



Frequently Asked Questions About PVC Roofing Systems: Benefits & Issues

- Q:** How long have PVC, or vinyl, roofs been around? Are they among the leading systems for commercial roofing?
- A:** Originally introduced in Europe in the early 1960s, polyvinyl chloride (PVC) roofing systems were among the first single-ply commercial roofing materials. Today, reinforced PVC roofs – also called vinyl roofs – account for 65 percent of the European commercial roofing single-ply market, and North American growth has outpaced the commercial roofing industry as a whole for more than 10 years. In 1985, PVC roofing systems were the first single-ply roofing products to obtain a standard designation from the American Society for Testing and Materials (now ASTM International): ASTM D4434 – Standard Specification for Poly(vinyl chloride) Sheet Roofing – which is regularly updated. Today, PVC is an increasingly popular thermoplastic roofing membrane worldwide.
- Q:** What makes PVC roofs so special?
- A:** PVC roofing systems have witnessed tremendous growth in recent years due to a variety of standout characteristics, notably: longevity; durability in harsh weather and temperature extremes; low life-cycle costs; energy efficiency; heat and solar reflectance; flame resistance; chemical and grease resistance; ease of maintenance; ease and flexibility of installation; and inherent recyclability/re-use, among many other benefits. Often referred to as the first “cool roofing” system, PVC is energy-efficient, environmentally sustainable, long-lasting and cost-effective.
- Q:** How are PVC roofs energy-efficient?
- A:** Lots of ways! White PVC roofing systems not only reflect sunlight and solar energy to save building owners up to 40 percent in annual electricity costs, they also improve the performance of the underlying roof insulation by 25 to 50 percent; extend the useful life of the roof by as much as 75 percent; enable rooftop cooling equipment to run more efficiently; contribute to better indoor air quality and comfort; and collectively help mitigate the effects of urban heat islands and the air pollution they cause.
- Q:** How are PVC roofing systems sustainable?
- A:** More than 26 Life Cycle Assessments (LCAs) confirm that PVC roofing membranes are an outstanding sustainable choice for many reasons:
- a. Energy efficiency.
 - b. Mitigation of urban heat islands that cause elevated levels of air pollution.
 - c. Waste reduction throughout its life cycle: production, shipment, installation, post-consumer disposal.



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- Only 43 percent of PVC membrane composition is derived from nonrenewable fossil fuel feedstocks, compared with other single-ply and built-up systems that contain a much higher percentage.
 - PVC requires less energy to produce than competitive products.
 - They last for 20 to 30 years, reducing the rate of waste flow into landfills.
 - There is virtually no scrap in PVC roof manufacturing or installation.
 - PVC roofs can often be installed directly over old roofs.
 - Many PVC roof manufacturers have post-use recycling programs.
 - PVC roofing membranes are inherently recyclable, and are the only roofing material that can be recycled back into roofing products.
- d. Extremely low contribution to greenhouse gases and hazardous emissions, due to closed-loop manufacturing.
- e. There are at least 10 categories in which white PVC roofing systems can help earn points under the LEED® rating systems.

Q: Why do PVC roofing systems last so long?

A: Among the reasons that PVC roofing systems typically last between 20 and 30 years with very little maintenance are the following:

- a. Reflective properties extend the useful life of the roof substrate materials by reducing the rate of deterioration by as much as 75 percent.
- b. Waterproof characteristics that prevent PVC from rotting, rusting or corroding.
- c. Mechanical fastening systems that enable vinyl roofs to withstand hurricanes and tornadoes with minimal damage.
- d. Custom prefabricated systems from some manufacturers that help ensure optimal installation and long-term performance.
- e. Heat-welding properties that create seams that are stronger than the membrane itself while eliminating the need for chemicals, torches or other hazardous installation methods.
- f. Inherent flame resistance strengthened by the addition of flame retardant additives, which facilitates Underwriter Laboratory Class A ratings and Factory Mutual Class 1 ratings.
- g. Extremely high resistance to chemicals, grease, and other harmful substances that are common on rooftops.
- h. Simple repair procedures normally accomplished by heat-welded patches or seams.

Q: What makes PVC systems more cost-effective in the long run?

A: Life Cycle Cost analyses have proven that PVC roofing systems are among the least costly over time for two major reasons: long service life and energy efficiency. The longer a roof lasts without major problems, the less costly it is on an annual basis. Energy savings of up to 40 percent every year due to the reflective properties of white PVC roofs can add up to tens of

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thousands of dollars during a 20- or 30-year life-span. Custom prefabricated PVC roofing systems also contribute to cost-effectiveness because they generate less waste, require less time and labor to install, and reduce the potential for rooftop human error, because up to 85 percent of membrane seaming can be completed in a controlled factory environment.

Q: Environmental groups seem to think that PVC is one of the most hazardous products ever created – dangerous to human health and the environment. How do you answer that?

A: During the last 35 years, there have been literally dozens of scientific studies and more than 26 full-scale LCAs relating to the safety and environmental impact of vinyl production, use and disposal. Study after study by a wide range of scientific, governmental, academic, and industry groups has confirmed that vinyl production in the United States today is very safe, and that finished vinyl products, including PVC roofing membranes, are inert, posing no risk to human health and very little impact on the environment. In fact, many PVC products – including reflective PVC roofing systems – often make a decidedly positive contribution toward sustainability. According to Dr. Patrick Moore, a co-founder of Greenpeace in 1971 and current chairman and chief scientist of Greenspirit Strategies:

“It’s completely unacceptable for these activists to call PVC ‘toxic’ when PVC’s effects on health and the environment have been investigated at every stage from manufacture through use and on to final disposal – in all cases vinyl has been shown to be safe and environmentally sound.”

Q: Who says PVC materials are safe and/or environmentally benign?

A: The following are among the many organizations that have conducted scientific studies and life cycle assessments on PVC that have arrived at neutral or positive conclusions regarding the comparative health, safety and/or environmental sustainability of PVC production, installation, use and disposal:

- U.S. Environmental Protection Agency (EPA)
- U.K. Department of the Environment, Transport and the Regions
- European Chemicals Bureau (ECB) of the European Commission
- California EPA, Office of Environmental Health Hazard Assessment
- Lawrence Berkeley National Laboratory (LBNL)
- New York State Energy Research & Development Authority (NYSERDA)
- Midwest Research Institute
- British Board of Agrément (BBA)
- American Society of Mechanical Engineers (ASME)
- Swedish Environmental Protection Agency
- U.S. Consumer Product Safety Commission (CPSC)
- U.S. Food and Drug Administration (FDA)

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- U.S. Centers for Disease Control (CDC)
 - National Institute for Occupational Safety and Health (NIOSH)
 - U.S. Occupational Safety and Health Administration (OSHA)
- Technical and Scientific Advisory Committee (TSAC) of the U.S. Green Building Council (USGBC)
- European Single-Ply Waterproofing Association (ESWA)
- Carbotech AG independent environmental consultants
- U.S. Department of Health and Human Services (HHS)
 - U.S. Agency for Toxic Substances and Disease Registry (ATSDR)
- Commonwealth Scientific and Industrial Research Organisation (CSIRO – Australia’s premier scientific organization)
- U.S. National Academy of Sciences – The Institute of Medicine (IOM)
- American Council on Science and Health (ACSH)
- Greenspirit Strategies

Q: What about concerns that PVC production results in deadly emissions of dioxin, ethylene dichloride and vinyl chloride, causing severe health problems among PVC workers and nearby communities?

A: According to the EPA, since adoption of a closed-loop manufacturing process in the mid-1970s vinyl chloride emissions in vinyl plants have been reduced by 99 percent and dioxin emissions from all sources have been reduced by 92 percent. During the same time frame, PVC production in the U.S. more than tripled. In 1997, CDC reported that the PVC industry had “almost completely eliminated worker exposures to vinyl chloride” as well as the incidence of cancer and other illnesses caused by exposure. More recent studies by ATSDR and others have shown that dioxin levels and the incidence of cancer in communities near PVC production facilities are no higher than the national average.

Q: Isn't PVC a major cause of dangerous toxic gases during accidental building fires?

A: Every organic substance that burns during accidental building fires is a source of toxic gases. In fact, the mix of gases produced from PVC combustion – carbon monoxide, carbon dioxide, hydrogen chloride (HCl) and water – is very similar to those of all other organic materials. More importantly, vinyl’s inherent flame resistance properties actually play a beneficial role in mitigating the spread and strength of accidental building fires. Most rigid and flexible PVC will not burn alone without the application of heat from another source. Studies in Europe and the U.S. have shown that dioxin is present in all large-scale accidental fires, whether vinyl is present or not. PVC roofing membranes are a very small component of the mass of any building, and the smoke produced in a roof fire typically is external to the building.

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- Q:** Isn't PVC made from chlorine, one of the most dangerous substances on earth?
- A:** In its common elemental form (Cl₂ or dichlorine), chlorine is a poisonous, pale green gas about 2.5 times as dense as air. This is why the safe production, transportation, and handling of dichlorine is tightly regulated by government and vigilantly administered by industry through training and programs like Responsible Care. However, chlorine is also a naturally occurring element found throughout the oceans and rocks of the world, and it is an essential nutrient for plants, animals and humans. The chlorine used to make vinyl is derived from salt – both sea-water and land-based. Once chlorine is processed into vinyl, it is chemically locked into the product more tightly than it is in salt. Chlorine gas is never produced when PVC burns. When vinyl is recycled, landfilled or disposed of in a modern incinerator, no chlorine gas is released into the atmosphere. PVC roofing products are made from a very stable chlorine compound, and no chlorine is ever emitted from the finished product.
- Q:** Haven't California and most of Europe banned phthalates – an important PVC additive – from use in children's toys and other articles? Isn't this a sure sign that PVC isn't safe?
- A:** The European and California bans on phthalates in children's toys and related products are the unfortunate result of a sustained, 10-year scare campaign by activist groups dedicated to the elimination of all plastics and industrial chemicals. The basis of their argument lately is a small number of very recent studies that not only clash with more than 40 years of respected global academic and governmental science, but have offered no tangible proof that phthalates pose a danger to people of any age from any application. Phthalates have established a very strong safety profile over the 50 years in which they have been in general use. There is no reliable evidence that any phthalate, when used as intended, has ever caused a health problem for a human. Environmental research conducted by industry and others has led to a scientific consensus on three key points. First, phthalates are not persistent; they are quickly biodegraded in water and soil. Second, bioaccumulation and biomagnification are also not concerns; living organisms do not build up levels of phthalates over time, but break them down and eliminate them quickly. Third, the typical varieties of phthalates used in flexible single-ply roofing membranes (high molecular weight phthalates) are generally not soluble in water, and thus have a difficult time being bio-assimilated, as solubility is normally a requirement for biological assimilation.

The safety of medical devices and toys made of flexible vinyl was affirmed in 1999 by a blue-ribbon panel convened by the American Council on Science and Health (ACSH) and headed by former Surgeon General C. Everett Koop. Said Dr. Koop at the time:

"Consumers can be confident that vinyl toys and medical devices are safe. The panel's findings confirm what the U.S. Food and Drug Administration and the Consumer Product Safety Commission have been saying about these products all along. There is no scientific evidence that they are harmful to children or adults."



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According to Dr. Patrick Moore of Greenspirit Strategies:

“The anti-phthalate activists are running a campaign of fear to implement their political agenda. This fear campaign merely distracts the public from real environmental threats ... and the cost of taking “the path of least resistance” is replacing DINP (a phthalate) with chemicals that have not been as thoroughly tested and found as safe.”

Among the many other organizations that have studied and confirmed the human safety and minimal environmental impact of phthalates are:

- U.S. EPA
- Institute of Medicine (IOM) of the National Academy of Sciences
- U.S. Consumer Product Safety Commission
- U.S. FDA
- The National Toxicology Program Center for the Evaluation of Risks to Human Reproduction (CERHR)

Q: I've heard that PVC cannot be recycled. Is this true?

A: No. In fact, PVC is inherently recyclable. Vinyl materials can be reprocessed and recycled repeatedly, and PVC is the only roofing material that has proven to be recyclable back into new roofing products. In Europe, PVC roofing materials have been recycled for nearly 15 years. In the U.S., more than one billion pounds of post-industrial vinyl are recycled annually, and that number is growing. Many U.S. PVC roofing manufacturers have established recycling programs, including Duro-Last® Roofing, Inc. Sister company, Oscoda Plastics®, Inc. has recycled an annual average of almost six million pounds of vinyl over the last three years using PVC scrap from at least 20 sources representing at least 10 types of products, including film, sheeting, seats, air domes, automotive and, of course, roofing.

The Vinyl Roofing Division of CFFA initiated a feasibility study for national recycling in January of 2008. PVC can also be safely incinerated to recover and use the latent energy, or land-filled. In fact, many landfills use PVC liners to contain contamination.

Q: Didn't the U.S. Green Building Council (USGBC) just propose a new LEED® system for health-care facilities that awards sustainability points for avoiding halogenated products like PVC?

A: Yes. Last November, the USGBC issued a draft proposal for LEED for Healthcare (LEED-HC) that would award points for avoiding all halogenated materials, including PVC. To date, LEED-HC has undergone two public comment periods, ending February 19, 2008 with many organizations and member companies questioning a rating system that ignores the conclusions of their own five-year study on PVC building materials. What's curious about the LEED-HC proposal is that it was issued just a few months after its own Technical and Scientific

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Advisory Committee (TSAC) issued its final report to the USGBC's LEED Steering Committee (LSC) on the technical and scientific basis for PVC-related credits within the LEED Green Building Rating System™. Like so many other exhaustive LCA studies, the five-year TSAC study indicated that overall, PVC is as benign as other construction products, and in some cases is the best environmental option.

Q: Where can I go for more information about the safety, sustainability, use and performance of PVC roofing systems, or PVC in general?

A: There are plenty of places to get solid, scientifically-proven information about PVC products and roofing materials:

The Vinyl Institute: <http://www.vinylinfo.org/>

Vinyl Roofing Division of CFFA: <http://www.vinylroofs.org/>

The Vinyl Environmental Council (Japan): <http://www.vec.gr.jp/english/about.html>

Vinyl In Design: www.vinylbydesign.com

Phthalate Information Center: <http://www.phthalates.org>

ASTM International: www.astm.org

The Cool Roof Rating Council (CRRC): www.coolroofs.org

Duro-Last Roofing®, Inc.: www.duro-last.com

ENERGY STAR ratings: www.energystar.gov

ENERGY STAR Roof Products energy savings calculator: <http://www.roofcalc.com/RoofCalcBuildingInput.aspx>

Green Globes, Environmental Assessments for Buildings: www.greenglobes.com/

Greenspirit Strategies: <http://www.greenspirit.com>

Lawrence Berkeley National Laboratory: <http://eandE.LBL.gov/heatiland>

Single Ply Roofing Industry association (SPRI): www.spri.org

U.S. Green Building Council, LEED Program: www.usgbc.org

