



A Division of The Society of The Plastics Industry, Inc.

October 29, 1991

Dear Colleague:

The vinyl industry has a good story to tell. Today, you'll be learning the facts to help you communicate that message to the industry's customers and suppliers, its allies and critics, your colleagues and friends – even your family and next-door neighbors.

As you can see from the enclosed agenda, we'll be discussing a wide range of topics today, but one important part of the program's success will be your participation. We encourage you to ask questions, share ideas and let us know how the industry and the Vinyl Institute can help you do your job better.

In reality, everyone in the vinyl industry is on the firing line every day. When today's session is over, we hope you'll feel we've provided you with some additional useful ammunition to help insure a strong future for a good product.

Welcome to Houston, and thank you for joining us.

Sincerely,

The Staff and Members of the Vinyl Institute

Resource Materials



A Division of The Society of The Plastics Industry, Inc.

Some Common Misperceptions About Vinyl (and what you can say to refute them)

1) No one is recycling vinyl.

Not true. Of course, industrial scrap vinyl has been recycled for years, but now, post-consumer vinyl recycling is growing, too, with about 5 million pounds of post-consumer vinyl (primarily bottles) currently being recycled. According to a recent study conducted by the Council for Solid Waste Solutions, there are an estimated 1100 municipal recycling programs in place or planned in the United States that include vinyl.

2) There's no market for recycled vinyl.

Not true. In 1989, the University of Toledo identified nearly 100 uses for recycled vinyl. Overall, the potential demand for recycled vinyl is estimated to be about twice the potential supply (494 million pounds needed vs. 207 million pounds available via recycling of bottles).

3) Vinyl is the "problem child" in municipal recycling because it contaminates other resins.

This is a two-way street. Other resins are just as much a contamination problem for vinyl. Except for commingled (mixed) plastics applications, different plastic materials cannot be mixed successfully in most recycled products applications. This is why it's so important to develop the technology to efficiently separate one plastic from another. Thanks to the chlorine that is present in it, vinyl lends itself very well to automated sorting technology.

4) If vinyl products were banned from the waste stream, there would be no problem sorting plastics.

Not true. The only plastic applications that are currently easily separated are PET soda bottles and HDPE milk bottles. But according to a study conducted by the Massachusetts Executive Office of Environmental Affairs in 1988, programs that limit themselves to these two products can only hope to capture 11 percent of the plastic packaging in the waste stream. To institute a truly comprehensive recycling program, you must include all the other products made from PET and HDPE (which aren't always easily identified), plus the products made from vinyl, LDPE, polystyrene and polypropylene. With or without vinyl, comprehensive plastics separation is a challenging problem.

- 5) **Individual municipalities can't afford the technology to separate different plastics. It's better to concentrate just on soda bottles and milk jugs.**

Eventually, consumers will want more. The ideal is to give them a curbside system that lets them dispose of all plastics, without requiring them to make involved decisions as to which container is "allowed" in the program. Long-term, the vinyl industry believes that the only feasible way for municipalities to do this is to band together to support the implementation of regional plastic recycling facilities (PRFs), where smaller volume plastics (the "third bale" that remains after you take out milk jugs and soda bottles) can be sorted economically.

- 6) **Rather than dealing with all these smaller volume plastics, it's better just to ban the ones that can't be easily recycled.**

Consumers would give up a lot if this were to happen. Vinyl has been used for years in packaging applications because it provides a combination of properties that other materials cannot provide. These include cost, appearance and technical performance. For small-volume applications in particular (such as house or regional brands), vinyl is often the most cost-effective packaging choice. In other applications, such as meat wrap, vinyl is the only suitable material.

- 7) **PET and HDPE packaging are listed as 1 and 2 in the SPI recycling coding system because they are the most recyclable.**

Not true. The numbers assigned to each plastic in the SPI coding system are purely arbitrary and do not reflect the material's recyclability.

- 8) **Vinyl gives off dioxin when it's incinerated.**

Not true. A study conducted by the New York State Energy Research and Development Authority in 1987 found that the presence -- or absence -- of vinyl in incinerators had no effect on the amount of dioxin produced. Rather, it was found that incinerator operating conditions (primarily, temperature) were the key to controlling dioxin formation.

- 9) **Vinyl should be banned from incinerators because the chlorine in it produces acid gases and causes acid rain.**

This ignores the big picture. About 50 percent of the chlorine present in incinerator wastes comes from sources other than vinyl such as table salt and food wastes. So even if all vinyl products were banned, incinerators would still need to operate with scrubber systems to make them environmentally acceptable. One of the leading manufacturers of incinerator systems, Ogden Martin Systems, has advised the EPA that its equipment "can tolerate reasonable increases in acid-producing waste components without adverse effect," and does not "perceive the anticipated increases in PVC food packaging to be problematic." As to acid rain, power plants burning fossil fuels, which produce sulfur dioxide and nitrogen oxide, are considered to be the primary cause of acid rain. In Europe and Japan, studies show that only about 0.3 percent of all atmospheric acidity can be traced to the incineration of vinyl.

- 10) **Vinyl should be banned from incinerators because it contains heavy metal additives.**

This is an evolving issue. Many vinyl products are being reformulated to eliminate the use of heavy metals. Granted, some use of heavy metals is likely to continue, but banning vinyl from incinerators will not eliminate this problem. Rather, regulating agencies (like the EPA) must make sure that all incinerator residues (ash) are disposed of appropriately.

- 11) **European packagers and grocery stores have banned vinyl.**

Not true. First, limitations on the use of vinyl packaging are taking place on a selective basis and some are already being reversed because the parties involved have gotten further information to make a more informed decision. In other cases, such as Switzerland and Holland, bans or restrictions have been proposed, but are being challenged. In Great Britain, one of the leading retailers, Marks & Spencer, has chosen vinyl over other materials as the chain's "most environmentally friendly polymer." In Switzerland, retailer Migros has stated that its whole attitude toward vinyl will change when incinerator scrubber technology is fully employed. The current trend in Europe -- led by the Germans -- is to take a comprehensive look at waste reduction and make industry a partner in that process. This involves all industries, not just the vinyl industry. Overall, Europe remains a larger consumer of vinyl packaging than the U.S.

- 12) **Vinyl plastics decompose in landfills and give off vinyl chloride monomer.**

Not true. Like all plastics, vinyl is an extremely stable landfill material. It resists chemical attack and degradation, and is so resistant to the conditions present in landfills it is often used to make landfill liners. On those occasions when vinyl chloride monomer is detected in landfills, it typically can be traced to the presence of other chemicals and solvents.

- 13) **Vinyl products are a prime contributor to the problem of indoor air pollution.**

Not true. At least three studies have been conducted to measure the amounts of vinyl chloride monomer and vinyl plasticizers released from typical household products. Those studies found that concentration levels were well below those considered to pose a significant health risk.

- 14) **Hydrogen chloride is a toxic "killer" fire gas. Fires that involve vinyl products are unusually hazardous.**

Not true. Hydrogen chloride is an irritant gas, but studies have concluded that humans can survive exposure to much higher levels than those that are found in the typical fire. The most common hazard associated with fires is carbon monoxide -- a lethal combustion gas given off by virtually all materials that burn (both synthetic and natural). The presence of vinyl does not make a fire unusually hazardous.

- 15) **Burning vinyl caused the deaths at the MGM Grand and Stouffer Hotel fires in the early 1980s.**

Not true. Combustion products from burning vinyl were never officially cited as the cause of death in these fires. The primary cause eventually was found to be inhalation of carbon monoxide, although the official investigation also cited several building code violations as contributing factors. In large fires such as these, there are often additional deaths caused by heart attack, burns or falls.

- 16) **Vinyl products (PVC) are cancer-suspect agents.**

Not true. While vinyl chloride monomer (VCM) is known to cause certain, rare types of cancer under extreme conditions of prolonged exposure at high levels, once VCM is converted to PVC, this hazard no longer exists. Because VCM is known to be a hazardous material, it is used and handled under the most strictly regulated conditions. These precautions help minimize any potential health threat that might exist for those who work with the material, or those who live in communities where VCM is handled or processed.

- 17) **Vinyl products present health hazards in food-contact applications.**

Not true. Vinyl is widely used in such applications as bottles, flexible food wrap and rigid blister packing without posing any sort of contamination problem. All vinyl compounds used in food-contact applications must be produced following U.S. Food & Drug Administration guidelines, and vinyl in general is "generally recognized as safe" for food-contact applications. Vinyl is also fully approved for use in blood bags and other medical applications, as well as in pipe used to transport drinking water.



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POLYVINYL CHLORIDE:

An Overview Of The Role Chlorine Plays In This Plastic Material

Chlorine, a common element typically found in sodium chloride, or table salt, has a number of uses in industry and agriculture. Perhaps the best known use is in water purification, where chlorine has been used since the turn of the century to eliminate the threat of waterborne diseases such as typhoid fever, cholera, viruses and parasites. Literally hundreds of millions of individuals benefit from chlorine everyday when they drink municipally treated water, and chlorine is credited with saving countless lives every year.

Chlorine also is used as a basic building block for the production of vinyl plastics -- PVC, or polyvinyl chloride. Vinyl plastics are used to make hundreds of industrial and consumer products, many of which evolved as a replacement for other materials that did not perform as well in a given application, cost more to produce or put a greater strain on the environment and natural resources. Examples of such applications include water piping, insulation and sheathing for electrical wiring, house siding, packaging, components for appliances and electronics, and medical goods and devices.

This document is designed to address some of the questions associated with the manufacture of this chlorine-based material and the use of vinyl products like these.

Major U.S. Markets for PVC -- 1990 (Source: *Modern Plastics*, January 1991)

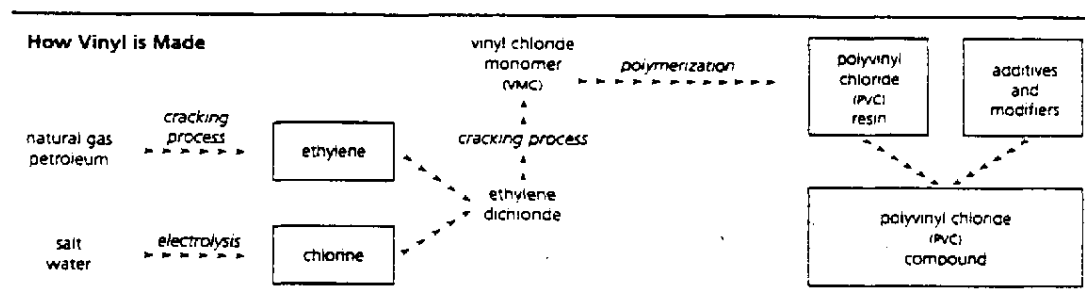
Rigid PVC		Flexible PVC	
Pipe and fittings	32%	Wire and cable	7%
Profile extrusion	26	Film and sheet	9
Siding	13	Flooring	4
Other	13	Other	8
Packaging	2	Total Flexible	28%
Records	>1	Export	10%
Total Rigid	62%		

(Includes imports, estimated at 290 million pounds in 1990.)

HOW CHLORINE BECOMES POLYVINYL CHLORIDE

Precautions and Safeguards Observed in the Process

Chlorine is produced by processing salt and water, or brine, with electricity. To make PVC, chlorine is combined with ethylene to produce ethylene dichloride, which is then converted into vinyl chloride monomer, or VCM. Using water and catalysts, VCM is in turn converted into polyvinyl chloride resin. The PVC resin is customized for the intended end use by first mixing it with various additional ingredients -- referred to as additives and modifiers -- in a sequence called compounding. These ingredients impart various performance properties such as impact resistance, weatherability or flexibility to the finished product, enabling PVC or "vinyl" to be used in applications as diverse as flexible packaging film and rigid drain pipe.



Essentially, the entire vinyl production process through the production of PVC resin is a closed one. That is, most activities take place within closed vessels. There are two reasons for this. First, it helps maximize production efficiencies. Second, it reduces environmental emissions and minimizes worker exposure to potential processing hazards -- primarily, the potential hazard posed by the use of vinyl chloride monomer.

In the 1970s, a link was made between extremely high, prolonged exposure levels to VCM among PVC production workers and a rare form of liver cancer, angiosarcoma. Approximately 100 such cases have been recorded worldwide since this discovery was made. Since then, the vinyl production process has been substantially modified to eliminate the high level of VCM exposure believed responsible for these cases. In addition, the vinyl industry has introduced an ongoing program of worker monitoring to track any health problems that might be associated with working with VCM or PVC. There are several important points to remember about the potential health risks associated with vinyl chloride monomer:

- 1) ***Risks to workers have been virtually eliminated.*** All vinyl production facilities are closely regulated by the Occupational Health and Safety Administration in order to eliminate potential health risks to workers. Not one case of angiosarcoma has been

definitely linked to a vinyl production worker whose work history began after the introduction of revised processing technology in the late 1970s.

- 2) *All VCM emissions are regulated; the nationwide totals are declining.* All vinyl production facilities also are closely regulated by the Environmental Protection Agency, which monitors VCM emissions to the environment. The EPA sets limits for the quantity of VCM that any vinyl production plant may release into the atmosphere, and all VCM emissions must be reported to the EPA. Since 1987, EPA has required such reporting under SARA Title III, the Emergency Planning and Community Right-to-Know Act of the Superfund Amendments and Reauthorization Act. Other monitoring requirements were in place prior to that date, and the vinyl industry can trace a 95% reduction in VCM emissions nationwide since monitoring began in the 1970s.[1]
- 3) *Community health risks are negligible.* The largest potential health hazard associated with VCM is exposure to air emissions. However, like any other gaseous material released into the atmosphere, VCM disperses. That is, the concentration of the material - or the parts per million concentration (ppm) - becomes less as it leaves the site of the release due to dilution in air. This means that the most significant health risk is at the site of the release and diminishes rapidly as the VCM disperses. Consequently, the potential health risk to residents who live near VCM production sites has been found to be virtually nonexistent. Over the years, a number of monitoring programs have substantiated the low exposure levels that typically exist in communities where VCM/PVC plants are located, and there is no documentation of any chronic health effects in residents of such communities that can be traced to VCM exposure.[2]

THE SAFETY OF PVC END-PRODUCTS. *Regulations Set Standards for Performance*

When vinyl chloride monomer is converted into vinyl, virtually all of the VCM is chemically transformed into the new polymeric material, thereby becoming inert and presenting no health hazard. In some cases, a small amount of vinyl chloride monomer ("residual VCM") may be present in the vinyl resin before it is converted into a finished product. However, the heat used in the compounding sequence as well as in the subsequent processing into a finished product eliminates even this small amount of residual VCM.

As an extra precaution, vinyl resin used to make items that convey or contain products designed for human consumption (food packaging, beverage bottles, potable water pipe, medication packaging, etc.) must meet federal regulations and national standards for residual VCM levels. Both the U.S. Food & Drug Administration and the National Sanitation Foundation (NSF) set standards in these areas. Certain vinyl materials are

cleared by the FDA and may be used as specified by the agency for a range of food applications, pharmaceutical and medical products, and nonalcoholic beverages. NSF certifies the use of PVC and CPVC (chlorinated PVC) pipe; both materials are used throughout the country to deliver drinking water.

PVC'S FIRE PERFORMANCE *Chlorine Enhances Vinyl's Fire Safety*

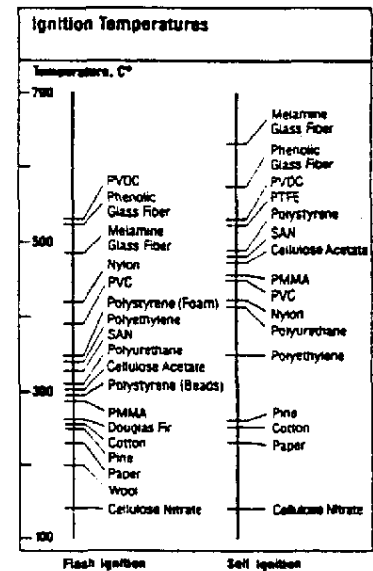
Chlorine is one of four halogenated elements known for their ability to impart flame-retardance. Because chlorine constitutes a significant portion of PVC resin (57 percent), it gives vinyl a range of outstanding fire performance characteristics that include ignition resistance and low flame spread.[3] As a result of these properties, vinyl has been called the material that stops fires from starting and from spreading. In some cases, small amounts of vinyl are added to other polymers to enhance their fire performance as well.

Like all other products used in critical fire performance applications (such as electrical applications and certain building products), vinyl compounds must meet the standards set by such groups as the National Fire Protection Association's National Electrical Code, Underwriters' Laboratories and the American Society for Testing and Materials. All three U.S. model building codes often set additional requirements that vinyl products must meet.

Surface flammability of some materials

Material	Thickness (mm)	Flame spread index
Chlorinated PVC	3	4
Polyether sulphone	3	5
PVC	4	10
Polyester	3	30-56
FR polystyrene	3	59
FR polycarbonate	6	73
Polycarbonate	3	88
Red oak	19	99
Phenolic resin	2	114
Plywood (fir)	6	143
Hardboard	6	185
GRP polyester (21%)	2	239
FR acrylic	3	316
Polystyrene	2	355
Acrylic	6	416
Polyurethane foam (flexible)		1490
Polyurethane foam (rigid)		2220

Note: The fire performance for this test improves as the flame spread ratings become lower



In two key areas, vinyl's fire performance ranks well compared to other commonly used materials, underscoring its appropriate use for demanding construction and electrical applications.

(Reprinted with the permission of the *Journal of Fire Sciences*, © 1987. Technomic Publishing, Lancaster, PA, USA).

PVC COMBUSTION BY-PRODUCTS:

HCl Not An Unusual Fire Hazard

When vinyl does burn (as in the case of a large-scale, fully involved fire), it produces carbon dioxide, carbon monoxide and hydrogen chloride (HCl). Of these, the most significant fire hazard comes from carbon monoxide, a known toxic substance produced by virtually any combustible substance, whether it is a "natural" material or synthetic.

Hydrogen chloride will act as an irritant. In those cases where a vinyl product is involved in the early stages of a fire, its distinctive acrid odor can serve as an alert mechanism. Recent technology developed by Bell Communications Research, Inc. takes this one step further: that organization's new device is designed specifically to sense the hydrogen chloride produced by burning vinyl.[4] In certain types of fires involving high concentrations of electrical and electronic equipment (such as telephone switching stations), the presence of vinyl may help Bellcore's new product supersede traditional smoke alarms, thereby arresting the development of these fires at an even earlier stage than is now possible.

Extensive research, conducted on behalf of the Federal Aviation Administration by Southwest Research Institute, has demonstrated that the hydrogen chloride produced by burning vinyl presents no unusual fire hazard to fire fighters or others exposed to fire gases.[5] These tests revealed that baboons -- who have respiratory systems similar to humans -- could survive HCl exposure levels up to 10,000 parts per million for 15 minutes. In a typical fire, hydrogen chloride levels rarely exceed 300 parts per million.

PVC RECYCLING

Chlorine Gives Vinyl An Edge In The Separation Phase

New developments in the area of vinyl recycling indicate that the presence of chlorine in vinyl facilitates the separation and, therefore, the reuse of vinyl products found in the solid waste stream.

Recent separation technology developed by the Center for Plastics Recycling Research at Rutgers University, and at National Recovery Technologies, Inc. of Nashville, Tennessee, are based on the fact that vinyl packaging contains chlorine. In vinyl packaging, the chlorine acts as an invisible "marker," or product identifier. The Rutgers and NRT systems detect this marker and then automatically separate vinyl packaging from a mixed stream of post-consumer plastic packaging waste.

The use of such technology may help eliminate the need for consumers to individually separate vinyl packaging for curbside recycling, and the need for hand identification/sorting of vinyl packaging at municipal solid waste handling facilities.

A recent study conducted by the University of Toledo has identified nearly 100 potential uses for recycled vinyl packaging.[6] In addition, the study indicates that demand for this material -- estimated at nearly 500 million pounds annually -- could be more than double the roughly 200 million pounds of vinyl available from rigid containers. An equal amount potentially is available by recovering rigid vinyl film used in "blister" packaging. Industry estimates calculate that all of the rigid vinyl currently being landfilled could be absorbed if only 10 percent of the vinyl siding market and 25 percent of selected pipe markets began using recycled vinyl.

These potential uses for recycled vinyl illustrate another unique characteristic of the material: unlike other packaging materials, second-generation uses for recycled vinyl packaging can be long-term applications -- some well in excess of 20 years. This means that even after reuse, vinyl packaging can be kept out of landfills for an extended period of time.

PVC IN LANDFILLS

Inert and Stable

Currently, vinyl products in general make up about 0.5 percent by weight of all materials found in municipal solid waste and vinyl packaging only about 0.2 - 0.3 percent.[7] Because of its inert chemical resistance, vinyl remains a stable, inert material when landfilled, and for this reason, it is often used to manufacture landfill liners and leachate collection systems. Vinyl disposed of in landfills does not revert to vinyl chloride monomer and vinyl plastics do not leach VCM or other harmful chemicals into groundwater.[8]

Components of Municipal Solid Waste (By Volume)

Nondurables		34.0%
All Packaging		29.0
Paper	14.1	
Plastics	8.1	
Metal	3.9	
Glass	1.8	
Other	1.4	
Durables		22.2
Other Wastes		14.3

Source: U.S. Environmental Protection Agency, Characterization of Municipal Solid Waste in the United States, 1990 Update.

PVC IN INCINERATORS
Recent Study Finds No Impact on Emissions

In 1987, the New York Energy Research and Development Authority conducted extensive tests to determine what effect, if any, the presence of vinyl plastics had on municipal solid waste incinerator emissions. Those tests revealed that the presence or absence of vinyl had no effect on incinerator dioxin formation.[9] Rather, it was found that incinerator operating conditions (primarily, temperature) were the key to controlling dioxin formation. At temperatures upwards of 1500 to 1800° F, generation of dioxins is minimal.

Research has also found that incinerator scrubbing systems can remove about 99 percent of the hydrogen chloride generated by incinerating vinyl plastics.[10] New requirements from the U.S. Environmental Protection Agency will make scrubbers mandatory equipment on all incinerators. One of the leading manufacturers of incinerator systems, Ogden Martin Systems, has advised the Environmental Protection Agency that its equipment "can tolerate reasonable increases in acid-producing waste components without adverse effect," and does not "perceive the anticipated increases in PVC food packaging to be problematic." [11]

Power plants burning fossil fuels, which produce sulfur dioxide and nitrogen oxide, are considered to be the primary cause of acid rain, and in Europe and Japan, studies show that only about 0.3 percent of all atmospheric acidity can be traced to incineration of vinyl.[12] Other studies have indicated that about 50 percent of the HCl generated in incinerators comes from sources other than vinyl such as table salt and yard wastes.[13] European studies have demonstrated that HCl produced in incinerators can be treated with sodium hydroxide and converted (recycled) into industrially usable salt.[14]

PVC AND OZONE DEPLETION
No Known Connection

Once chlorine is processed into polyvinyl chloride, free chlorine gas cannot be liberated from the product. This means that vinyl products -- either incinerated or landfilled -- do not release chlorine gas to the atmosphere.[15] There is no connection between vinyl products and chlorofluorocarbons, and chlorine gas is not considered by scientists to play a role in the depletion of the ozone layer.

SOME PRODUCT LIFE CYCLE CONSIDERATIONS

The Case for Vinyl

The most comprehensive evaluation of a product's impact on the environment takes a "cradle to grave" approach to assessing its overall performance. Under such a system, not only is a product's recyclability considered, but also a number of other factors including: raw material usage; energy used in processing; distribution and transportation costs (energy usage); durability (time until the product must be disposed of/replaced); and unique or important performance properties provided during use. For these reasons, there is new interest in vinyl as a "green" material.[16] These considerations include:

- Over 50 percent of the base polymer product consists of chlorine -- a readily available, inexpensive commodity that makes vinyl a cost-effective alternative to many other materials. Vinyl is also far less dependent on hydrocarbon feedstocks than other polymeric materials.
- Vinyl can be produced more efficiently using less energy than many materials it replaces, such as aluminum, steel or glass.
- Likewise, the energy used to process vinyl scrap for reuse is less than that for many other materials.
- Because of their relative light weight, the cost to transport and handle products like vinyl pipe and packaging is far less than for comparable items made out of "traditional" materials.
- In a number of applications, including blood bags, tubing for dialysis machines and flexible food wrap, vinyl is the only viable material choice. In many others, vinyl provides superior performance properties such as better weatherability, better fire properties, longer durability or better corrosion resistance. In these applications, vinyl products last longer and require less maintenance.

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For more information about the issues discussed in this document, contact The Vinyl Institute, 155 Route 46 West, Wayne Interchange Plaza II, Wayne, NJ 07470. Or contact the Vinyl Environmental Resource Center at 1-800-969-VINYL (1-800-969-8469). The Vinyl Institute is a division of The Society of the Plastics Industry, Inc. For additional copies of this document, ask for the Chlorine White Paper.

Issued July 1991.

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REFERENCES

- [1] *Community Health Effects of Vinyl Chloride*, published by the Vinyl Institute, August 1, 1986; cites an EPA report 450/3-85-002 (1985).
 - [2] *Community Health Effects of Vinyl Chloride*.
 - [3] *Fire Properties of Polyvinyl Chloride*, published by the Vinyl Institute, 1988.
 - [4] *New Device Sniffs Out Fires Before There's Smoke or Heat*, Bell Communications Research, Inc. press release, September 26, 1990.
 - [5] *Fire Properties of Polyvinyl Chloride*.
 - [6] *End Use Markets for Recycled Polyvinyl Chloride*, Robert A. Bennett, Ph.D., The University of Toledo College of Engineering, July 1990.
 - [7] *Vinyl Industry Response to Environmental Concerns About PVC in Municipal Solid Waste* by Roy T. Gottesman, William C. Carroll and Leon Fishbein, Journal of Energy Progress (Vol. 8 No. 3), September 1988.
- Calculation also based on domestic consumption of 675 million pounds of PVC packaging reported in 1989 and the Franklin Associates estimate that approximately 180 million tons (360,000 million pounds) of MSW are discarded annually.
- [8] *On the Potential Sources of Vinyl Chloride in Landfills and Groundwater*, prepared by the Vinyl Institute, March 1990.
 - [9] *Results of the Combustion and Emissions Research Project at the Vicon Incinerator Facility in Pittsfield, Massachusetts*, prepared by Midwest Research Institute for the New York State Energy Research and Development Authority, Final Report, June 1987.
 - [10] *Air Emission Tests at Commerce Refuse-to-Energy Facility*, May 26 - June 5, 1987, Vol. I test results ESA 20522-449, Energy Systems Associates, Pittsburgh, PA, July 1987.
 - [11] *Incineration Advances Seen Reducing Impact of PVC Food Use Increases*, Food Chemical News, September 18, 1989.

- [12] *Plastics in Municipal Solid Waste Incineration: A Literature Study*, by Professor R. S. Magee, Hazardous Substance Management Research Center, New Jersey Institute of Technology, Newark, N.J. 07102.

Also, *Does PVC Waste Incineration Contribute to Acid Rain?* by P. Lightowlers and J. N. Cape, Chemistry and Industry, June 1987.

- [13] *The Chlorine Content of Municipal Solid Waste from Baltimore County, Maryland and Brooklyn, New York*, K.L. Churney, A.E. Ledford, S.S. Bruce and E.S. Domalski, National Bureau of Standards, Gaithersburg, Maryland (NBSIR 85-3213), April 1985.
- [14] *PVC: Friend or Foe?* Techpak, March 26, 1990.
- [15] I. B. Wakeman and H. R. Johnson, Journal of Polymer Engineering Science 18-404 (1978).
- [16] *Green Consumer's Supermarket Shopping Guide*, John Elkington and Julia Hailes, Penguin Books, 1989.

Available from the Vinyl Institute

Note: Individual copies of all items listed are available free of charge to employees of Vinyl Institute member companies unless otherwise noted. There may be a nominal charge for multiple copies or large quantities of some items. For more information, or to order materials, contact Ms. Pat Benkner at the Vinyl Institute (201) 890-9299.

General Information:

"Vinyl: Serving More People, In More Products, Made By More Industries, Than Almost Any Other Material Today" – 16-page four color brochure describing how vinyl is made and used. Highlights five major markets with testimonials from industry customers.

"Polyvinyl Chloride: An Overview of the Role Chlorine Plays in this Plastic Material" – Ten-page white paper with references. Discusses the major topics associated with the manufacture and use of vinyl. A resource document designed for use by VI members.

"We're Glad You Asked: Answers to the Most Commonly Asked Questions About Vinyl" – Eight-panel wallet card. A condensed version of the white paper for use with customers, suppliers, community residents, etc.

"Facts About Working with PVC" – 12-page pamphlet designed for PVC plant workers and converters.

"Facts About Vinyl Chloride Monomer – 12-page pamphlet designed for VCM/PVC plant workers and plant community residents.

"Community Health Effects of Vinyl Chloride" – 13-page Vinyl Institute technical paper with references.

"Potential Effects of Vinyl Chloride on Human Offspring" – 10-page VI technical paper with references.

"Recommended Guidelines for Vinyl Chloride: Storage, Shipping and Handling" – 10-page VI technical paper.

"On Potential Sources of Vinyl Chloride in Landfills and Groundwater" -- 13-page technical paper.

Builder Brochures – A series of four, four-page, four-color direct mail pieces promoting the attributes of vinyl building products of most importance to builders.

Solid Waste/Environmental:

Solid Waste Information Kit – Pocket folder containing a basic fact sheet, press releases announcing availability of other materials, several trade magazine article reprints, latest issue of Environmental Briefs newsletter, information about the VI Environmental Resource Center, VI member list, backgrounder about the Vinyl Institute.

National Vinyl Environmental Resource Center Rolodex Card – Promotes VI 800-number and hotline.

"End Use Markets for Recycled Polyvinyl Chloride" -- Research study prepared by University of Toledo. \$5.00 per copy for VI members.

"Directory of Companies Involved in the Recycling of Vinyl (PVC) Plastics," Second Edition -- 20-page pamphlet.

"Vinyl Plastics and Solid Waste: Some Basic Facts" -- Two-page fact sheet.*

"PVC Recycling: Landfill Fodder? It Doesn't Have to Be" -- Reprinted from the March 1989 issue of Modern Plastics magazine.*

"Earth Day 1990" -- Reprinted from the April 22, 1990 issue of Plastics World magazine.

"From Sortation to Marketing, the Vinyl Loop Gets Stronger" -- Reprinted from the March 1990 issue of Recycling Today magazine.*

"Vinyl Recycling: Often Asked Questions" -- Reprinted from the February 1991 issue of Public Works.*

"NRT Process Sorts PVC From Other Plastics" -- Reprinted from the November 12, 1990 issue of Plastics News.*

"Environmental Briefs" -- Quarterly newsletter published by the Vinyl Institute. Free subscriptions available to VI members, customers and others by request to the VI office.*

"Vinyl Institute/NRT Vinyl Separator" -- 3.25 min. videotape. \$10 charge for VI members.

* Available separately or as part of Solid Waste Information Kit.

Electrical Market/Combustibility/Toxicity:

"Vinyl: Material of Choice for Electrical Applications" -- Pocket folder containing Institute's "Vinyl" brochure, "Wired for Safety" brochure, "10 Reasons" brochure, fire technical paper, various ad and article reprints, background on the VI's Electrical Materials Council, three "Electrical Perspectives" fact sheets and various technical papers given by VI members.

"Electrical Connection" -- Periodic newsletter published by the Institute's Electrical Materials Council. Free subscriptions available to VI members, customers and others by request to the VI office.*

"PVC Electrical Non-Metallic Tubing vs. Electrical Metallic Tubing: A Cost/Benefit Comparison" -- Four-page executive summary of a study conducted on behalf of the Vinyl Institute.*

"Wired for Safety with Vinyl Electrical Materials" -- Eight-page four-color brochure.*

"Ten Reasons to Rely on Vinyl, the World's Leading Electrical Material" -- Six-panel pamphlet (printed on recycled rigid vinyl sheet).*

"Vinyl: An Enlightening Look at the 50-Year History of the World's Leading Electrical Material" -- Ten-page backgrounder with references and key milestones.

"Fire Properties of Polyvinyl Chloride" -- Eight-page Vinyl Institute technical paper with references.*

"Electrical Perspectives" -- Three fact sheet covering the safety, performance and preference of vinyl in electrical applications, produced by the Vinyl Institute.*

"Vinyl's Fire Performance: The Perception and Reality" -- Article by Roy Gottesman, reprinted from the August 1990 issue of EC&M magazine.*

"An Evaluation of the Performance Properties of Poly(vinyl chloride) Wire and Cable Compounds for Severe Service Applications" -- article by VI members given at the November 1989 Wire Symposium, reprinted from Wire Journal.*

"Update on Smoke Corrosivity" -- Paper presented on behalf of the Vinyl Institute at the 1990 Wire and Cable Symposium.*

"General Principles of Fire Hazard and the Role of Smoke Toxicity" -- Article authored by Marcelo Hirschler, reprinted from the American Chemical Society Symposium Series No. 425.*

"Fire Hazard in a Room Due to a Fire Starting in a Plenum: Effect of Polyvinyl Chloride Wire Coating" -- Article authored by BFGoodrich, reprinted from the American Chemical Society Symposium Series No. 425.*

"The Toxicity of Hydrogen Chloride and of the Smoke Generated by Polyvinyl Chloride, Including Effects on Various Animal Species, and the Implications for Fire Safety" -- Article authored by BFGoodrich, reprinted from "The Toxicity of Smoke."*

"A USA Approach to Combustion Toxicity of Cables" -- Authored by AT&T Bell Laboratories and Anderson Laboratories Inc., reprinted from Vol. 15, No. 3 of Plastics, Rubber and Composites Processing and Applications magazine.*

* Available separately, or as part of the Electrical Materials Council information kit.

Pipe Market/Water Integrity:

"PVC Pipe For All The Right Reasons" -- Illustrated pocket folder with promotional copy also containing Institute's "Vinyl" brochure, assorted ad reprints, case histories, technical bibliography, drinking water technical paper and background on the VI Pipe Resource Organization.

"PVC Pipe Delivers!" -- Series of six ad reprints as they appeared in AWWA Journal. Each features a different testimonial from an independent expert and discusses a different attribute of PVC pipe.*

"PVC Pipe Resource Report" -- Series of seven newspaper-style case histories developed in cooperation with Uni-Bell PVC Pipe Association. Each features a different installation of PVC large diameter pipe.*

"PVC Drain, Waste and Vent Pipe vs. Cast Iron Soil Pipe: A Cost/Benefit Comparison" -- Four-page executive summary of a study conducted on behalf of the Vinyl Institute.*

"PVC vs. Copper Domestic Hot & Cold Water Systems: A Cost/Benefit Comparison" -- Four-page executive summary of a study conducted on behalf of the Vinyl Institute.*

"PVC Pipe and Drinking Water Safety" -- *Technical paper summarizing VI-sponsored research on pipe permeation and leaching. Revised July 1991. References.**

"Technical Information Available" -- *Special four-page PVC Pipe Resource Report listing publications about PVC available from ASTM, AWWA, Uni-Bell, PPI, PPFA and the Vinyl Institute*.*

"Is PVC Piping Firesafe?" -- *Article by VI consultant Joseph Zicherman, reprinted from the November/December 1990 issue of Fire Journal.**

* Available separately, or as part of the Pipe Resource Organization information kit.

Packaging Market:

"Eight Packaging Professionals" -- *Eight-page, four-color brochure highlighting brand-name vinyl bottle applications with testimonials from package designers and other independent experts.**

"Vinyl: The Advantage You Need" -- *Six-page, four-color brochure about the advantages of vinyl for bottled water applications.*

"Which Bottle Gives Your Water the Right Look?" -- *A set of three, four-color direct mail pieces, each focusing on one of the benefits of using vinyl for water bottles.*

"A Look at the Packaging Options for Bottled Water" -- *Authored on behalf of the Vinyl Institute, reprinted from the August/September 1988 issue of Bottled Water Reporter magazine.*

"Vinyl Packs Get VIP Treatment" -- *Coverage of the Institute's vinyl packaging awards competition, reprinted from May 1991 issue of Packaging Digest.*

- Available separately, and as part of the Packaging Council's version of the VI's solid waste information kit.



Scientist Confirms VI Position On Fire Hazard, Toxicity

The Vinyl Institute's long-held position that the New York State toxicity data bank is not, by itself, an appropriate vehicle for assessing combustion toxicity has received significant new support.

In a technical paper co-authored with Stanley Kaufman and James J. Refi of AT&T Bell Laboratories in "Plastics, Rubber and Composites Processing and Applications", Rosalind C. Anderson of Anderson Laboratories, Inc. — principal architect of the toxicity data bank — acknowledges that lethal concentration data about wire and cable should be based on test sample length rather than weight.

The paper further states that combustion toxicity by itself is insufficient to assess a material's total fire hazard, another position put forth by the Vinyl Institute but ignored at the time the New York State toxicity data bank filing regulations were enacted.

"To determine if one cable is safer than another in a real fire requires full scale fire testing," the paper states. "Combustion toxicity data alone should not be used for cable selection."

Copies of the paper (EMC 3-1) are available by writing the Vinyl Institute at the address indicated in the upper left corner of this newsletter's mailing panel.



SBCCI To Spotlight Vinyl In Construction

A seminar about vinyl construction applications, designed for those involved in the code-making process, will be presented by the Vinyl Institute at this year's Southern Building Code Congress International (SBCCI) Annual Conference, Oct. 27-31 in Tampa.

The seminar will examine vinyl's performance properties in applications including piping,

conduit and other electrical materials, siding and windows. It will touch on vinyl's proven ability to deliver safe, reliable, cost effective service. It will also include a review of the perceptions of vinyl products held by key specifiers in the construction industry.

Another portion of the seminar will provide an update on the ability of vinyl products to meet the requirements for fire and physical performance set by various code, standards and regulatory organizations.

The third portion of the program will review vinyl's ignition resistance, flammability, heat release, smoke generation, corrosivity and toxicity.

The final portion of the program will discuss technologies and programs relating to vinyl waste handling and separation, recycling and incineration.

For more information, contact: SBCCI, 900 Montclair Rd., Birmingham, Alabama 35213, (205) 591-1853.



Vinyl Conduit Cost Savings Confirmed

Builders and contractors can realize savings of up to 33 percent by using rigid vinyl conduit instead of metallic tubing in construction applications, a newly completed study shows.

The study, based on 1991 materials, installation costs and labor rates in estimating the savings advantages of vinyl in electrical raceways, was conducted by IFT Technical Services, Berkeley, California.

Updating an earlier cost/benefit comparison based on 1988 information and containing virtually identical results, the new study looked at actual building costs in Atlanta, Boston, Cleveland, Houston, San Francisco and Seattle. Concealed lighting and outlet systems were evaluated for

four types of structures: wood frame townhouse, strip shopping center, high-rise residential building and high-rise office building.

"This study reconfirms that there are significant cost advantages in using vinyl electrical conduit," said Richard R. (Rick) Smith, chairman of the Vinyl Institute Electrical Materials Council.

"Moreover, this study doesn't even consider the added safety factor provided by vinyl — the fact that it does not arc or conduct electricity," Smith continued. "When you weigh these additional features, the advantages of vinyl become even more obvious."



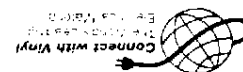
Vinyl Products In Plenums Contribute Little To Fire Hazard

Vinyl products in plenum spaces do not add significantly to fire hazard, according to a technical paper recently presented at a symposium titled "Fire and Polymers: Hazards Identification and Prevention", sponsored by the American Chemical Society.

According to the paper, authored by two industry scientists, F. Merrill Galloway and Marcelo M. Hirschler, a room fire would reach flashover — and hence create a lethal toxic atmosphere — before it would generate enough heat to decompose vinyl products in a plenum.

Hence, the smoke generated by a room's contents in a fire should be a much greater and more immediate toxic concern than any smoke that might ultimately be generated by vinyl products in a plenum, the paper asserts.

Copies of the paper (EMC 3-2) are available by writing the Vinyl Institute at the address indicated in the upper left corner of this newsletter's mailing panel.



The Vinyl Institute
Electric Materials Council
155 Route 46 West
Wayne Interchange Plaza II
Wayne, NJ 07470



Fire Health Effects Testing Questioned

Scientists need to revise the way they measure the health effects of certain combustion by-products, warned two presenters at the Second Annual BCC Conference on Flame Retardancy of Polymeric Materials, held earlier this year in Stamford, Connecticut.

Harold L. Kaplan, a consultant in toxicology, and Robert K. Hinderer, manager of health and toxicology for the BFGoodrich Company, issued the warning as part of a presentation detailing the results of a three-year study conducted by Southwest Research Institute, which was designed to assess the health effects of hydrogen chloride, or HCl.

"Numerous test methods to evaluate the combustion toxicity of materials use the mouse or rat as the test animal because of their small size, low cost and ease of handling," Kaplan and Hinderer noted. "However, little attention has been paid to their suitability as models for humans."

Differences in test species can have an impact on evaluating not only the absolute combustion toxicity of a material, but also its relative toxicity, Kaplan and

Hinderer stated.

"Without real-world testing, we can end up with building codes and standards that unnecessarily restrict perfectly acceptable materials," the two scientists noted. "Even more problematic is the prospect of allowing the use of less desirable materials based on narrow and unrealistic test data."

Copies of the paper (EMC 3-3) are available by writing the Vinyl Institute at the address in the upper left corner of this newsletter's mailing panel.



VI Establishes Vinyl Environmental Resource Center/Hotline

The Vinyl Institute has established a Vinyl Environmental Resource Center that will provide information about vinyl recycling and the environment through an 800-number hotline: 1-800-969-VINYL (1-800-969-8469).

The Center also will provide information on vinyl's fire performance and other health and safety issues, and referrals when appropriate.

"A significant body of knowledge has been developed regarding the role of vinyl in the solid waste management process," said Roy T.

Gottesman, Vinyl Institute executive director. "This hotline will be supported by a national data base where all of that information will be gathered."

The Center is offering a directory of over 50 companies in 25 states involved in the recycling of vinyl. The directory provides names, addresses and phone and fax numbers for key contacts at each company listed. Information about the particular recycling processes each company offers is also listed where available.

The Resource Center hotline is staffed Monday through Friday from 9 a.m. to 5 p.m. EST. The hotline also has a message system to handle calls during off hours.



Who We Are...

The Vinyl Institute Electrical Materials Council was established in 1989 to promote and expand the use of vinyl in electrical applications. It is part of the Vinyl Institute, the national trade association representing the leading manufacturers of vinyl, vinyl feedstock additives and film and sheet products. Headquartered in Wayne, New Jersey, the Vinyl Institute is a division of The Society of the Plastics Industry, Inc.