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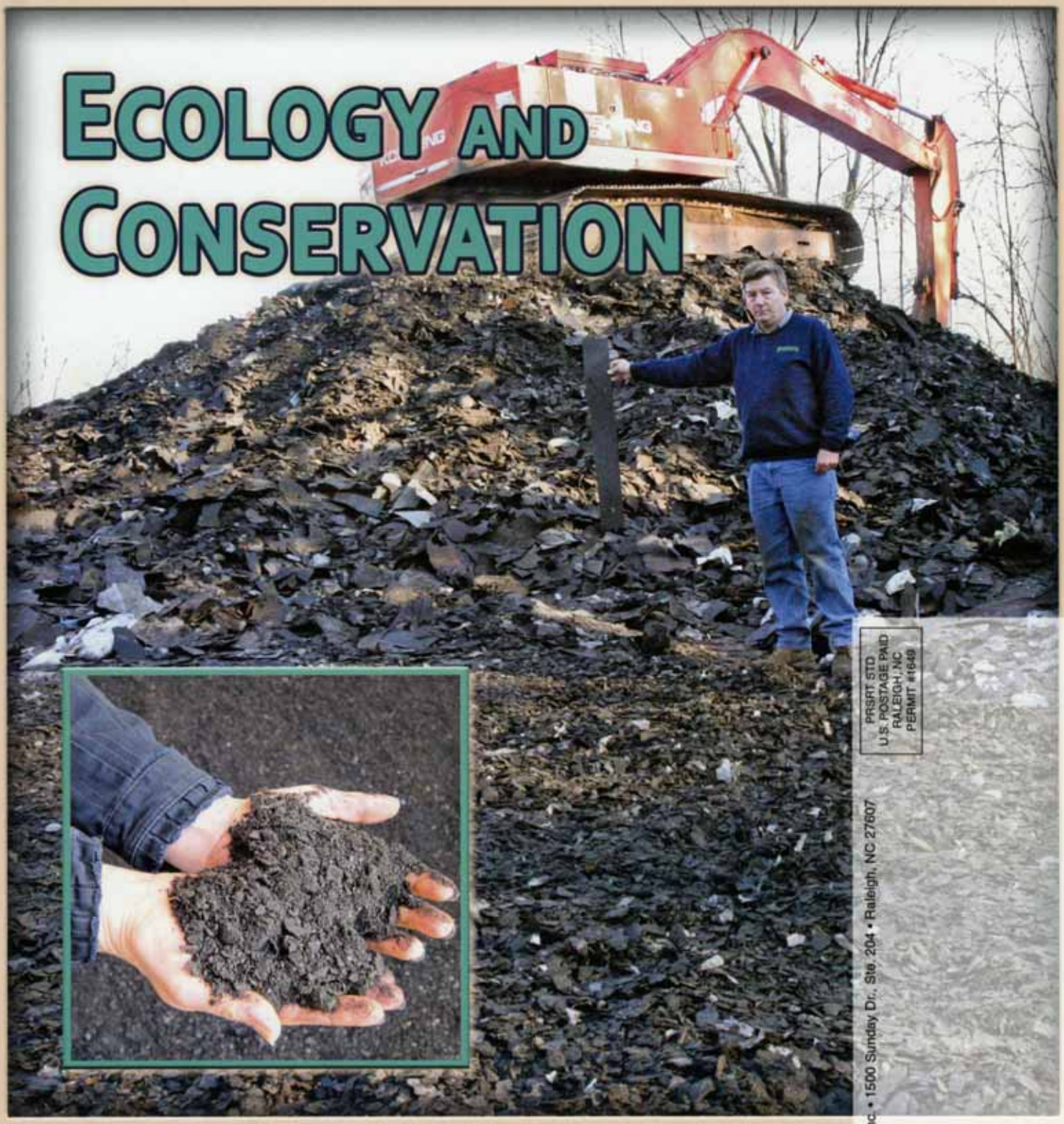


RCI, Inc. • 1500 Sunday Dr., Ste. 204 • Raleigh, NC 27607

Plastics and Their Contributions to "Green Buildings"

By Brian Whelan

Plastics and thermoplastics are part of our daily lives–from the alarm clocks that wake us up in the morning, to the helmets our children wear while riding their bikes, to the blood bags used to help save lives.

A thermoplastic is made from polymer resins that become a homogenized liquid when heated and hard when cooled. These characteristics, which lend the material its name, are reversible. That is, they can be reheated and reshaped repeatedly. This quality also helps make most thermoplastics recyclable.

Plastics have been safely used in buildings for well over half a century and are major contributors to the environmental profile of a building. Plastic products such as insulation, window frames, and roofing lower the carbon footprint of a building through energy savings. Wiring, cable, flooring, and electrical products contribute to the fire safety and low maintenance of the interior of the building. Plastic piping has proven to safely deliver and conserve water, with fewer breaks than competing materials.

Plastics dominate the commercial roofing market. Polyisocyanurate, polystyrene, and polyurethane insulation are all plastics. Polyurethane foam roofs are plastic. Plastics are used to modify asphalt in modified bitumen, improving their low temperature properties and durability. Thermoplastic polyolefin (TPO) and polyvinyl chloride (PVC or vinyl) are both thermoplastic roof membranes. It is estimated that 40% of the low-slope commercial roofing market utilizes a thermoplastic membrane.

With the exception of the newest generation of prototypical materials, all plastic products are made from petroleum. Vinyl is unique among plastics in that it requires much less petroleum to make. More than 50% of the PVC resin is derived from salt, an abundant renewable source.

It is interesting to note that plastics and the chemicals used to make plastic products have recently come under fire by some. Elizabeth Whelan (no relation to the author), the president of the American Council of Science and Health, said, "What most people don't understand is that most everything is made up of chemicals." We rely on chemicals to improve human health, and pharmaceuticals keep us healthy. Whelan said, "Pseudoscience and fear of

Photo 1 – 120,000-sq.-ft. retail project in which the original PVC roof was recycled into new membrane.

perceived environmental risks among the public have led to what we call chemophobia." Chemophobia–or an irrational fear of chemicals–seems to be spreading across America.

The truth is that solar cells, wind turbines, batteries for electric cars, treatments for diabetes, vaccines, and water purification systems are all enabled by chemistry and chemicals. They allow us to constantly improve and innovate.

Although, for the most part, the green building movement is a worthy cause, some are taking things to unrealistic and counterproductive extremes. Certain proposed green building codes and the first draft of Leadership in Energy and Environmental Design (LEED®) 2012 rating system, as now written, could have dramatic and likely unintended consequences. With the proposed LEED® 2012 requirement to restrict any building products containing chemicals listed on California Proposition 65, it's doubtful that a building could be constructed to meet existing building codes. Eliminating basic products such as concrete (crystal silica) and wood (wood dust) will be very difficult to do. Building products used safely for decades will no longer be permitted in "green buildings." It is ironic that new unproven products could be substituted for tried-and-true materials. Products with superior fire performance and quantifiable durability will be replaced with so-called "green products." The ques-

Photo 2 – PVC flooring.

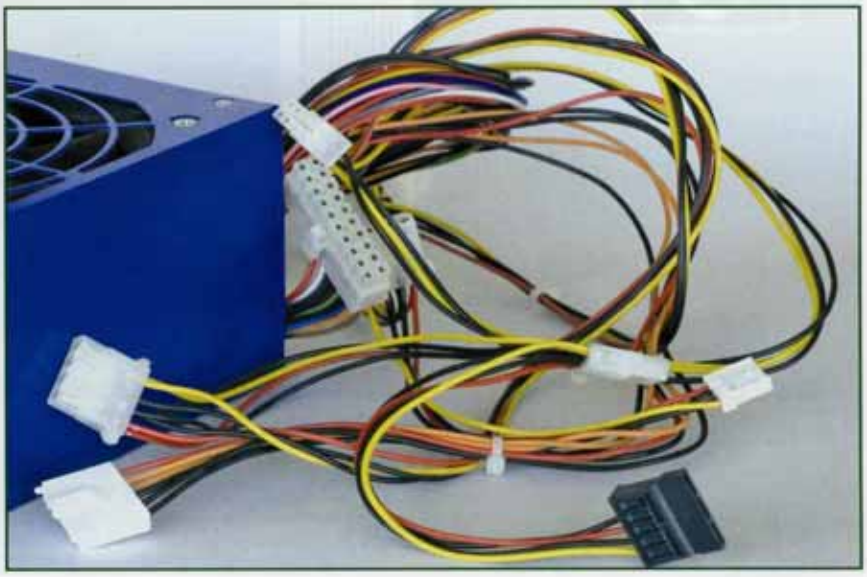
tion is what makes them green? They, too, are made from chemicals. If it turns out they only last half as long as the original product, how is that "greener"? What about the disposal costs and negative impact on landfills from the failed product? What about the financial impact for the building owner? We would encourage architects, engineers, roof consultants, building product manufacturers, building code officials, and building owners to become engaged in discussions regarding "green buildings" so that some common sense prevails.

A complete life cycle analysis (cradle-to-grave) as well as an economic assessment should be completed prior to any claims being made on a product's environmental profile. Looking at a building product with a single-attribute focus is inappropriate but, unfortunately, not uncommon in the roofing business. One manufacturer touts that its product does not contain this chemical or another. The mere presence of any particular chemical in any construction material says nothing about whether the compound presents a risk. The truth is that the alternative product is made of chemicals as well and may not have a fraction of the real-world field experience as the time-

Photo 3 – PVC pipe.

Photo 4 – PVC windows.

Photo 5 – PVC wire and cables.



proven product.

A life cycle analysis and economic assessment of five popular roof systems in the U.S. was conducted by Carbotech,[1] a well-known environmental consulting company located in Basel, Switzerland. Analysis of the life cycle impacts of the five roof systems concluded that the PVC membrane performed the best, followed by TPO, EPDM, modified-bitumen, and built-up roofing. PVC and TPO both benefited from their energy-saving, reflective white color and the ability to reduce urban heat island effects. PVC stood out for its 30-plus years of proven performance. Although not included in the Carbotech study, PVC roofing also has a proven track record of being able to be recycled into new roof membrane and walkways at the end of its service life.

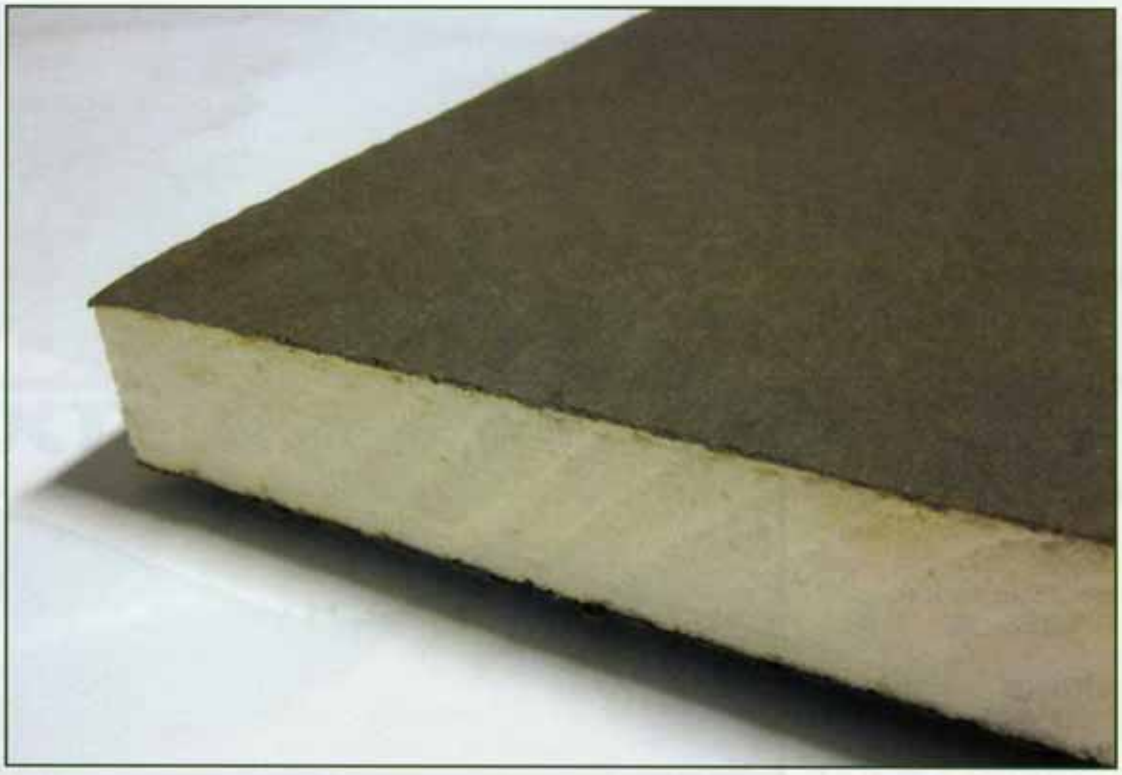


Photo 6 – Polyisocyanurate insulation.

Much has been written about global warming and the need to change behavior as a society to reduce carbon dioxide (CO_2) emissions. Representative Ed Markey, chairman of the House Select Committee on Energy Independence and Global Warming, stated before the committee on May 15, 2007, "Energy-efficient buildings must be a part of a fight against global warming. Energy-efficient design, low-emission construction materials, and decreased energy use in buildings can combat global warming and simultaneously reduce rising costs of heating and cooling structures."

A study conducted by Akbari and Levinson of the Heat Island Group of Lawrence Berkeley National Laboratory[2] (LBNL) confirmed that a cool roof lessens the flow of heat from the roof into the building, reducing electricity demand for space cooling in conditioned buildings. According to the authors of the study, substituting a weathered cool roof (solar reflective 0.55) for a conventional, darker-colored roof (solar reflective 0.20) could have far-reaching impacts per square meter of roof area, annually, averaged across America. See *Table 1.*

LBNL estimated retrofitting 80% of the 2.58 billion m^2 of conditioned commercial buildings in the U.S. would yield annual energy-cost savings of $735 million. It would also offer an annual CO_2 reduction of 6.23 million tonnes (offsetting the annual CO_2 emissions of 1.2 million typical cars), an annual NO_x reduction of 9.93 kt (offsetting the annual NO_x emissions of 0.57 million cars), an annual SO_2 reduction of 25.6 kt (offsetting the annual SO_2 emissions of 815 peak-power plants), and an annual Hg reduction of 126 kg.

Beyond energy savings, cool roofs contribute to a reduction in the urban heat island effect, a source of smog and other environmental burdens.

In another study, Carbotech evaluated one PVC roofing manufacturer's carbon footprint as a result of a total annual membrane production, offset by the energy savings of using a reflective roof membrane.[3] The study factored in the total installed square footage by state, accounting for the differences in CO_2 production from varying energy sources.

The CO_2 payback time (carbon neutral) varied from 4.3 years in Alaska to 0.9 years in Hawaii. The average payback for all of the U.S. was 1.7 years. With a conservative, 20-year average service life for the PVC roof membrane studied, across the U.S., the one-time CO_2 investment to produce the cool roof membrane would pay for itself almost 12 times over. Installing a cool thermoplastic roof is one of the simplest ways to help reduce cooling costs and improve the carbon footprint of the building.

Cooling energy savings (kWh/m^2)	Heating energy penalty ($therm/m^2$)	Energy cost saving ($/m^2$)	CO_2 reduction (kg/m^2)	NO_x reduction (g/m^2)	SO_x reduction (g/m^2)	HG Mercury reduction ($\mu g/m^2$)
5.02	0.065	0.356	3.02	4.81	12.4	61.2

Table 1

Plastics can and will continue to be a major factor in improving a building's energy efficiency and durability, both of which reduce its carbon footprint. Energy-efficient roofing is a cost-effective strategy to improve the energy efficiency of buildings. Reflective roofing, vegetative roofing, and solar roofing are all options to help the environment. Thermoplastic roof membranes such as PVC can contribute with their unmatched fire safety, proven durability, and established track record of recyclability.

Photo 7 – Thermoplastic single-ply membrane.

REFERENCES

1. Dr. Fredy Dinkel and Cornelia Steitler, "Ecological and Economical Balance Assessment of U.S. Flat Roof Systems," Carbotech, December 2004.
2. Ronnen Levinson and Hashem Akbari, "Potential Benefits of Cool Roofs on Commercial Buildings – Conserving Energy, Saving Money, and Reduce Emissions of Greenhouse Gases and Pollutants," Lawrence Berkeley National Laboratory, December 2007.
3. Cornelia Steitler, "Profits From 2007 Installed White Reflective PVC Membrane," Carbotech, October 2008.

Brian Whelan

Brian Whelan has been employed by Sarnafil, Inc., and now Sika, for 30 years and is currently senior vice president of Business Unit Roofing. He is a graduate of Harvard University's Business School PMD Program and has a degree in architectural technology. Whelan is on the board of the Center for Environmental Innovation in Roofing and was one of the original members of the Single-Ply Roofing Institute (SPRI), later becoming a member of its board and chairman of its Thermoplastic Subcommittee. He has been a member of RCI since 1989. He was on the original board of the Roofing Industry Committee on Weather Issues (RICOWI). Whelan jointly owns three patents for hot air welding of thermoplastic membranes and profiles. He has participated in various committees for NRCA, most recently the Industry Advisory Council and on the Steering Committee for PCCRS (Performance Criteria for Constructed Roof Systems).

Government Contractor Withholding-Tax Repealed

On November 21, President Barack Obama signed legislation that repeals the 3% withholding tax for government contractors. Both chambers of Congress passed the repealing legislation earlier in the month with no opposing votes. The 3% Withholding Repeal and Job Creation Act (H.R. 674) amends the tax law to cancel the withholding requirement on payments due to vendors providing goods and services to federal, state, and local government agencies. The tax was originally passed in 2005 and had been scheduled to go into effect this year.

The bill also requires the Treasury Department and the Office of Management and Budget to study ways to reduce the amount of federal taxes owed but not paid by contractors. For the study, officials must figure an estimated amount of delinquent taxes and whether having companies certify in bid proposals that their taxes are up to date has helped in compliance. Officials also will have to delve into various aspects of contracts awarded to tax-delinquent companies. The study is due in one year.

Many construction industry groups have applauded the repeal, believing that the withholding requirement would have added more turmoil to a struggling economy.