



Environmentally Conscious Building Owners Specify "Green" Polyisocyanurate Roof Insulation



by Paul R. Bertram, Jr. CDT, CSI

Building owners today are much more environmentally conscious than they were just a few years ago. There are very clear building owner trends toward using "green" construction products, such as glazing products that reflect the sun, automatic lighting products, lighter colored (i.e. "cooler") construction products including roofing and cladding materials, and products that improve the energy efficiency of the structure.

And while polyisocyanurate insulation has long been on the list of products that can help improve a structure's energy efficiency, it can now be placed squarely on the list of "green" construction products, due to recent manufacturing developments.



Polyisocyanurate foam insulation (polyiso) has long been the choice for commercial roofing applications. In fact, polyiso roof insulation represents over 60% of all insulation used in new roof construction and at least 40% of all insulation used in re-roofing applications, according to the Polyisocyanurate Insulation Manufacturers Association (PIMA). Furthermore, PIMA reported that in 1999, 4.5 billion board feet of polyiso were used as both wall and roof insulation, clearly establishing the confidence of the construction industry for its energy efficient productivity. To make polyiso even more appealing, many manufacturers have qualified in participation of various Energy Star programs.

Polyiso foam insulation is a mix of polyisocyanurate and polyurethane polymers that form a closed cell structure. During manufacture, the liquid foam forming mix is deposited onto a continuously moving facing, where it expands, then the upper facing is applied. The combined form and facer "sandwich" then goes through a heated conveyer press when the expansion of the foam and the integral bond to the top and bottom facer sheets is completed.

This preference for polyiso insulation among commercial building owners has not been without its challenges, the most notable being the Montreal Protocol, which in March of 1985 adopted requirements to protect the ozone layer. Among other things, the Montreal Protocol required that polyisocyanurate foam insulation manufacturers eliminate harmful ozone depleting chemistry, which first affected the use of CFCs. By 1994, the polyiso industry had reformulated its products around a new blowing agent, HCFC141b, a compound with only about 10% of the ozone depleting potential of CFC-11, which had been used as a blowing agent since the introduction of polyiso in the 1970s.

In keeping with Montreal Protocol requirements, however, all HCFC141b must be eliminated by January 2003, so that polyiso is manufactured with zero ozone depleting blowing agents.

One of the concerns stated by the National Roofing Contractors Association (NRCA) at this year's convention is that there doesn't seem to be a clearly defined chemistry transition for elimination of HCFCs as there was for

PROPERTY	TEST METHOD	TYPICAL RESULTS
Dimensional Stability (length & width)	ASTM D 2126	<2%
Compressive Strength (10% deformation)	ASTM D 1621	20 psi (140 kPa)
Water Absorption	ASTM C 209, ASTM D 2842	<1%, <3.5%
Moisture Vapor Transmission	ASTM E 96	<1.5 perm (85.0 ng/(Pa•s•m ²))
Product Density	ASTM D 1622	Nominal 2.0 pcf
Flame Spread	ASTM E 84 (full 10 min. test)	25-50**
Smoke Developed	ASTM E 84 (full 10 min. test)	50-170**
Tensile Strength	ASTM D 1623	>730 psf (35 kPa)
Service Temperature	-	-100°F to 250°F (-73°C to 122°C)

*** The numerical ratings as determined by ASTM Test Method E 84 are not intended to reflect hazards presented by this or any other material under actual fire conditions. A flame spread index of 75 or less and smoke development of 450 or less meet code requirements regarding flame spread and smoke development for foam plastic roof insulation. However, flame spread values do not apply to foam plastic insulation used in roof deck constructions that comply as an assembly with FM 4450 or UL 1256 (see IBC, BOCA, SBCCI, and ICBO model building codes, Chapter 26). Smoke development does not apply to roofing.*

The physical properties shown are presented as typical average values as determined by accepted ASTM test methods and are subject to normal manufacturing variation.

Table 1. Typical physical properties of new HCFC-free polyiso insulation.

the elimination of CFCs to HCFC141b. Very few polyiso manufacturers are on the fast track for compliance, and only a few to date have fully met the rigid new standards. Atlas Roofing led the industry and was the first polyiso manufacturer to introduce a plant conversion dedicated to HCFC-free technology, shifting its blowing agent from HCFC141b to a hydrocarbon type chemistry. To date, Atlas has converted two additional plants, constructed another, and is finishing conversion on five additional facilities, which is expected to be completed within 18 months.

Rick Gelatka, marketing services manager for Atlas Roofing Company, says that his company is phasing out the use of HCFC141b earlier than required and is seeing benefits for doing so.

“We’re now seeing HCFC-free requirements in many commercial specifications and we’ve seen a real trend for building owners becoming much more environmentally conscious about the products that they use on their buildings.”

New technologies are not immediately embraced by an industry that relies on testing approvals and proven track records. However, the good news is that there are currently two years of field-tested applications as well as additional field performance data from the first prototype roof applied in 1995 and subsequent installations.

Material characteristics and performance ratings of HCFC-free polyiso products are equal to or better than polyiso with HCFCs. Adhesion, compression strength, fire ratings, moisture vapor transmission, water absorption and R-values have proven test results. The table above provides the typical physical properties of this new HCFC-free polyiso insulation.

While conversion of polyiso from HCFC141b to new blowing agent technology has been going on, the U.S. Green Building Council has developed the “Green Spec” and polyiso insulation is now listed as a “green” building product. And in fact, polyiso can be considered “green” for several reasons:

- First, polyiso manufacturers that have eliminated HCFC141b offer a “green” product because they have removed the harmful ozone depleting chemicals from their products.
- Second, polyiso that is HCFC-free also classifies as a building component that reduces heating and cooling loads.

The U.S. Green Building Council announced the first standard for green buildings. Its LEED – Leadership in Energy and Environmental Design – Building Rating System is a voluntary, consensus-based, building rating system based on the environmental performance from a “whole building” perspective over a building’s life cycle, providing a definitive standard for what constitutes a “green”

building. The LEED program has identified five specific environmental goals:

1. Planning sustainable sites
2. Improving energy efficiency
3. Conserving materials and resources
4. Enhancing indoor air quality
5. Safeguarding water.

In conclusion, the new generations of HCFC-free polyiso rigid board insulation meet the requirements for the LEED program and for the first time are considered a “green building” product. The Montreal Protocol motivated the industry to make polyiso more environmentally friendly. However, programs like LEED also have incentives for working with green products. Companies like Atlas Roofing and others continue to lead the industry in research and development of new technologies. With the 2003 Montreal Protocol polyiso conversion deadline a short time away, building owners and specifiers are well advised to keep aware of trends.▲

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