprayed foam roof also seals a roof better (prevents leaks) better than any traditional pre-manufactured material (even foam boards).

Myth #8: Polyurethane Foam is Toxic

Here's just one more myth to add to our list. Polyurethane foam is really just a form of altered plastic with millions of tiny trapped air bubbles. Although the formulation is designed for roofing applications and optimized for the best combination of thermal resistance and durability, the base material is the same thing used in most refrigerators or foam mattresses. Polyurethane foam materials are completely inert, and are just as safe as the foam pillows you probably have on your couch by your TV or in the seat cushions inside your car.

Myth #9: Soy Foam is Substantially 'Greener' Than Polyurethane Foam

We have looked at the most recent Soybean oil based foams, and they presently contain a maximum of about 15% soybean oil. Considering the expense, and the risk that these formulations won't stand the test of time (last the life of your building), we are not completely sold on this product.

Perhaps one day, Soybean oil based foams will be substantially different from traditional foam. For now, it's 85% exactly the same as your every-day polyurethane foam, and for us, it's not enough to justify the added expense. Although we will look for new developments in bio-based foams in the future, our present conclusion is that soy (and other bio-based) foams are just a gimmick. Once technology changes and the second generation of soy based (and other bio-based) foams are released, we will re-visit the subject.

Myth #10: Foam Roofing Absorbs Water

If foam on a roof system is found to soak up water, either the wrong material was used or the material components were not applied using the proper equipment and expertise. The Spray Polyurethane Foam (SPF) used in roofing applications is "closed cell". In other words, it is a plastic with millions of tiny closed cells which are impenetrable by water. A block of SPF submerged under water will remain buoyant and dry indefinitely. For this reason, spray polyurethane foam is used in flotation docks and the hulls of sea vessels. In roofing applications, closed-cell SPF is manufactured at the job site using specialized equipment. Foam that soaks-up water is not classified as "closed cell" SPF.

Summary

During the last few decades foam roofing has grown in popularity and become the flat and low slope roofing material of choice for environmentally conscious consumers. Unfortunately, there are some obstacles for foam roofing contractors due to large amounts of misinformation that have propagated through society. There are many foam roofing myths; the ones we have listed here are just some of the most common ones. Foam roofing is truly a highly quality, high performance product. Hopefully this article will help at least a few people separate fact from fiction in reference to foam roofing.