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Icynene: Ozone-friendly, Open-cell Polyurethane

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We first learned about Icynene at the First Annual Conference on Alternatives to CFCs and Halons in November 1990. At that time it was a tiny Canadian company (founded in 1986) with a type of foam insulation that had no harmful effects on the Earth's stratospheric ozone layer. Company founder Graeme Kirkland recognized early on that Icynene had significant environmental benefits over its spray-polyurethane cousins, but it has taken him a long time to convince a conservative U.S. insulation industry to embrace his product.

Today, five years later, Icynene has some 60 installers in 25 states--along with its continuing presence in the Canadian market. Expansion efforts have been helped by a recent infusion of capital from the Monsanto Company, the St. Louis-based chemical giant, and Neste Inc., an oils and chemicals company based in Espoo, Finland. These two companies now own minority interest in the company.

Icynene is a low-density, open-cell modified polyurethane that is typically foamed into open cavities. The product has a very high (100-fold) expansion rate, so installation involves spraying on a very thin layer--much like spray painting. Within seconds, the foam expands to its full thickness, filling (and often overfilling) the cavity. The cured foam has a density of about 0.5 lb/ft3 (8 kg/m3) and an R-value of 3.6 per inch (RSI/m-25).

About two years ago, Icynene introduced a slightly different formulation for use in closed cavities. In this formulation, the Icynene is poured into the cavity and expands from bottom to top to fill the cavity. The company recommends two pours: one to fill the cavity about 90% full, then a smaller amount of foam to top it off. The cavity-fill product has a slightly greater density and an insulating value of R-4/inch (RSI/m-28).

From an environmental standpoint, there are several advantages to Icynene. First and foremost is the absence of any ozone-depleting chemicals. Water serves as the foaming agent, reacting with the other components to generate CO2, which expands the foam. (The switch by conventional polyurethane manufacturers from CFC-11 to HCFC-141b has greatly reduced the ozone-depletion impacts, but even the HCFC depletes ozone to some extent.)

Second, Icynene has a very low density, one-quarter that of conventional closed-cell polyurethane. As a result, less petroleum-based material is required in its manufacture. (Note, however, that the R-value is significantly lower than that of closed-cell polyurethane, so the difference in material use per insulating unit is less.)

Third, Icynene is very effective at sealing air leaks in buildings. In fact, the company has promoted the product as much for its air-sealing properties as for its insulating properties. As a polyurethane, it adheres extremely well to most surfaces, and because the foam remains flexible, it expands and contracts with seasonal movement of a building to remain airtight.

Fourth, testing indicates that Icynene is fairly safe from an indoor-air-quality standpoint. Because of the open-cell structure, volatile chemicals left over from the reactants offgas quickly. The Saskatchewan Research Council tested Icynene in May 1994 and found that after 30 days, offgassing of five different VOCs virtually ceases. Green-Eclipse Inc., which runs the Envirodesic(TM) certification program for healthy buildings, lists Icynene as the only recommended insulation material. A Toronto developer is currently building a 115-unit subdivision of Envirodesic-certified homes, all of which will be built using Icynene.

Icynene has a few down sides. First, because of its very great expansion rate, cavities are typically overfilled and excess insulation needs to be trimmed off--this is usually done with a handsaw. Unless this insulation waste is used in the attic as loose-fill insulation, it can result in significant quantities of solid waste needing landfilling.

Our other concern with Icynene is not with the product itself, but with a recommended installation practice of the company: using Icynene for insulating metal-framed buildings. We have seen wall sections at trade shows demonstrating Icynene insulating 8" steel-stud walls. Although there is some benefit to tightly filling the steel-stud cavities (which can be difficult to do with fiberglass), using an expensive insulation such as Icynene is difficult to justify economically. With steel framing, it makes more sense to use as inexpensive an insulation material as possible to fill the stud cavities, then invest any additional available budget in rigid insulative sheathing. It is certainly not justifiable to insulate steel-stud walls that are more than 31/2" (90 mm) thick, as Icynene has been known to recommend.

An exciting new development at Icynene is the launching of a program to guarantee low home heating bills. Using blower door tests and computer simulations, the company will help participating installers calculate the heating load of a house. Based on that, a guarantee will be provided for annual heating costs.

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