Knowing exactly when to say, 'Uncle'

BY THOMAS SKERNIVITZ / RSI Editor-in-Chief

There's a science to determining the proper thickness of insulation, and according to Roger Morrison, it has nothing to do with rules of thumb, how deep the existing fiberglass batts might be or what the customer thinks is best.

The legitimate way to choose the appropriate thickness has more to do with economic feasibility, building code requirements, condensation prevention, and practicality, Morrison told several hundred attendees of the Spray Polyurethane Foam Alliance (SPFA) annual meeting in Orlando, Fla.

Economic thickness

Morrison, a production manager with North Carolina Foam Industries in Mount Airy, N.C., emphasized his first point with an analogy. Determining the most feasible thickness is similar to the law of diminishing returns, which states that the incremental return on an investment decreases with added investment.

In other words, "the first half-inch of SPF gives you the most bang for your buck," Morrison said. But at some point, "it doesn't pay to add more insulation."

Calculating how much insulation is too much is "a whole lot easier said than done," Morrison said. Certainly, the zero percent efficiency of a bare, half-inch plywood wall jumps to 80 percent efficiency when only a half-inch of spray foam is added. Another half-inch lessens the heat transfer another 10 percent.

"So when you get up to 3 inches, is there much effect in adding another inch of foam? No, there isn't," Morrison said.

The key is comparing future energy dollars to current insulation dollars. As an example, Morrison cited a firewater storage tank in Fargo, N.D. The estimated annual cost to maintain the tank's water at 45 degrees Fahrenheit was $15,800. In turn, the present value of 10 years of heating costs was $210,000, discounted 3 percent over time but inflated 10 percent for rising fuel costs.

Upon inputting the insulation cost and calculating the numbers, Morrison determined that 2 inches would be most feasible thickness, or what he termed the "economic thickness" (see figure opposite page). At no other point would the combination of insulation cost and the present-value cost of heating over 10 years be lower.

"Notice (on the figure) the economic thickness does not correlate where the two cost lines intersect," he said, while adding that the cost of the first half-inch was greater than the cost per additional half-inches because the first half-inch included the cost of coating, getting to the job, and other inherent expenses.

"Economic thickness is highly mathematical," Morrison said. "It's based on a lot of different assumptions and a lot of anticipating what's going to happen in the future. It does come up with the best economical choice for the customer."

Building and energy codes

Codes can be split into prescriptive requirements and performance requirements. The former is clear-cut: Look at a map that is regionally itemized, determine where your building is and figure out how much R-value is required.

Performance requirement, or the "trade-off approach," is based on the International Energy Conservation Code's allowance that building designers can modify insulation thickness as long as the overall energy consumption of the building is the same. For example, designers may install larger windows if they increase the R value of the walls and ceilings. HVAC performance can be enhanced. "Typically designers use computer programs to do this," Morrison said, noting the REScheck residential compliance tools.

On top of conventional codes, EnergyStar or Green Building codes require even greater energy efficiency.

"This is another determining factor in determining how much insulation needs to go into a building," Morrison said. "Complex structures are likely to require more insulation than is economically desirable."

Condensation control

As an example of condensation run rampant, Morrison cited a Denver-based building in which tropical fish aquariums were being stored. The interior temperature was 75 degrees with 85 percent relative humidity. Installed beneath a modified bitumen roof and plywood deck, the existing 1 1/2-inch layer of cellulose insulation was getting wet. By using a psychometric chart, it was determined that the interior temperature needed to rise above a dew point of 68.5 degrees.

Assuming an exterior design temperature of 15 degrees, the temperature of the interior plywood surface was determined to be 30 degrees — well below the dew point of 68.5 degrees.

"What we need to do is add foam to this system in order to raise that temperature above the dew point," Morrison said. "If we can do that with 7 inches of foam, and we can get that dew point to 69 degrees, we're OK."

However, 7 inches of spray foam adds up dollarwise. The alternative, Morrison said, was to eliminate the cellulose insulation and add 1 inch of spray foam as a roof system in order to warm the surface of the plywood to 71 degrees.

"There were two assemblies here at work. Both were taken care of with spray foam — one fairly economically, one not," Morrison said. "The placement of other insulations is very, very significant."

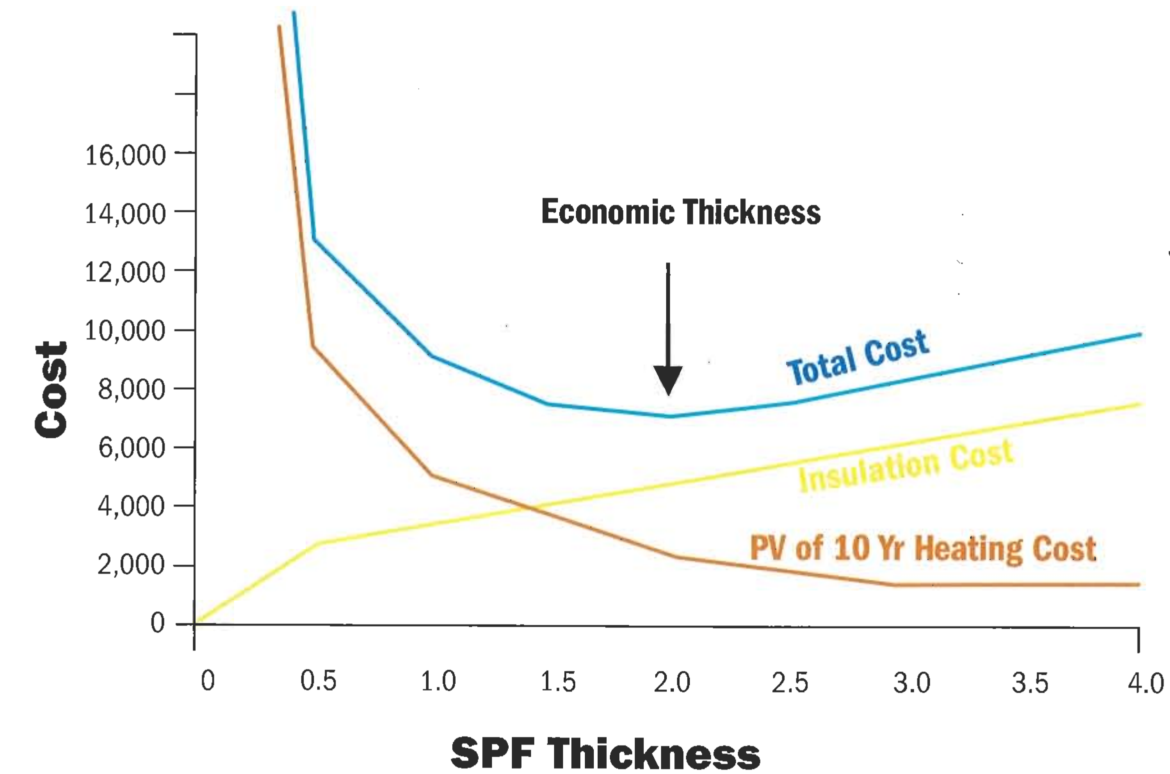
Minimum practical thickness

There are several physical factors that dictate the thickness of spray foam.

- Minimum thickness to get a smooth texture or profile
- Minimum recommended or permitted by the manufacturer
- Minimum needed for slope to drain
- Minimum needed for air barrier application
- Minimum needed to achieve physical properties

"Minimum practical thickness is easily determined," Morrison said, noting that there are no complicated calculations and that projects and SPF systems vary.

"If you're in doubt as to how much to apply, determine all four methods and use the greatest thickness," Morrison said. "You're going to be in pretty good shape." ■



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Gale Tedhams, director of sustainability for Owens Corning, on LEED recognizing her firm