Does Vinyl Belong on a Fine Home?

A look at the pros and cons of vinyl siding and polyvinyl chloride

BY ALEX WILSON

Perhaps no other issue in custom-home building is as hotly debated as vinyl siding. Is it a quality product? Does it improve or cheapen the appearance of a home? Should it be avoided from an environmental standpoint? Or are the low-maintenance and durability benefits of vinyl enough to outweigh concerns relating to the use of PVC—a material vilified by some environmental groups?

PVC is versatile, durable and inexpensive

There are many good reasons why vinyl jumped ahead of wood as the market leader in residential siding, why vinyl windows continue to gain market share against wood, why vinyl flooring is so popular and why PVC pipe and wire sheathing account for the vast majority of their respective markets. Polyvinyl chloride, commonly referred to as PVC or vinyl, is a highly versatile material, useful in a wide range of building applications: everything from rigid drainage pipe to highly flexible electrical-wire sheathing to wood-grain siding. PVC is rugged, with buried structural pipe able to withstand high compressive loading and PVC roof membranes able to carry 25-year warranties. PVC is low-maintenance, with vinyl siding requiring virtually no maintenance for decades; wood siding needs paint or stain as frequently as every five years. PVC is inherently fire-resistant, owing to its high chlorine content. PVC is even recyclable (though little postconsumer PVC is actually used today). Finally, PVC is inexpensive, providing an affordable alternative to traditional materials, whether wood siding, cast-iron drainpipe or built-up roofing systems.

What exactly is PVC?

PVC is a plastic. To be specific, it is the polymerized form of vinyl chloride; chemists refer to it as poly (vinyl chloride), or polyvinyl chloride. PVC is often referred to as vinyl, but vinyl more correctly refers to a chemical radical (CH_2CH) used in many organic compounds, such as vinyl acetate, a common ingredient in paint.

PVC is produced in a multistep process that involves combining chloride (from a brine solution of common rock salt) with ethylene (from natural gas) to produce vinyl chloride. This vinyl chloride then is polymerized to produce PVC. Polymerization, the process of combining organic molecules into long chains, is the basis of all plastics. Pure PVC is 57% chlorine by weight; the rest is hydrogen and carbon.

Early commercial production of PVC was hazardous. Mercury was used to separate chloride from sodium chloride, and open vats were used to polymerize the vinyl chloride monomer (VCM). After exposure to VCM was found to cause a rare liver cancer, angiosarcoma, the manufacturing process was cleaned up in 1971. Today, PVC production is highly regulated and far cleaner than it was a few decades ago.

PVC is the most widely used plastic in construction today; nearly 7 million tons were used in North America in 2000, mostly in piping and siding. To be used in these wide-ranging applications, PVC is mixed with various additives in a process called *compounding*. These additives include plasticizers, stabilizers, inert fillers, pigments and biocides. Hard PVC products, such as schedule-40 PVC pipe, may be as much as 90% PVC, and softer, more flexible PVC products, such as vinyl flooring, vinyl siding and vinyl shower curtains, may contain as little as 35% PVC.

What's wrong with PVC?

PVC's environmental drawbacks fall into five categories:

1. Pollution emissions from manufacture. Despite dramatic improvements, the manufacture of PVC and its precursor compounds still releases pollutants. The U. S. Environmental Protection Agency has just released figures for 2000 showing emissions of vinyl chloride (one of the primary pollutants) totaling 817,000 lb. (approximately 0.12 lb. per ton of PVC produced). Furthermore, some evidence exists that dioxins can be produced during one of the PVC-manufacturing processes. Dioxins, a family of chlorine-containing chemicals, are among the most deadly toxins, with a wide range of effects on humans and ecosystems.

Although U. S. industry has done a good job of cleaning up its act with PVC production, not all our PVC products are produced here. To save money, more and more U. S. manufacturers are setting up operations in third-world countries, where environmental regulations are often far less stringent.

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2. Toxic releases during incineration or accidental fires. For people not involved in its manufacture, the most significant environmental and health threat from PVC comes from disposal or accidental fires. Burning PVC generates

enough hydrochloric acid that some (but not all) firefighter organizations have lobbied against the use of PVC roof membranes because hydrochloric acid can be emitted before visible smoke is produced.

Burning PVC under reduced-oxygen conditions, such as in a poorly controlled municipal incinerator or through backyard burning, also can create dioxins. Far more toxic than hydrochloric acid, dioxins last a lot longer in the environment and can accumulate in food chains by being stored in body fat. Even if manufacturing emissions are eliminated, an organic polymer containing up to 50% chlorine always will remain a risk as long as poorly controlled incineration or accidental fires are possible.

3. Release of plasticizers. In the past several years, the plasticizers that make PVC more flexible have generated almost as much concern as PVC itself. The most commonly used plasticizer, DEHP (di-2-ethylhexul phthalate), identified as a suspected carcinogen in 1987, also is believed to be an endocrine disrupter. Endocrine disrupters mimic natural hormones and, even in minute quantities, can interfere with sex-organ development in fetuses. Phthalate plasticizers can be released during manufacturing, but also over time from flexible PVC products. These compounds are widely used in vinyl siding, flooring, roof membranes, electrical-wire sheathing and wallcoverings; the more flexible the PVC product, the higher the quantity of plasticizer. A shower curtain, for example, loses about half of its weight over the course of a few years as the phthalate plasticizers diffuse out: That's the distinctive smell of shower curtains.

4. Contamination of recycling stock. Another concern with PVC is the fact that even a small quantity of PVC plastic in a batch of other plastics being recycled can contaminate everything. PVC melts at a lower temperature than the PET used in most plastic bottles and the high-density polyethylene (HDPE) used in most plastic bags.

5. Use of a nonrenewable resource. A significant raw material used in producing PVC is natural gas, a nonrenewable fossil fuel. (For what it's worth, because of the high percentage of chlorine in PVC, the fossil-fuel content is actually a lot lower than in most other plastics.)

Looking into the crystal ball

It's hard to say where the current controversy over PVC will end up. The PVC industry is huge (over $20 billion per year in the United States), and so far at least, concerns about health and the environment have not significantly affected PVC's use by the construction industry. The market share of vinyl siding, for example, continues to grow.

On the other hand, the environmental groups attacking PVC are smart, tenacious and deeply committed to their cause—and they have a good track record of bringing about change. Consider the recently announced phaseout of chromated copper arsenate (CCA) pressure-treated lumber, which was brought about largely by the Environmental Working Group (www.ewg.org) and the Healthy Building Network. Or look at the impact Greenpeace has had in getting The Home Depot and other building-product suppliers to embrace certified wood.

The efforts of these environmental groups should not be underestimated. But when it comes to raising public awareness about the risks of PVC, the greatest driver of change could be something different: innovation in the plastics industry. During the past ten years, there have been tremendous advances in metallocene-catalyzed polyolefin chemistry. Polyolefins (polyethylene and polypropylene) are considered by many to be the "cleanest" plastics. They contain nothing but carbon and hydrogen, they are easily recyclable, and they can be burned as cleanly as petroleum.

Proponents say that in a few years, metallocene polyolefins will be used to produce a variety of building products (siding, roof membranes, flooring, wire sheathing, window frames, etc.) with properties that equal or exceed those of PVC products. Such companies as Exxon, Dow Chemical and DuPont have invested billions of dollars in the technology. When a lawsuit between Exxon and Dow over metallocene patents was settled in 1999, products finally began reaching the marketplace.

FOR MORE INFORMATION ON VINYL IN BUILDING MATERIALS

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What's the bottom line: Should you use PVC?

In some product categories, either alternatives to PVC are not widely available, or tradespeople skilled in installation are difficult to find. With drain piping, alternatives to PVC include ABS (another plastic—but one that doesn't contain chlorine) and cast iron. In some parts of the country, almost everyone uses PVC drainpipe, and obtaining ABS or finding a plumber willing to install cast iron can be difficult. Finding electrical wire sheathed with something other than PVC is virtually impossible, except by special order.

For product categories where PVC alternatives are readily available, my suggestion is to go with the greener alternatives. With windows, choose all-wood, aluminum-clad wood or fiberglass products. With siding, choose wood or fiber cement—and incorporate a rain-screen detail to extend the life of the material and to reduce the frequency of repainting (*FHB* #137, pp. 86-91). With wall coverings, stick with paint or a paper product. With resilient flooring, consider natural linoleum, cork or the new chlorine-free Stratica flooring from Amtico International (www.stratica.com). With low-slope roofing, opt for a modified bitumen or TPO single-ply membrane. □

Alex Wilson is the founder and executive editor of *Environmental Building News* in Brattleboro, Vermont. More detailed information on PVC can be found on his Web site: www.buildinggreen.com. Search for the article "Should We Phase Out PVC?"