
healthy homes
healthy communities
the healthy habitat: a report

The Healthy Habitat: A Project of Greenpeace and the Healthy Building Network

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GREENPEACE

Public Demonstration by Greenpeace against Vinyl Industry: NO ARRESTS EXPECTED

On March 18, 2004, Greenpeace began one of its most compelling actions to end the use of polyvinyl chloride plastic (PVC), also known as vinyl. But instead of piloting its trademark inflatable boats and climbing to unbelievable heights, the group was hauling two-by-fours and swinging hammers. The project was completed in just four weeks on April 20, 2004, two days before Earth Day.

The goal of this project was to build an affordable PVC-free house within a typical Habitat budget of less than $60,000. To document the construction, we produced a short video and report on lessons learned and ways to build additional PVC-free homes.

More than two-thirds of all PVC or vinyl production is used in construction materials such as siding, window frames, waste water pipes, floor tiles, carpeting, wiring and wall covering.

One of the most widely used plastics, PVC is also the most toxic, releasing hazardous chemicals such as dioxin during its lifecycle. These chemicals can build up in the air, water and food chain, causing severe health problems such as cancer, immune system damage and hormone disruption. Pollution from PVC plants has displaced entire towns and disproportionately affects low-income and African-American communities, particularly in the Baton Rouge-New Orleans corridor known as "Cancer Alley."

Like homelessness, pollution is a global problem — one that disproportionately affects the poor and communities of color. This historic partnership between Greenpeace and the New Orleans Area Habitat for Humanity is proof that we do not have to choose between a healthy environment and affordable housing.

While the immediate goal of the project was to build an affordable PVC-free house, the long-term goal is to promote safe building materials of all kinds.

Features of the House

- Alternatives to PVC were utilized for the siding, windows, pipes, flooring, carpeting, wire sheathing and wall coverings.
- Instead of vinyl siding, a cement-based fiber-board called Hardiplank was used.
- Aluminum was used for the window frames.
- The pipes were made of copper and ABS (an alternative plastic).
- A natural linoleum was used for the floors.
- The nylon carpeting has a polyolefin backing.
- Metal conduits were used for sheathing the wiring together.
- Instead of vinyl wallpaper, low-emission paint coated the home's walls.

The energy efficient heating and cooling system results in lower utility bills without ozone-depleting refrigerants. Compact florescent lights were used in the light fixtures. The house is also wired to be solar-ready, should the family decide to add solar panels in the future. Electricity for all power tools used during construction was supplied by Greenpeace's "Rolling Sunlight" mobile solar power generator.

Greenpeace's solar-powered generator, the "Rolling Sunlight"
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Sustainably harvested southern pine was used for the framing of the house. Also, the pressure treated wood for the front porch is arsenic-free and chromium-free.

For many years, Greenpeace has protested the pollution from PVC plants that dominate Louisiana communities from Lake Charles to Baton Rouge. Over the years this industry has displaced whole communities. Morrisonville, Louisiana is one community that was entirely displaced by Dow Chemical between 1989 and 1993.

PVC Production

The production of PVC and its basic ingredients, vinyl chloride monomer and ethylene dichloride, results in the release of hundreds of thousands of pounds of toxic chemicals, including dioxin, into the environment each year, mainly in poor communities of color in Louisiana and Texas. Dioxin, one of the most toxic substances known, causes a wide range of health problems, such as cancer, endometriosis and diabetes (see "Dioxin: The Deadly Byproduct of PVC"). PVC production also poses catastrophic accident risks to workers and surrounding communities.

PVC Use

Materials made from PVC bring other potential hazards. PVC products such as vinyl flooring can release chemical softeners called phthalates. PVC flooring has been associated with increases in respiratory sensitization (such as asthma). Lead additives in PVC mini-blinds were found to cause lead poisoning in some children. Plumbers have also complained about toxic glues used to fit PVC pipes, and toxic chemicals have leached out of PVC pipes in the past.

PVC and Fire

When PVC burns, some 100 different toxic compounds are produced. Because of its high chlorine content, PVC fires produce hydrogen chloride gas and dioxin, both of which can create severe and chronic health hazards to residents, firefighters and surrounding communities. Vinyl materials may smolder slowly and give off hydrogen chloride gas long before visible signs of fire appear. Hydrogen chloride gas is a highly toxic and corrosive gas that can cause skin burns, severe long-term respiratory damage and death. Not surprisingly, the International Association of Firefighters supports efforts to reduce PVC use.

PVC fires also produce hundreds to thousands times more dioxin than other common materials, including wood or other plastics. Because dioxin persists in soil for a long time, a single fire can lead to long-lasting health impacts. When incinerated as waste, PVC similarly produces dioxin. In fact, PVC is the largest source of chlorine, and hence dioxin, in municipal waste incinerators.

PVC and Recycling

While the PVC industry boasts about its efforts to recycle PVC materials, the industry has the poorest recycling record of all plastics: less than one percent of post-consumer PVC is recycled in the United States, making it the least recycled of all plastics. PVC cannot easily be mixed with other plastics for recycling because it releases toxic additives when melted down. The Association of Post-Consumer Plastic Recyclers (APR) has stated, "We're going to view this material [PVC] as a contaminant, and you sure won't find PVC packaging listed as a recycled plastic in APR's revised design guidelines."

Alternatives to PVC

Given the well-established health and environmental hazards associated with the PVC lifecycle and the availability of safer and more environmentally-friendly substitutes — many of which are both cost and performance competitive — common sense dictates the need to identify and use alternative materials. The good news is that alternatives to PVC do exist. In home construction, there are non-PVC alternatives for siding, pipes, windows, wiring and cable, wall coverings and flooring. To find healthier and more environmentally-friendly choices, check out Greenpeace's international database of alternatives to PVC construction material at:

http://archive.greenpeace.org/toxics/pvcdatabase

Construction began on a new home for Shylia Lewis and her four children, sponsored by Greenpeace and the Healthy Building Network, and was built by volunteers in partnership and under the supervision of the New Orleans Area Habitat for Humanity affiliate.

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Together with Habitat for Humanity and the Healthy Building Networks as partners, Greenpeace publicly demonstrated against the use of PVC building products without fear of getting arrested. This paper documents what was done in Shylia's home to avoid unhealthy building practices typical in low-cost housing. Though our focus was on alternates to PVC products in the home, Greenpeace and Healthy Building Network took a much broader view in order to provide Shylia with a healthier house.

Architects and contractors reading this paper will recognize its organization, but we hope that will not scare the rest of you away. Divisions are sections of the specifications and help to organize the list of materials to be used in the work. The first "division" is about why, what and how. The remaining divisions address the parts of the building process starting more or less from the ground up. In other words, from the soil and foundations on up though the walls and windows, to the more complicated systems like air conditioning and electrical.

Division 1: General

Why did Greenpeace undertake building a healthy home?

As part of its extensive campaign to eliminate the use of the most toxic chemicals that affect the environment and human health, Greenpeace has targeted the elimination of PVC plastic, also known as vinyl. PVC is the worst plastic for the environment, and there are many alternatives to PVC, including other plastics. Approximately two-thirds of PVC is used to manufacture building materials, from pipes, to floors, to the ubiquitous vinyl siding. Greenpeace wanted to show that it was possible to avoid using PVC in an ordinary, affordable house. Teaming up with the Healthy Building Network (HBN) and architect Bruce Hampton, Greenpeace sponsored a typical Habitat for Humanity house in New Orleans, Louisiana. Habitat agreed to let Greenpeace and HBN "green" the specifications for their standard design home.

PVC is one of many deceptively inexpensive building products manufactured to service lower cost housing. The manufacturers often make huge profits by using non-renewable resources (petrochemicals) that poison our communities as well as present and future generations. Greenpeace and HBN wanted to

demonstrate that affordable housing is not only an important national goal in need of support, but that it can be even furthered by taking action — one house at a time.

While the initial focus for Greenpeace was to avoid the use of polyvinyl chloride, it was clear from the outset that the team goal was a healthy demonstration home. Health for our planet must be factored into healthy decisions made at the local level. Good environmental decision-making looks at the health of our forests as well as our waters and air. The team invested in sustainable lumber, arsenic-free pressure treated wood for the porch and compact fluorescent lights at the same time that it avoided the use of toxic materials in and on the home.

What did we try to accomplish?

Approaching the Habitat build as a prioritization exercise, the team made its material choices based on the impacts on health and environment with a strict eye on the dollars. If this Habitat project was not affordable, it would not meet our twin goals of a greener and reasonably priced home. Replicability was another important goal: that every Habitat organization might be able to use some or all of the processes employed in New Orleans to build a healthier, more durable, more energy efficient house. Good, healthy design decisions can often cost the same or less than traditional building habits. For example, today's closet shelving often is made of vinyl coated metal. We specified wood shelving and painted metal support brackets. This type of change cost no more money, and has no negative impact on the quality of the home. But low initial cost is not always the most economic choice. As a result, we spent a little more on energy efficient components for the house. These investments will put more money in Shylia's pocket each month by lowering her utility bills.

How did the team proceed?

Habitat for Humanity is the ultimate in grassroots efforts. A great deal of the work is performed by volunteers with little or no building experience. Simple is good. Common sense is good. Houses need not be

© Les Stone/Greenpeace

complicated to work well, but a house is a system of parts and will only work as well as the worst piece. If we are going to put a big hole in a wall to let in light (most of us understand this as a WINDOW), then that window should not make us more miserable than the wall that used to shelter us. On the other hand, if we use the best performing window we can afford, then we are more comfortable and we will use less air conditioning.

Though the following examples of what we did in Shylia's house are organized as a list of pieces, the decisions were thought out holistically: the choice of an aluminum window could have been justified by the use of a recyclable material rather than a non-recyclable one such as PVC, but the choice of a higher performing window glazing meant that we were also able to reduce the size of (and the fossil fuels used by) the air conditioning system.

Division 2: Site Work

Habitat for Humanity of New Orleans chose an existing neighborhood site on which to build. Utilities existed in this neighborhood and no greenfields were destroyed. Neighborhoods are being rebuilt. The tra-

ditional single and double shotgun house uses a pier foundation to raise the floor up above the flood level. Local conditions prevail. We suggested mechanical termite protection, but local building codes require termiticide treatment of the soils prior to construction. We abided by the local building department regulation, but we would have preferred mechanical solutions such as sand barriers and termite shield systems. They are healthier for the planet and more durable for the homeowner. A mechanical solution would be done once. Whereas the chemicals must be reapplied often and given the high water table in New Orleans, one can only imagine where these pesticides turn up.

Division 3: Concrete

Except for the grout in the block foundation piers, little concrete was used in Shylia's house.

Division 4: Masonry

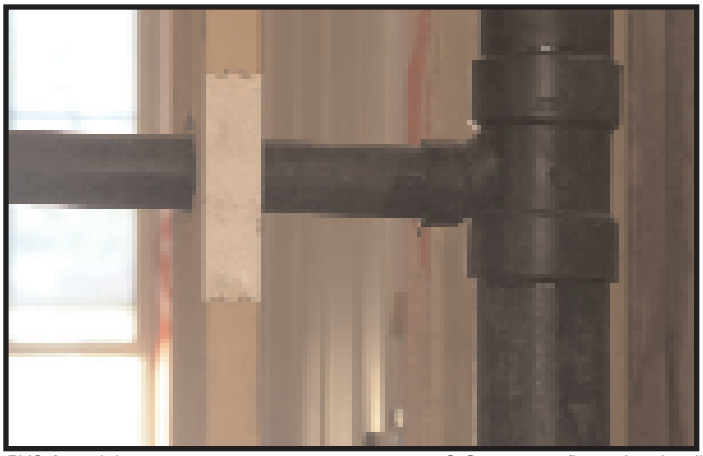
The piers for the foundations were constructed from locally-produced concrete masonry units.

Division 5: Metals

Often today's closet shelving is made of vinyl coated metal. We specified wood shelving and painted metal support brackets. This type of change cost no more money, just a bit of brainpower.

Division 6: Wood and Plastics

All decking and pressure treated wood was specified to be non-arsenic treated. This is a big health issue especially with a family with several young children who will inevitably play on the pressure-treated decking and then potentially put hands and fingers into their mouths. We used ACQ (alkaline copper quaternary) treated lumber, a much safer arsenic-free alternative fought for by the Healthy Building Network and other non-governmental organizations (NGOs). Safer pressure treated materials are now on the shelves of most lumber suppliers and replacing arsenic treated lumber had no cost premium. As mentioned above, we used wood shelving for closets and rods supported by metal brackets. No vinyl-coated metal was used. The framing lumber and trim lumber was FSC (Forestry Stewardship Council) certified which ensures lumber that was harvested from sustainably managed forests. Most of the framing lumber was locally-sourced Southern Yellow Pine.



PVC-free piping © Greenpeace/Laura Lombardi

Division 7: Thermal and Moisture Protection

The biggest avoidance of PVC in Shylia's home was in substituting fiber cement clapboards for vinyl siding. The clapboards cost no more than the vinyl siding, but they do require painting. This adds some time and cost to the project, but has many advantages. From professional experience, we also predict that the vinyl siding used on the homes next to Shylia's will become brittle, fade and end up in a landfill in 15 or 20 years, and look worn years before that. We predict that because of its inherent stability and durability, this fiber cement siding will last a lifetime on Shylia's home. It can be any color the owner decides, and touched up much more easily than vinyl can be repaired.

Exterior venting soffits for the home were similarly substituted with fiber cement panels.

The performance of the windows depends greatly on their installation. In a warm climate like New Orleans, hot moist air will creep in along side the window and

PVC-free carpet, linoleum and wiring © Kent Hardouin/Greenpeace

door cracks, and when that moisture encounters the nice cool air-conditioned interior it condenses on the first surface. Thus, a health nightmare of mold and mildew can fester in Louisiana homes. A little attention to the sealing of windows and doors will save on air conditioning and on mold and health impacts such as asthma. We recommend using low expanding foam sealants to help reduce infiltration around the windows. This is one of those "high skill" jobs but "a little dab will do ya."

Ducts and duct insulation were specified to be non-PVC but, like the windows, it is crucial that they are installed right. Leaky ducts are one of the biggest energy losers and allow unhealthy air, mold and mildew into an otherwise healthy home.

Division 8: Windows and Doors

We substituted aluminum for vinyl windows in this New Orleans home. Vinyl windows are often advertised as "energy efficient," misleading people into thinking that the vinyl coating creates the energy savings. That is not the case. It is the window glazing that gets the efficiency gains, so we sought a good balance between price and performance.

"Thermally broken" aluminum windows were not available in this local market, but we were happy to have a solar heat gain coefficient of less than 0.4 on the glass. In this air conditioning dominated climate this glass will reduce the cooling load significantly and thus allow us to save on Shylia's energy bills and on the initial cost of her air conditioning equipment. The aluminum windows cost only $169 more than the vinyl windows next door. (Solar shading glazing added $525, but is well worth it in this climate whether one adds it to vinyl, wood, fiberglass or aluminum windows). Other parts of the house system contribute to the sizing of the equipment such as lights and refrigerators….more later.

Interior doors were ordered as hardboard faced painted doors which are made from wood scraps and salvaged fibers from other wood milling products. No trees are cut for the manufacturing of the interior doors.

Division 9: Finishes

All finishes were chosen with an eye of the health of the occupants. All the paints were water based with low off gassing of volatile organic compounds (VOCs). These are often triggers for asthma and other allergic reactions. We "spent" more on the interior paint then we expected. In keeping with the budget on the Habitat houses, we chose a carpet with no PVC backing. Again, the plasticizers in the backing of carpets make it flexible, but those plasticizers are suspected of triggering asthma.

Where normally a Habitat home might use vinyl sheet goods or tiles for the kitchen and bathrooms, we used naturally derived and renewably-sourced linoleum floor tiles. Natural linoleum also has the

PVC-free siding (cement fiberboard) © Greenpeace/Laura Lombardi

advantage of being more durable than sheet vinyl, so we expect Shylia's floors to outlast her neighbors. We thought Shylia was particularly chic in her choice of black linoleum for her kitchen floor. Very cool.

Though we did not do it here, we would suggest simple ceramic tile for bathroom floors. It lasts a long time, the bathroom is a small area and it is a very good value. It will outlast three or four vinyl sheet floors. The PVC-free carpeting is new to the market, and there is no domestic manufacturer of natural linoleum at this time. As a result of selecting these low production volume materials, we "spent" an extra $1,200 on the combination of non-PVC backed carpet and the natural linoleum. We are confident that current prices will drop in the foreseeable future however, and that these products are good choices in the context of affordable construction.

Division 10: Specialties

Shylia Lewis and her four children (Shawn, Steven, Sheldon and Serenity), Jim Pate, Elizabeth Lisle, Valerie Smith and all the Habitat gang and scores of volunteers.

Division 11: Equipment

All the kitchen appliances were Energy Star rated. A more efficient refrigerator works less hard resulting in energy savings.

Division 12: Furnishings

Here there are many PVC-free options. Our preference was to specify formaldehyde free fiberboard for the cabinetry, preferably the brands that utilize non-wood. Unfortunately, because these are in limited production they cost a lot more. Because they are not considered more durable than standard furnishings, nor do they increase other environmental gains in the home (e.g. energy efficiency) we chose not to make this investment in order to keep within our budget targets.

Division 13: Special Construction

Sure is.

Division 14: Elevators and Conveyances

Raised all of our spirits.

Division 15: Plumbing, Heating and Cooling

We substituted all PVC piping. Interior vent and stack piping was acrylonitrile-butadiene-styrene (ABS) piping and all waste lines were done in cast iron. The combination saved $40 overall, the only issue is making sure ahead of time that you have your sources lined up. You cannot expect to walk into your local hardware or lumberyard today and find alternatives. Call ahead.

By making the windows more efficient, by supplying Energy Star equipment and lighting, and by insulating well, we lowered the air conditioning loads on the home. Pay attention to what your mechanical contractor wants to put in for equipment. A piece of equipment that is engineered right runs more efficiently than an oversized one. Shylia's house is 1,200 square feet. The contractor suggested a three-ton air conditioner. We wanted about a ton and one half. We compromised on a two-ton unit with Puron refrigerant (low on the ozone depletion scale) with a SEER of 14 (high on the energy efficiency scale) to get more heat and humidity out of Shylia's home for less electricity cost. The $225 extra spent on this better air conditioner will be saved within the first couple of years of operation and continue to save Shylia more and more each year as energy prices continue to rise.

Because we designed the home to be more air tight, we asked the mechanical contractor to attach a fresh air supply to the return air side of the air conditioning system. This, in addition to the special control on the bathroom fan which provides continuous fresh air exchange, it ensures that the family will live in a well-ventilated and energy efficient home.

A ceiling fan is traditional in all New Orleans Habitat homes and helps enormously with keeping the occupants comfortable and their energy bills lower.

Division 16: Electrical

The vast majority of the PVC normally present in a home's wiring systems was eliminated in this home by installing BX cable and metal junction boxes. We recognize that much of the wiring inside the metal jacketed cabling is still insulated with PVC insulation, but we chose to eliminate a good deal of the PVC which resides in the casing of typical plastic jacketed cabling (Romex, etc.). The cost was an extra $2,000 by switching to metal jacketed cabling and metal junction boxes. If a healthier alternate to PVC wiring and boxes were readily available to the homebuilding industry (the Air Force and the Navy insist on non-PVC wiring in their new ships, submarines and aircraft due to the mortal dangers of smoldering vinyl insulation), we would have installed them. This is a market issue, not a technical issue. Greenpeace decided to go ahead with the extra $2,000, in essence to demonstrate the need to develop markets for PVC alternates. We found readily available alternatives to PVC plumbing, siding and windows at virtually no added cost. We will continue to pursue ways to stop burying vinyl products inside our walls.

In the living room of Shylia's house is one of those metal electrical boxes with a blank cover over it. Behind it is the wiring we provided for the day the photovoltaic electrical solar panels go up on the roof. She's solar ready.

All the lighting supplied to the home was Energy Star lighting. Compact fluorescent bulbs and tubes will not only reduce the heat build up inside the home (incandescent bulbs turn most of their energy into heat, not light), but they will also last longer, and save more on her electric bill.

The Habitat for Humanity house built for Shylia and her family in New Orleans is simple and affordable. It demonstrates that good fundamentals and healthy materials do not have to conflict with affordable homes.

Shylia Lewis (on ladder) and volunteers

See accompanying Greenpeace DVD about this build with music by Wynton Marsalis and the Lincoln Center Jazz Orchestra.

Volunteer support in building this PVC-free home provided by:

Advocates for Environmental Human Rights
Americorps
Citizens Environmental Coalition
Greenpeace
Gulf Restoration Network
Healthy Building Network
Loyola University Business Leadership Group and Environmental Club
Mossville Residents for Environmental Action Now
National Black Environmental Justice Network
New Orleans Area Habitat for Humanity
Sierra Club, New Orleans
Toxic Comedy Productions
Tulane University Green Club
Vista
Volunteers of America
Xavier University Deep South Center for Environmental Justice and Habitat Club

For more information:

www.greenpeaceusa.org
www.healthybuilding.net
www.habitat-nola.org
www.eltonhamptonarchitects.com/portfolio/green/index.html
www.myhouseisyourhouse.org
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Congratulatory message to New Orleans Habitat for Humanity on the Occasion of the Completion of its PVC-free Affordable House

April 16, 2004
Mr. Jim Pate
Executive Director
New Orleans Area Habitat for Humanity
7100 St. Charles Ave.
New Orleans, LA 70118

Dear Mr. Pate,

The hope inherent in the construction of New Orleans Area Habitat for Humanity's PVC-free Affordable House is a milestone on the path towards the creation of a healthy, safe and sustaining world even under conditions of tight cost restraint and understandably immense inertia inherent in current business interests and standard building practice.

There are many people now expressing concern that PVC is potentially damaging to humans, the environment and the economy at various steps of its manufacture, use and final disposition. We also heard of serious market concerns, in terms of human health (especially among nurses), over the use of potentially endocrine-disrupting chemicals in PVC and in terms of its long term economics with regard to the undue costs and grave concerns regarding its proper healthful final disposal or incineration. Also, because a great deal of PVC production now takes place cheaply in Asia, these possible external costs are also transported to the United States and Europe in the form of potential health care expenses and compromised environments. Many companies are declaring their intention to provide their markets with alternatives to PVC in their products and are designing their transitions to alternative, positively defined materials. These companies include globally important brands and some of them have actively supported this project.

The use of properly designed alternatives to questionable materials within the construction markets is a major step in the transition towards realizing the implementation of alternative technical nutrient polymers and other materials, such as metals and bio-based products. These materials can be designed for all industries that to not adversely impact humans or the environment when they remain in closed-loop natural and/or technical cycles thereby acting as nutrients for the environment or industrial systems rather than perpetuating potential anxieties about our health, our society and our world.

Demonstration projects are an ideal way to initiate this change, and we applaud New Orleans Area Habitat for Humanity, Greenpeace, product suppliers, volunteer laborers and the families involved for their hard work and commitment in carrying out this project. We wish them all well. We hope that others, such as the U.S. Green Building Council, which is currently reconsidering the status of PVC in the LEED system, have the foresight to honor and engage in these kinds of commitments too.

Sincerely,

Michael Braungart
Hamburg, Germany

William McDonough
Charlottesville, Virginia