vinyl THE MATERIAL FOR LIFE

# Hot topics

## What people need to know about the most important issues facing vinyl today

Sometimes the many benefits of vinyl (also known as polyvinyl chloride, or PVC) are eclipsed by the concerns surrounding it.

We've taken the 10 most common concerns regarding vinyl and provided the information people need to know about them. When it comes to these big issues, the facts speak for themselves. We think that the more people understand the facts about these issues, the more people will see vinyl for what it is: The Material for Life.

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## 1. Recycling and landfill avoidance

The vinyl recycling industry is robust. Pre- and post-consumer amounts are growing. According to the Vinyl Institute's 2019 recycling survey of over 100 recyclers in the U.S., some 1.1 billion pounds of pre- and post-consumer vinyl were recycled in 2018. The survey, conducted by Tarnell Company, found there are 142 million pounds of post-consumer materi-als —a 40% increase of the post-consumer volume since 2014.[1] The vinyl industry is focused on continuous performance improvements that reflect the industry-wide commitment to sustainability efforts that include recycling.

In the U.S., most of the 10 billion pounds of vinyl resin consumed annually goes into durable goods like pipe, siding, roofing, windows, and other building products. Approximately 5 billion pounds goes into water infrastructure (large PVC pipes, for example) that is buried underground and has a service life more than 100 years. Since it is still in use, it is not available to go into the recycling stream.

### Incineration

Vinyl can be safely incinerated along with other waste materials by modern, highly-controlled and regulated waste-to-energy incinerators. Its energy can also be recaptured and reused. A large-scale study by the American Society of Mechanical Engineers found no link between the chlorine content of waste like vinyl and dioxin emissions from controlled combustion processes. Instead, the study stated, the operating conditions of combustors are the critical factor in dioxin generation. Other scientific studies confirmed this conclusion.[2]

### Landfill avoidance

Vinyl products are extremely resistant to the corrosive conditions found in landfills. In fact, vinyl is often used to make landfill liners and caps because it is inert and stable. According to EPA's annual Sustainable Materials Management report, Vinyl waste accounts for less than 0.6% of landfilled waste by weight.[3]

## 2. Phthalates and other plasticizers

Plasticizers, stabilizers, and other vinyl additives are used for performance characteristics. Plasticizers are used to make vinyl flexible. Rigid applications such as pipe, window frames, siding, and wall protection do not contain plasticizers.

Phthalates are a family of plasticizer compounds that are colorless and odorless and have low volatility. There are many kinds of phthalates and they are often used to soften vinyl. Phthalates are commonly used in PVC products such as wire and cable, medical devices including IV and blood bags, wall covering, self-adhesives, coated fabrics and roofing. They are among the most thoroughly studied families of compounds in use today and have developed a very strong safety profile during the 50 years in which they have been in general use. Claims of a potential health risk are based on results of high-dose rodent experiments. However, humans metabolize differently than rodents and direct correlation to humans is not accurate. Information collected by the Centers for Disease Control and Prevention during the last 10 years indicates that, even though phthalates are used in many products, exposure is extremely low, and significantly lower than any levels of concern set by regulatory agencies.[4] However, anti-phthalate campaigns have affected public perception.

Additives evolve as manufacturers strive to innovate, improve, and meet customer needs. Flexible vinyl can be made without phthalate plasticizers. Some manufacturers are using several new types of terephthalates as well as bio-based plasticizers, which seem to be doing well in performance and LCA studies.

## 3. Red lists and chemicals of concern

Health and safety to building occupants is important to all specifiers. Lists of chemical and materials to avoid are hazard based. Some are using these lists to guide their product decision-making. According to the European Molecular Biology Organization (EMBO) report "The Public Perception of Precaution," these avoidance lists are based on The Precautionary Principle, which is a "better to be safe than sorry" perspective. Unfortunately, measurable science in this process is ignored. "There is ample controversy

about why, when and how to invoke the precautionary principle as a protective measure; however, so far there has been little attention paid to whether the measures achieve the desired effects."[5] It is natural for people to take reasonable precautions.

However, in building science, this prescriptive path of specific chemical or material avoidance confuses hazard with risk. A hazard is the potential for harm under the right conditions and exposure. The same EMBO report states that "risk management looks at hazards, weighs the benefits and tries to manage exposure. Uncertainty management sees hazards (NGO approach: risk=hazard) as something uncertain and needing to be avoided."[6] Red lists oversimplify the selection process and imply that substitutions are safer without any question of exposure to the chemical or material in question; or if that chemical is even present in a final product.

PVC is included on several red lists generated by organizations that have not allowed the PVC industry stakeholder involvement in determining why PVC does not meet their selection criteria for materials. In fact, if the same criteria for deselection were applied universally to other materials, those same red lists would include a host of other materials as well.

Some companies market products under PVC Free to try to gain market advantage. As explained by David Zaruk, a professor at Odisee University College, "… market advantage can be more easily gained if a competitor's substance or process be legislated out or perceived to be banned soon by precautionary measures. So, we should not be surprised if companies raise the alarm about environmental-health risks of products their competitors make."[7] Sadly, these products are sold for what they do not contain, and performance is often lacking. These product failures are costly for manufacturers, end-users, and the environment.

Life-cycle science shows that different materials and products have different impacts over their lifetimes, and only by inventorying these impacts and comparing them can a user be anywhere close to confident about making the best choice. Choosing products based on their ability to perform and meet client expectations is always a better choice.[7]

## 4. Indoor environmental quality

Air quality is one component of a building's indoor environmental quality. Environmental quality encompasses many building aspects such as daylight, acoustics, and occupant control over lighting and thermal comfort.[8]

But what many are concerned about are VOC levels in products for home or building projects.[9]

Vinyl products all start with vinyl resin, which is inert and does not contribute to indoor VOC measurements. Additives like plasticizers, stabilizers, and pigments are compounded with the resin to make products with specific performance requirements. As manufacturers have moved to reduce VOC levels for products, these additives for compounding have change and improved. For instance, solvent-based inks were replaced with water-based inks. Today, most vinyl products meet low VOC requirements in standards such as FloorScore®, Green Label Plus, and GREENGUARD.[10-12]

Air quality can be affected by biological factors, as well. In hot and humid climates, impermeable wallcoverings can cause condensation to occur inside the walls. Manufacturers have addressed this issue with innovations such as mildew-resistant or "micro-vented" products that allow moisture to escape.

## 5. Life cycle assessment and Environmental Production Declaration

Choosing products can be complicated. Many experts agree that to truly understand a product's environmental and health impact, its entire life cycle should be evaluated.[13] That's why architects and designers rely on the life cycle assessment (LCA), a comprehensive document that contains details on the environmental and health impacts of a product.

Another useful tool is the Environmental Product Declaration (EPD), a concise document that provides insight into selected important impacts of the product throughout its life cycle. The science and verification process for completing an EPD is time-consuming and expensive. Some companies have industry average EPDs available, while others have developed EPDs for their products. It is important to understand

the criteria used in an EPD before comparing one product with another.

You can't have an EPD without industry agreement on transparency and method, so product category rules (PCRs) have been developed to calculate and report on product-specific impacts and enable better comparison and consistency.[14]

When LCA aspects are considered, vinyl products generally do extremely well. Manufacturing, durability, maintenance, carbon footprint, energy and water consumption, and cost are all important factors. For example, impacts associated with the production of vinyl building products such as windows, roofing, and cladding production are far outweighed by decades of minimal maintenance and energy-saving benefits.

Ultimately, we want to choose products that serve the clients' needs well. The flooring industry is one of the first to come together and work with NSF International to develop a PCR according to ISO 14025 guidelines. Vinyl industries with PCRs, EPDs, and/or LCAs include flooring, roofing, wallcovering, large diameter pipe, windows and siding.[15-21]

## 6. Chlorine

By a process known as electrolysis, caustic soda and chlorine are extracted from salt (sodium chloride). Caustic soda is a key commodity chemical for things like pulp, paper, and aluminum processing, water treatment, and cleaning solutions. Chlorine is a basic building block for polyvinyl chloride (PVC, or vinyl) and is also widely used in water treatment, cleaning products, pharmaceuticals, and other polymer intermediates. In the United States, the vinyl industry consumes 20% of the output of the chlor-alkali process. Once chlorine is processed into vinyl, it is chemically locked into the product more tightly than it is in salt. Chlorine makes vinyl naturally fire resistant and uniquely valuable in building and construction.

When vinyl is recycled, landfilled, or disposed of in a modern incinerator, chlorine gas is not released into the atmosphere.

## 7. Fire properties and safety

PVC possesses excellent fire performance properties. Vinyl is less flammable than most polymeric materials, natural or synthetic, and will typically not burn once the source of heat or flame is removed. In an accidental fire, this may give building occupants more time to escape.

Rigid vinyl such as those found in pipe, siding, and window frames, have better fire performance than many other combustible materials, including wood. In addition, technologies developed in the 1980s and 1990s that combined plasticizers with other additives, resulted in plasticized PVC materials with fire (and smoke) properties that can exceed rigid PVC. This finally made it possible to use PVC materials in applications such as plenum cables. Vinyl is used in wire and cable insulation for fire safety as well as chlorinated polyvinyl chloride (CPVC) sprinkler systems. (Product manufacturers usually include fire test performance in their technical data.)

All smoke from any burning material is highly toxic. In an uncontrolled fire, combustible materials will yield polynuclear aromatic hydrocarbons (PAH) which are persistent BATs. The smoke toxicity of vinyl material is no different than the toxicity of most commercial non-vinyl materials. For additional information on this topic, please read Fire Properties of Polyvinyl Chloride, a well referenced paper that addresses smoke toxicity, flammability, ignitability, and flame spread.[22]

Hydrogen chloride (HCl) is a byproduct of burning vinyl, but it does not incapacitate or become dangerous until it reaches concentrations far higher than those that have been measured in actual fires. In real fires, HCl air concentration declines rapidly as it adheres to surfaces. Because it is an irritant with a pungent odor, HCl can serve as a warning to evacuate. Since the 1970s, fire incidence and deaths have declined steadily.

## 8. Dioxins

Dioxins are an unintentional byproduct of incomplete combustion. They are considered persistent bioaccumulative toxins (PBT) and tend to accumulate in our bodies as we age. The good news is that dioxin levels measured by the Environmental Protection Agency (EPA) in the environment have been declining for decades.

Municipal incineration and manufacturing used to be the largest man-made sources of dioxins. However, strict regulatory controls on major industrial sources of dioxin have reduced emissions into the air by 90% since 1987.[23] Today, forest fires, volcanic eruptions, and open backyard burning are the largest man-made sources of dioxin emissions in the U.S.[24] Other dioxin sources include burning wood in fireplaces, exhaust from diesel-powered vehicles, metal smelting, and accidental building fires.[25]

As dioxin levels have declined, vinyl production has doubled. Yet vinyl production is a small source of dioxin. The vinyl industry has worked hard to reduce its contribution to dioxin. Vinyl's dioxin emissions are a tiny fraction of the overall total. In fact, according to EPA's Toxic Release Inventory, the chlor-vinyl manufacturing chain emits six to seven grams (on a toxic equivalent basis) of dioxin per year—or 100 grains of salt.

## 9. Manufacturing safety and emissions

The culture of safety within a vinyl resin and monomer facility is paramount to employment. It is good business to have healthy workers.

U.S. Occupational Safety and Health Administration (OSHA) requires manufacturers to report injury and illness.[26] In addition, the Vinyl Institute conducts an annual survey asking member companies to report OSHA recordable incidents. (A recordable incident would be one that requires any sort of medical attention, e.g. cuts, sprains, etc.) Our rates are half the rate of the overall chemical industry, and one-fourth the rate of all manufacturing. As a comparison, retail stores typically report the highest OSHA incident rates of any sector.[27]

Early methods of manufacturing exposed workers to vinyl chloride monomer. When several cases of a rare form of liver cancer were traced back to high exposure, the entire vinyl industry completely re-engineered its production operations to eliminate this exposure. There have been no documented cases of this cancer among vinyl workers whose careers began after the regulations took effect.

Emissions are also part of our manufacturing safety. Maximum Achievable Control Technology (MACT) is part of the Clean Air Act amendments. The purpose of these amendments was to expedite the development of standards that would reduce hazardous air pollutant (HAP) emissions. These regulations require resin and monomer producers to invest in the latest and most efficient emissions control technology. In addition, voluntary investments were made in plant modernization, including programmable computer control technology that was widely implemented from the 1980s to the 2000s for process control. The vinyl resin industry invested heavily in pollution abatement equipment that reduced emissions well beyond the allowable levels established by EPA regulations. The age of computers took manufacturing from an art to a science.

Employees live and work in these communities and want healthy and safe environments for everyone. They not only want their families and friends to thrive, but the next generations as well.

Because of stringent EPA and OSHA regulations, the U.S. has the safest and lowest emission profile for any vinyl manufacturing region in the world.

## 10. Progress and best practices

Successful businesses are always innovating and improving. Environmental responsibility, resource conservation, human health protection, and economic well-being are all things the vinyl industry strives for.[28] Modern materials, like vinyl, are sometimes a better solution for some of today's challenges. PVC pipe is just one example of a more effective and affordable system for clean water delivery.

According to the Utah State University study "Water-main Break Rates in the USA and Canada: A compre-

hensive Study, "a critical component to public health and economic well-being is our drinking water which is brought to the tap through an elaborate network of underground pipe distribution systems. Since most of this infrastructure is underground, it is out of sight and often neglected. Empirical data on water main breaks helps utilities in their repair and replacement decision-making processes in order to deliver clean drinking water to their customers at an affordable price." According to Steven Folkman, author of the report "PVC pipe has the lowest break rate of any pipe."[29]

We have made great progress. However, we are committed to doing better. In 2016, the vinyl industry took a leadership role by bringing together all facets of the vinyl value chain into a collaborative, self-funded business council called the **Vinyl Sustainability Council (VSC)**. Its mission is to implement a roadmap to evaluate current conditions, recognize the best practices now in place, and innovate for continual improvement. All these activities are focused on purpose-driven sustainable development and innovation. Raising industry performance to a universal high level will be recognized by all stakeholders as a brand of excellence.

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