

Low-Cost

LOT SEPARATION FENCING

B@100 Interior Applications

A holistic comparison:

Proto II™ 4-Inch Wall System

Vinyl Fencing

Comparing their relative values in:

Fire Safety Performance

Wind Resistance

Seismic Resistance

Noise Attenuation

Impact Resistance

Retaining Capabilities

Child and Pet Safety

Environmental Impact

Embodied Energy

Recognition as a 'Green' Material

Builder Marketability






Proto II™ Wall Systems

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Lot Separation Fencing - B@100 Interior Applications

A holistic comparison: Proto II™ 4-Inch Wall System and Vinyl Fencing

Consideration	Proto II™ 4-Inch Wall System for B@100	Vinyl (PVC)
<p>Fire Safety Performance</p>	<p>Excellent. Noncombustible. No toxins emitted.</p>  <p>Concrete masonry simply does not burn.</p>	<p>Very poor. Melts at sub-ignition temperatures. Loses up to 60% of its mass prior to combustion by outgassing highly toxic chemicals. See articles following.</p>  <p>In these news service and web contributor photos of the Southern California wildfires of October 2007, the effects of radiant heat on vinyl are quite evident. Note the wood sign, right, is untouched while the vinyl rail fence is completely destroyed. Worse, while heated, the PVC outgassed a considerable portion of its mass in deadly toxins such as hydrogen chloride gas - which turns into hydrochloric acid when inhaled, and dioxins.</p>
<p>Wind Resistance</p>	<p>Excellent. Designs based on site specific criteria. Ductility of post-tension construction and cracked-wall-analysis engineering provide safety advantages.</p>  <p>Strong desert winds blew hard enough and long enough to do some excavating! This wall was still within spec and undamaged.</p>	<p>Fair. Quality of materials and installations vary enormously since these walls are not typically site engineered. Recommendations on using additional structural elements to reinforce beyond "normal" (undefined) winds vary by manufacturer and installer.</p>  <p>The vinyl fence on the left was damaged by a 60 mph wind, not uncommon wind speeds during a Santa Ana winds event. The photo on the right shows the failure of a vinyl fence during a thunderstorm. Granted, very violent winds can be generated by thunderstorms, severe enough to damage other types of fencing as well. HOWEVER, masonry walls will not disintegrate into flying missiles!</p>
<p>Seismic Resistance</p>	<p>Excellent. Base design suitable for all seismic criteria. Ductility of post-tension construction and cracked-wall-analysis engineering provide safety advantages.</p>	<p>Good. Vinyl fences are very lightweight. Quality of materials and installations vary enormously since these walls are not typically site engineered.</p>
<p>Noise Attenuation</p>	<p>Excellent. Concrete masonry is the preferred soundwall material for CalTrans.</p>	<p>Extremely poor. Typical vinyl fences are very thin, lightweight, and have gaps at every post.</p>
<p>Impact Resistance</p>	<p>Excellent. Concrete masonry units have high compressive strength. Post-tensioning adds further compressive forces to the materials.</p>	<p>Poor. Vinyl providers tout the flexibility of the material, yet normal outdoor activities will ding, bend, or break vinyl fence pieces. Their own literature warns against mowers, edgers, etc.</p>  <p>What's more normal than a kid playing catch in his yard...and missing? Or testing her arm strength against any surface in sight?</p>

Lot Separation Fencing - B@100 Interior Applications

A holistic comparison: Proto II™ 4-Inch Wall System and Vinyl Fencing

Consideration	Proto II™ 4-Inch Wall System for B@100	Vinyl (PVC)
Retaining Capabilities	Excellent. Proto II's 4-inch wide design accommodates 1'-4" of retaining with no further engineering required.	None. A separate structure (typically concrete masonry) must be built below the vinyl fence for any amount of retaining. Depending on the height of the retaining requirement, this could negate any presumed cost savings.
Child and Pet Safety	Excellent. No digging under it. Walls are very stout and will not wobble as children climb over the fence.	Extremely poor. Pets, and kids for that matter, can easily dig under panels. Walls are very flimsy and will move when being climbed upon, creating a safety hazard. (Children and dogs do not read manufacturers' disclaimers.)
Environmental Impact	Excellent. All materials are inert and non-toxic. Raw material sources and production facilities are local. All materials are easily recycled.	Extremely poor. See articles following. PVC is toxic at every stage of its life, especially in its production and disposal, and when subjected to high heat. Raw materials and processing facilities of base product not local. Significant consumption of energy.
Embodied Energy*	Excellent. 1.27 MJ/kg	Extremely poor. 70.00 MJ/kg
Recognition as a 'Green' Material	Yes. Excellent lifecycle performance, little to no maintenance, easily repairable with minimal material impact, low environmental impact, completely recyclable at end-of-life.	No. Its manufacture and additives make PVC a significant health hazard. Known carcinogens are created at beginning of life and at end of its life, and are outgassed or leached at lower levels during its service life. So many toxic chemicals are added to PVC to counteract its brittleness and UV degradation, it is virtually NOT recyclable. PVC contaminates otherwise legitimate recyclable plastic. Therefore, it ends its life in a landfill where it continues to leach toxins, or is incinerated, releasing more toxins.
Builder Marketability	Excellent. Homebuyers know a concrete masonry fence is there for the lifetime of the property, instantly adding future value, and the ancillary benefits of post-tensioning are bonus points for the builder.	Very questionable. Many prospective buyers are wary of a "plastic" fence and its unnatural, shiny look. Vinyl fences are typically marketed as a "no maintenance" material, compared to wood, a short-term, non-durable, fire-wick, inexpensive material. Interestingly, the main selling point for vinyl - no maintenance - is the only thing it has relatively in common with masonry. However, it falls short in every other metric, and the no-maintenance applies only if you protect the fence from outdoor activities.
Cost Difference	Negligible	
Cost / Benefit Analysis	Higher performing, yet less cost than conventional. Analysis: Proto II's fire safety, structural safety, lifecycle performance, environmental impact, non-toxicity, recyclability, and supreme marketability provide the builder and the buyer with tangible, long-term value far in excess of its cost versus other systems.	Lowest initial cost, lowest marketing value, highest threat to human health and the environment. The antithesis of a green material. Analysis: A classic you-may-lose-more-than-you-tried-to-save scenario. As the movement to eliminate PVC continues to grow, as led by major, high-profile corporations, your buyers will be more aware of the risks and detrimental impact of this "cost-saving" alternative.

* Measures the total energy expended for the complete lifecycle of a material, from raw material extraction and transportation, to production processes, delivery, use, and finally, end of life disposal. Measured in megajoules per kilogram.

**See back page for article citations related to
PVC health and environmental issues.**

Information Sources

PVC: *Bad News Comes in Threes*, Center for Health, Environment and Justice:

Overview of Hazards Associated with PVC Production, Use and Disposal	
Production	
	Dioxin and mercury emissions and asbestos waste from chlorine production.
	Air emissions and wastewater releases from Ethylene Dichloride/Vinyl Chloride Monomer (VCM) production facilities.
	Dioxins and other organochlorines released as by-products of Ethylene Dichloride/Vinyl Chloride Monomer (VCM) production.
	Worker exposures to VCM.
Use	
	Incineration of production wastes.
	Additives leach and otherwise migrate from PVC products (plasticizers/metal stabilizers).
	Accidental structure and vehicle fires release dioxins.
Disposal	
<i>Landfill</i>	
	Accidental landfill fires release dioxins.
	Additives, heavy metals and dioxins leach into groundwater.
	Gaseous emissions from additives.
<i>Incineration</i>	
	Dioxins form when PVC is burned.
	Hydrochloric acid, toxic metals and dioxins are emitted to air.
	Ash, later stored in landfills, contains high levels of heavy metals and dioxins.
<i>Recycling</i>	
	Diversity of additives prevents effective recycling of mixed PVC products and materials resulting in poor quality products (downcycling).
	Low recycling rates (currently <1%).
	Contaminates other plastics during recycling as well as other valuable commodities that are targeted for recycling.
	Does not reduce the overall demand for raw materials to make plastics (virgin resin) and has no effect on the amount of vinyl produced each year.

The major reason why PVC poses so many environmental and health threats throughout its life cycle is because it contains large amounts of chlorine (Thornton 2000). Chlorine is a highly reactive substance that readily combines with carbon molecules, the building block of life in people and animals. Carbon is the most important element in living things because it combines with oxygen, nitrogen and hydrogen to produce stable molecules such as DNA, proteins, hormones, sugars, starches and fats that are essential for life. Chlorine reacts readily with carbon, altering the original molecules and their functions.

Office of the New York State Attorney General (www.oag.ny.us), Andrew M. Cuomo, *Press Release: PVC Industry Abandons Challenging "Green Building" Rules*

Vinyl chloride, the building block of PVC plastic, is a known human carcinogen and it may pose health risks to workers who manufacture the material. Also, PVC plastic can produce hazardous chemicals when burned in garbage incinerators and backyard burn barrels. PVC poses serious risks of chemical exposure to firefighters battling blazes in buildings that have PVC building products. Even under normal conditions, PVC plastics release low levels of toxic chemicals into the air.

Judith Schreiber, Ph.D., Senior Public Health Scientist, New York State Department of Law, New York State Office of the Attorney General, *Affidavit*, Submitted to Supreme Court of the State of New York

Before flames are present, heated PVC can generate toxic and deadly fumes. In the early stages of a fire, heat causes the PVC molecules to begin to come apart generating hydrochloric acid (HCl), carbon monoxide, phosgene gas, benzene, toluene, xylenes, chlorinated biphenyls, PCDDs and PCDFs (IAFF, 1995). The release of HCl on thermal degradation of PVC has been well documented in the scientific and medical literature. PVC, of all the synthetic plastic polymers, has been implicated as causing one of the most insidious, serious problems in fire fighting due to its release

of HCl while burning (Dyer and Esch, 1976, page 394). Once the decomposition temperature has been reached (above 225 degrees Celsius), hydrogen chloride is generated from the thermal decomposition of PVC. By the time actual combustion begins (around 475 degrees Celsius), PVC has lost over 60% of its weight in the generation of HCl and other chemicals (Dyer and Esch, 1976, page 395). The toxic gases generated during this pre-combustion period are particularly dangerous as there is no flame to warn fire fighters and occupants (IAFF, 1995).

Joe Thornton, Ph.D., *Environmental Impacts of Polyvinyl Chloride Building Materials, A Healthy Building Network Report*

Chlorine production is one of the world's most energy-intensive industrial processes...Chlorine production for PVC consumes an estimated 47 billion kilowatt hours per year—equivalent to the annual total output of eight medium-sized nuclear power plants.

The PVC lifecycle presents one opportunity after another for the formation and environmental discharge of organochlorines and other hazardous substances. When its entire lifecycle is considered, it becomes apparent that this seemingly innocuous plastic is one of the most environmentally hazardous consumer materials produced, creating large quantities of persistent, toxic organochlorines and releasing them into the indoor and outdoor environments. PVC has contributed a significant portion of the world's burden of persistent organic pollutants and endocrine-disrupting chemicals—including dioxins and phthalates—that are now present universally in the environment and the bodies of the human population. Beyond doubt, vinyl has caused considerable occupational disease and contamination of local environments as well.

In summary, the feedstocks, additives, and by-products of the PVC lifecycle are already present in global, local, and workplace environments at unacceptably high levels. Efforts to reduce the production and release of these substances should be environmental and public health priorities. The hazards posed by dioxins, phthalates, metals, vinyl chloride, and ethylene dichloride are largely unique to PVC, which is the only major building material and the only major plastic that contains chlorine or requires plasticizers or stabilizers. PVC building materials therefore represent a significant and unnecessary environmental health risk, and their phase-out in favor of safer alternatives should be a high priority.

PVC is the antithesis of a green building material. Efforts to speed adoption of safer, viable substitute building materials can have significant, tangible benefits for human health and the environment.

Legal View (vinyl-chloride.legalview.com), *Vinyl Chloride Classified as Carcinogen*

The following are some health risks and symptoms which may develop with prolonged exposure to vinyl chloride:

- Lymphoma: Cancer which develops in the lymphatic system, a major component of the immune system.
- Leukemia: A malignant disease marked by a proliferation of white blood cells.
- Angiosarcoma (brain, liver, lung): Cancer that begins in the lining of blood vessels.
- Adenocarcinoma: Malignant tumors which form in the glandular tissue of organs (e.g. lungs, cervix, prostate).
- Pseudo-scleroderma: A progressive disease characterized by the deposition of fibrous connective tissue in the skin and often in internal organs; results in a thickening, swelling and hardening of the skin.
- Acro-osteolysis: Marked by ulcers on the palms of the hands and the soles of the feet, also disintegration and fragmentation of the ends of the fingers and toes.
- Various fetal damage issues, spontaneous abortions and birth defects.

Pasadena Think Green, Green Building Outreach and Education Program 2007, *Know Your Plastic*

PVC /Vinyl (polyvinyl chloride) ... Contains chloride and Phthalates DEHP & DINP, carcinogens & endocrine disruptors*. Very toxic for the environment. One piece of PVC plastic can contaminate an entire batch of recycled plastic. MOST DANGEROUS especially for young children. The phthalates sit on the surface of the plastic so just by touching this plastic you pick up the phthalates. Children are always putting their hands in their mouths so the phthalates are easily ingested.

*endocrine disrupter, disrupts normal hormonal functions.

Many of these chemicals mimic estrogen.

Washington Toxics Coalition (watoxics.org), *Press Release: Microsoft Completes Phaseout of PVC, 'the Poison Plastic'*

Microsoft, along with Kaiser Permanente, Crabtree and Evelyn, and others announced they have joined the fast-growing ranks of major corporations demonstrating concern about the environmental health impacts of their products or packaging by phasing out PVC plastic (polyvinyl chloride or vinyl). Hazardous chemicals are used and released in this commonly used material, the second highest selling plastic in the world. Studies show links between chemicals created and used during the PVC lifecycle and cancer, reproductive and immune system damage, and asthma.

Some of the major corporations with PVC phase-out strategies:

Adidas	Bath and Body Works
The Body Shop	Catholic Healthcare West
Firestone Building Products	Gerber
Honda	HP
Ikea	Johnson and Johnson
Lego Systems	Nike
Samsung	SC Johnson
Shaw Industries	Toyota
Victoria's Secret	Volkswagen
Volvo	Wal-Mart

A 2005 report from the Center for Disease Control and Prevention found eleven of twelve phthalates tested were higher in children than adults. A study published in the Environmental Health Perspectives (EHP) journal in August 2005, demonstrated for the first time a link between a mother's exposure during pregnancy to phthalates and adverse effects on the male reproductive system. These changes were seen at phthalate levels below those found in one-quarter of the female population of the United States. Most recently, Danish medical researchers published a new study in EHP on September 7, 2005 finding that 3-month-old boys exposed to higher levels of phthalates through breast milk produced less testosterone than baby boys exposed to lower levels of the chemicals, suggesting the human testis may be vulnerable to phthalate exposure during development.

The Center for Health, Environment and Justice, *PVC: The Poison Plastic*

PVC cannot be effectively recycled due to the many different toxic additives used to soften or stabilize PVC, which can contaminate the recycling batch. Most consumers do not know that a 3 in the recycle symbol indicates that the plastic is made of PVC, and therefore recycle those products, inadvertently rendering thousands of potentially recycled containers useless. In fact just one PVC bottle can contaminate a recycling load of 100,000 PET bottles. Recycling of PVC is negligible, with estimates ranging from 0.1% to 3% of post-consumer PVC waste being recycled.

Riverside-Corona Resource Conservation District, *Help Create a Sustainable Community*

Choose durable, high quality, energy efficient products... Avoid products that are fabricated with persistent chemicals, such as vinyl, PVC's, CFC's. Seek out sources of earth-friendly, least-toxic products.

Sandra Steingraber, Ph.D., Distinguished Visiting Scholar, Ithaca College, *Update on the Environmental Health Impacts of Polyvinyl Chloride (PVC) as a Building Material; A Commentary for the U.S. Green Building Council*

All together, data from the past four years indicates that PVC poses serious threats to environmental health at every stage of its existence. Its production contributes to the ongoing contamination of fish and seafood with methylmercury. Its manufacture and assembly is linked to lung cancer, as well as liver cancer, in workers. PVC plants routinely poison neighboring communities. The use of PVC as a building material contributes to the degradation of indoor air and is linked to respiratory symptoms in children and office workers. The plasticizers with which it is treated pose clear threats, at background level, to fetal development of the male reproductive tract and may also damage sperm cells in adult males. At the end of its life, PVC waste creates intractable disposal problems because it is expensive and unsafe to burn, it releases hazardous chemicals into groundwater and air when buried, and is not cheaply or easily recycled.