Facts regarding PVC piping and the environment

by David Chasis

Misconceptions about the environmental impact of polyvinyl chloride (PVC) piping systems are widespread, due in part to the controversies which exist regarding PVC in general. However, a careful examination of the facts clearly demonstrates that the negative allegations regarding PVC pipe are erroneous. This article is adapted from the Plastic Pipe and Fittings Association publication: *The Design Guide for PVC Piping Systems for Commercial and Industrial Applications*.

Resin: By weight, PVC resin is 57 percent chlorine and 43 percent hydrocarbon. The chlorine content is derived from salt. The hydrocarbon content is derived from ethylene which is a derivative of fossil fuel feedstocks. This formulation uses less fossil fuel energy, generates fewer unwanted emissions, and requires fewer fossil fuel resources than other piping material formulations. The abundance and low cost of salt contributes significantly to making PVC more price competitive and sustainable compared to piping materials made of other materials.

Fossil fuels: Ethylene can be made from either oil, gas or coal feedstock, offering a wide selection of existing natural resources. A growing percentage of the current production of ethylene is being made from bio-feedstock such as sugar cane. If these new bio-fuel processing methods prove to be economically and environmentally sound, the elimination of the use of fossil fuels needed to produce PVC could be a reality in the future.

PVC (1/6th the weight of most non-plastic piping) minimizes on-site heavy equipment, allows easier installation in close quarters and eliminates many job-site safety issues.

Chlorine: Chlorine is one of the most abundant elements in the world. It is a major component of building materials, packaging and pharmaceuticals. Used as a disinfectant of water for human consumption, it has saved more lives than any other world health initiative ever! Chlorine is derived from an inexhaustible source — ocean water. In some instances, salt can be derived from seawater using electrodialysis desalinization, which extracts the sodium chlorine and gives potable water as the resultant end-product.

Durability: The first PVC piping was installed in Germany in the mid 1930s and has remained operational for over 75 years. PVC is immune to electrolytic and galvanic corrosion, scaling, rusting and pitting. It is also resistant to abrasion, bacteria, fungi and hundreds of chemicals. Independent studies have shown that municipal PVC piping systems are performance-rated at a minimum of 100 years usage, while concrete and ductile iron piping systems are rated at 85 and 60 years respectively[1]. Increased durability means fewer leaks, better water conservation and lower costs.

Easy and safe to install: PVC piping is one of the easiest and safest piping materials to install. Its advantages include: being light weight, standard 20-foot lengths, simple joining methods, no need for expensive tools, no hot plates or open flames issues, no corrosive protection requirements, minimal or no insulation requirements, as well as ease of product identification and fabrication. Compared to that of other piping materials, the ease and safety of PVC installation reduce on-site accidents and property damage, enable faster project completion rates, and allow installer crews to be easily trained.

Cost effectiveness: Considering costs across the board, from product, labor, installation, maintenance and insurance to theft and shipping, PVC piping systems are, in most cases, the most cost-effective. Costs should be considered when determining the sustainability and utility of any product. Higher up-front costs and maintenance building costs both result ultimately in less investment in new or remodeled construction, higher unemployment rates and other undesirable factors that negatively affect the well being of people and communities.

Draining pipe (not for potable water) using recycled PVC.

Economic savings: In a recent study sponsored by the Vinyl Institute and the American Chemistry Council, the use of PVC results in cost savings estimated to be over $9 billion in North America alone, when compared to the costs of using substitute piping materials[2]. Comparatively, the use of PVC results in savings from lower material and installation costs, savings from less frequent replacement, savings from less required maintenance and repair requirements.

Recyclable: PVC is totally recyclable, but as most PVC piping is still in use, not much of it has entered the recycling stream. During PVC pipe production there is minimal scrap with virtually 100 percent of the PVC compound fully utilized. At present, most end-of-life or post-consumer PVC piping is incinerated or sent to landfills. This form of disposition will change in the near future due to the ag-

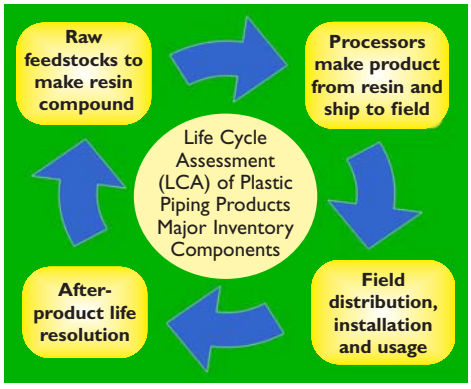
gressive industry plans to recycle as much PVC products, in all forms, for reuse as possible.

Joint integrity: PVC piping can be joined in different ways: flanging, threading, compression couplings, bell and gasket, heat fusion and solvent cementing. The two most commonly used joining methods are solvent cementing and gasketed-bell and spigot. When properly installed, these two methods have working pressures equal to or greater than the pipe or fitting. Studies and history indicate solvent cementing and gasketed-bell and spigot top the list in providing leak-proof and long-lasting joint integrity.

Plasticizers: Rigid PVC piping systems *do not contain plasticizers*. To make PVC material flexible and pliable, plasticizers such as phthalates are added to the final compound. Environmentalists allege that plasticizers are harmful, although there are studies that dispute the charge. Again, as mentioned, there are no plasticizers used in rigid PVC piping compounds.

Vinyl chloride monomer (VCM): In the early 1970s, there were reports that exposure to excessive levels of vinyl chloride in some manufacturing operations resulted in a rare form of liver cancer. In response to this discovery the vinyl industry acted quickly in cooperation with OSHA and the EPA to completely re-engineer vinyl production operations. This action resulted in the elimination of unsafe occupational exposures to VCM and very low emission of VCM to the environment as a result. VCM emissions are now continually monitored and controlled in all PVC processing plants.

Hydrogen chloride gas: When PVC is burned, hydrogen chloride gas is emitted. Yet, when wood and other building materials burn, lethal carbon monoxide or other toxic gases are emitted. In a typical fire there are much greater amounts of harmful fumes emitted by the burning of wood and other construction materials than by the burning of PVC. Why? PVC piping represents less than 2 percent by weight in most building construction, whether residential or commercial[3].



Life cycle assessment is a scientific, unbiased analysis of a selected product examining the product's total environmental footprint on our planet.

Dioxins: Dioxins are compounds that are suspected of being human carcinogens. Opponents of PVC argue that PVC manufacturing is a major dioxin polluter. This is not true. The largest contributors to dioxin discharge, according to EPA findings, are forest fires, wood-burning fireplaces, coal-fired utilities, metal smelting, diesel trucks, sewage sludge and burning of trash[4]. Studies estimate that the entire PVC industry produces less than 14 grams (less than half of one ounce) of dioxin a year. Another irrefutable fact is that dioxin levels in the United States have decreased 90 percent in the past three decades, while vinyl production has increased 300 percent during the same time period.

Life cycle assessment (LCA): LCA is a scientific evaluation that analyzes the environmental impacts of a material or product from its raw material sources through its production, use and end-of-life disposition. Several green building rating systems offer points for the use of LCA in the evaluation of competitive materials. European and North American life cycle assessment of PVC piping have shown it to have, in many applications, a favorable environmental impact compared to that of non-plastic piping materials.

Manufacturing industry safety: According to 2006 statistics provided by the U.S. Bureau of Labor, the plastic piping industry, from feedstock origination to shipped end-product, has a significantly lower reported incidence of employee illness and injury than other non-plastic piping industries have. In addition, when compared to the average of all U.S. industries, the plastic piping industry has one-third fewer reported employee illness and injury rates.[5]

Boon to flora and fauna: PVC is a material that affords protection to flora and fauna. The use of PVC in siding, decking, fencing, window siding, pipe, faux auto-panel trim and other products have prevented the destruction of millions of trees. And, as a substitute for animal hides and ivory tusks, PVC has prevented the slaughter of thousands of animals.

World health issues: The United Nations estimate that more than 6,000 children die each day — that's over two million a year — due to unsanitary drinking water and waste control. To address these issues, many PVC piping companies and associations have either donated or sold at cost product and engineering services to dozens of non-profits. Because of the superior features and benefits of PVC piping, more and more engineering firms are specifying its use, and by doing so improving the lives of third world citizens.

Water conservation: Experts estimate that 700 water main breaks occur each day across North America, wasting over 2.2 trillion gallons of potable water yearly. The loss of revenues to North American water utility companies total over $3 billion a year. To fix these aging mains, the U.S. government estimates, $23 billion a year for the next 20 years is needed[6]. The American Water Works Association Research Foundation concluded from a survey that the life expectancy rating of PVC surpassed that of any other tested pipe material. A two-year Canadian study found that for each 100 kilometers of water distribution pipe laid, PVC had only 0.7 breaks per year compared to 35.9 breaks for cast iron and 9.5 breaks for ductile iron[7]. Communities around the world are favoring PVC water main and distribution systems due to PVC's documented record of unsurpassed durability and joint integrity.

One final word: The obligation to support sustainability touches everyone, in everything we do: the cars we drive, the houses we live in, the vacations we take, the products we buy, even the hobbies that relax us. Today our paramount responsibility is to leave a better planet for the next generation. Now and in the future, the use of PVC piping can help us accomplish our goal of minimizing the human footprint on our environment. ■

David Chasis is president of Chasis Consulting Inc. and editor of PPFA's *Design Guide for PVC Piping Systems for Commercial and Industrial Applications*. For more information on how to download or review the Design Guide, go to www.ppfahome.org.

Notes:

1. AWWA Research Foundation (1998) "Quantifying Future Rehabilitation and Replacement needs of Water Mains."

2. Chlorine Chemistry Division of the American Chemistry Council and the Vinyl Institute (2008) "The Economic Benefits of Polyvinyl Chloride in the United States and Canada."

3. U.S Environmental Protection Agency Municipal and Industrial Solid Waste Division (1998) "Characterization of Building-Related Construction and Demolition Debris in the United States."

4. U.S Environmental Protection Agency – Report No. EPA/600/P-03/002F-2006 (1998) "An Inventory of Sources and Environmental Releases of Dioxin-like Compounds in the United States for the years 1987, 1995 and 2000.

5. Article in *The IAPD Magazine* (Dec. 2008/Jan. 2009) "Plastic Piping Systems ... Here's to your Health," author David A. Chasis.

6. U.S Environmental Protection Agency (2002) "Cleanness and Drinking Water Infrastructure Gap Analysis."

7. Infrastructure Laboratory of the Institute for Research in Construction at the National Research Council (1995) "Survey of Water Main Breaks."