

ALASKA LEGISLATURE COMMITTEE FILES 1983 - 1984 86/2

2726 SLC HB 508 (FILE 1) - (FILE 2)

2726

Tests of Polybutylene Pipe at PT Relief Valve Conditions

Over four years ago, Shell contracted with Springborn Testing Institute, Inc. to evaluate the performance of polybutylene tubing subjected to a constant pressure of 150 psi at a constant temperature of 210°F. Sustained pressure testing was done in accordance with the ASTM D1598 test method. The results accumulated to date (see table below) clearly show that the tubing far surpasses the IAPMO performance requirement of 48 hours at 210°F and 150 psi.

| <u>Test Sample</u> | <u>Nominal Size (inches)</u> | <u>Failure Time (hrs.)*</u> |
|--------------------|------------------------------|-----------------------------|
| 1                  | 1/2 CTS                      | N31792                      |
| 2                  | 1/2 CTS                      | 26929                       |
| 3                  | 1/2 CTS                      | 26653                       |
| 4                  | 3/4 CTS                      | N31792                      |
| 5                  | 3/4 CTS                      | N31792                      |
| 6                  | 3/4 CTS                      | N31792                      |
| 7                  | 1/2 CTS                      | N31008                      |
| 8                  | 1/2 CTS                      | N31008                      |
| 9                  | 3/4 CTS                      | N30072                      |
| 10                 | 3/4 CTS                      | 25887                       |
| 11                 | 1/2 CTS                      | N31008                      |
| 12                 | 1/2 CTS                      | N31008                      |
| 13                 | 3/4 CTS                      | 21792                       |
| 14                 | 3/4 CTS                      | 14415                       |
| 15                 | 3/4 CTS                      | N31008                      |
| 16                 | 3/4 CTS                      | N31008                      |

\*N denotes a sample which has not yet failed and is still under test.

BY THE COMPTROLLER GENERAL

# Report To The Congress OF THE UNITED STATES

## Greater Use Of Innovative Building Materials And Construction Techniques Could Reduce Housing Costs

Problems exist within different levels of government and the homebuilding industry that hinder the development and use of innovations which could check rising costs. For example:

- Builders are reluctant to accept risks associated with using new technology.
- Local building codes are sometimes restrictive and administered inconsistently.
- Builders lack technical information on innovative technology.

GAO makes several recommendations to the Secretary of Housing and Urban Development and the President of the National Institute of Building Sciences to encourage the development and use of cost-saving innovations in homebuilding.



CED-82-35

FEBRUARY 18, 1982

A 1971 study prepared for HUD <sup>1/</sup> regarding builders' use of 12 cost-saving innovations showed that, on the average, 70 percent of the responding builders did not use the innovations. According to building code officials, 73 percent of the time builders in their areas used the innovations occasionally, seldom, or never. Subsequently, a 1973-74 NAHB survey, which included 11 of the 12 items, showed that 8 of the 11 were not used in the great majority of new single-family houses nationally. Our 1978 report, which addressed 8 of the 12 items, showed 3 of the 8 were still widely unused by builders in the 87 communities included in our review. The three still widely unused items and the estimated potential savings per house at the time were: spray painting (\$185), 2x4 studs 24" oncenter for exterior bearing walls (\$119), and the preassembled plumbing tree (\$55).

Examples of available cost-saving innovations currently not widely used by builders, as identified by HUD and NAHB research officials, and estimates of savings they could yield in the medium-price house include:

|   |               |
|---|---------------|
| Engineered 2" by 4" studs,<br>24" oncenter interior and<br>exterior wall framing (in lieu of<br>16" oncenter) | \$300 - \$700 |
| Under floor plenum heating system<br>(in lieu of duct work system)  | \$400         |
| Polybutylene piping for plumbing<br>(in lieu of metal piping)   | \$300         |
| One-piece fiber glass bathtub with<br>integral surround (in lieu of tile-<br>work)                            | \$50          |

Rapid, widespread adoption of cost-saving innovations is hindered in part because the traditional onsite homebuilding industry is extremely fragmented--more than 100,000 builders, the majority of which build less than 25 units annually. However, the 1971 HUD study identified and analyzed a range of other factors impeding builders' use of innovations. While the study has not been updated, its results were substantially corroborated by the widely varied sources we consulted during our review. The study ranked in order of importance a total of 20 constraints, of which it called the following "important":

---

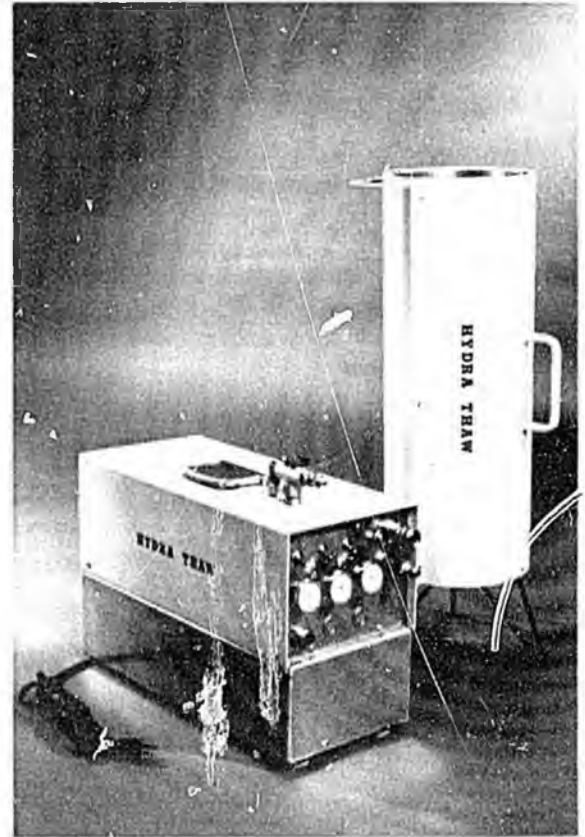
<sup>1/</sup>"Constraints to Builders' Use of Cost Saving Innovations," NAHB Research Foundation, Inc., July 1971.

# HYDRA THAW

## PROFESSIONAL PIPE THAWING EQUIPMENT

### EXCLUSIVE HYDRA THAW II FEATURES

- \* Thaws both PLASTIC and METAL Drinking Lines
- \* Thaws up to 3 FPM
- \* Thaws up to 300 feet in Distance
- \* Safe, Fast, Economical, Efficient
- \* Compact, Light in weight yet Heavy Duty
- \* Rugged Aluminum and Steel Construction
- \* Will Not Harm Pipes
- \* Tolerates Temperatures from 32 to 200 degrees F.
- \* Environmental Temperatures 0 to 100 degrees F.
- \* "Knock Down" Construction
- \* Engineered for Continuous Duty at 0 to 400 PSI
- \* Pilot Light Safety Valve
- \* Unique Electronic Pulsation Aids Line Travel
- \* Limited Use in Drains and Sewer Lines
- \* Temperature and Pressure Gauges for Your Convenience



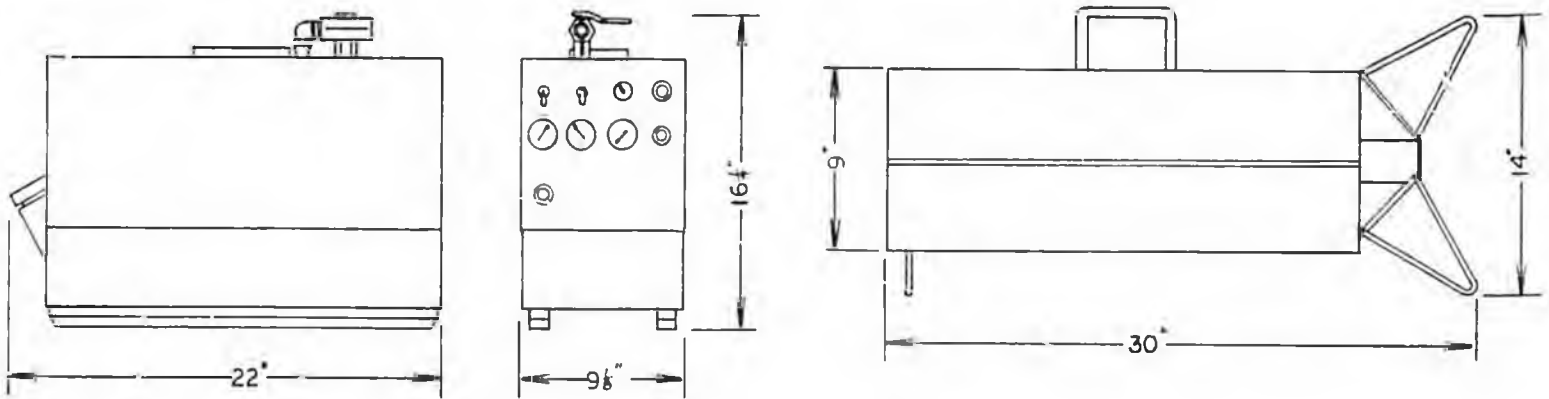
Remember, you may call us  
DIRECT  
1-802-254-6886  
for an even faster response.

PO Box 47

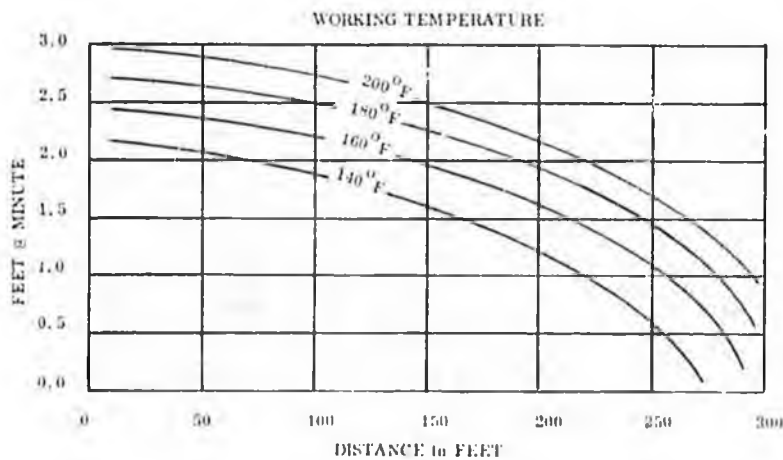
HYDRA THAW CORPORATION  
Vernon, Vermont 05354

802-254-6886

## HYDRA THAW II DIMENSIONS



## PERFORMANCE (3/4" PVC)



### SPECIFICATIONS

Pump Design  
Capacity  
Motor

Working Pressure  
Heat Exchanger  
Design (HE)  
Rating (HE)

Weights:  
Pump Unit  
Heat Exchanger

Propane Cylinder

500 PSI piston  
3 GPM at 400 PSI  
115 VAC 3/4 HP  
continuous duty  
Adjustable to 400 PSI  
150,000 BTU @ Hr. input  
Conical Wound ASTM B-75 Cu.  
860 PSI to 200 degrees F.  
400 PSI to 400 degrees F.

aprox. 60 pounds (empty)  
30 Pounds

From 2 to 20 pounds as  
desired by operator

### STANDARD EQUIPMENT

Power Unit with Electronic  
Pulsation  
Heat Exchanger with All  
necessary Hoses  
Thaw Tubing—200' x 1/4" OD  
300' x 5/16" OD  
Propane Pressure Regulator  
Adapter Fittings for  
PVC Pipes 1/2" to 1"

Instruction Manual  
Parts Book

(not included: Propane  
Cylinder)

Dimensions & Specs: subject to  
change without notice

### DISTRIBUTED BY:

# PIPER

Published by Shell Chemical Company

Volume IV, Number 1, 1983

## Corrosion-resistant Duraflex<sup>TM</sup> polybutylene pipe specified for Florida medium-rise.

The water in Jacksonville, Florida, is so corrosive that it can eat through copper and galvanized metal pipe.

"In Jacksonville, the only way you can use copper or galvanized metal pipe is to treat the water first," says David Batzka.

Batzka served as owner's representative for Sundale Manor, a six-story apartment building currently under construction. To avoid installing a costly water treating system, Batzka specified corrosion-resistant Duraflex<sup>®</sup> polybutylene pipe for Sundale Manor's potable water system and PVC pipe for the drainage system.

Sundale Manor will be the first medium-rise building in Jacksonville with all-plastic plumbing. Polybutylene pipe received Jacksonville city code approval in late 1981.

W. W. Gay Mechanical Contractor, Inc. is handling the polybutylene pipe installation at the 90-apartment complex.

Job superintendent Jimmy Lasco is the key installer for the polybutylene pipe, which ranges in size from 1/2 inch to three inches in diameter. Heat fusion is used to install the larger (one-inch to three-inch) diameter pipe. Insert/compression ring fittings are used for the smaller diameter pipe. The installers can pressure-test the pipe and fittings immediately.



Billy Knight, who handles all of the heat fusion, says, "Once you learn to heat-weld the pipe, it's really quick and easy. We had some trouble with the first couple of welds, but now it's really simple."

According to Lasco and Knight, the larger diameter polybutylene pipe's flexibility and light weight provided unique advantages over rigid pipe; installation of Duraflex polybutylene pipe became a simple two-man operation. Risers for the pipe were shop-fabricated in an open area outside the building, coiled up for

*(Continued on page 4)*

## Duraflex pipe installed in California solar-based housing project.

In an effort to provide substantially lower utility bills for heating, cooling and hot water, a farsighted county housing authority has initiated the development of the first solar-based public housing project in California.

"Solar housing benefits all the taxpayers by conserving energy for other uses. We believe that these homes will serve as a model for other public agencies and for private developers who seek to respond to the energy realities of the 80s," said Roger Salquist, president of Trident Energy Systems, Davis, CA, the developers and installers of the solar system.

The systems are being installed in sixty-two 3 and 4 bedroom single family homes in the Rancho Algodon project outside Delano in Kern County. Completion is scheduled for late 1982.

For heating, Trident uses roof-mounted solar collectors to heat water which is then circulated through coils of flexible pipe made from Duraflex polybutylene resin embedded in the slab of each house. For cooling, a radiant chiller with a counterflow heat exchanger provides three tons of cooling capacity

*(Continued on page 3)*

## Fire sprinkler system tested in Scottsdale.



Fire sprinkler systems retrofitted into two new Scottsdale, Arizona homes quickly extinguished deliberately-set test fires, thereby dramatically reducing the potential damage to the homes.

Federal and local fire officials monitored the tests which ranged from wastebasket fires to kitchen grease fires and burning dry Christmas trees.

Insurance officials estimated damages in the series of duplicated fires in the two homes and compared the losses to the property damage that would have occurred without sprinkler systems.

On the basis of eight tests, damages in the sprinklered fires were estimated at \$17,200 while the average damage estimate without sprinklers totaled \$116,000, a savings of \$98,000 or 85 percent.

"The answer to reducing the number of lives lost in residential fires is in-place protection with automatic suppression systems and smoke detectors," said Harry Shaw of the U.S. Fire Administration (USFA) in Washington, D.C. following the tests.

Sprinkler systems were installed after the two \$70,000 subdivision homes were built. One house was retrofitted with a standard iron pipe system and the

second house used flexible pipe made from Duraflex polybutylene resin and a black iron pipe system. Both systems employed newly developed fast response sprinkler heads.

Grantham Fire Protection, Inc. of Phoenix, Arizona, installed both sprinkler systems in the second house and tabulated material and labor costs. The system using the flexible polybutylene pipe required only half as many man hours to install as the system with the metal pipe.

"The house was retrofitted with polybutylene in three days using two men and it took four and one-half days and three men to complete the black iron pipe system," said Terry Glenn of Grantham.

In order to install the black iron system, it was necessary to cut a hole in the roof. Sections of the pipe were cut outside the home, brought in through the roof, then threaded into position in the sprinkler head installation.

The lightweight Duraflex polybutylene pipe was assembled in a garage. Sections of the pipe were heat fused and then easily snaked through an attic opening. In addition to installation advantages, the pipe will not crack if water

should freeze inside the pipe and it has the highest heat rating of any thermoplastic pipe, a particular advantage in the "Sun Belt" where attic temperatures soar in the summer.

Scottsdale Administrative Fire Chief Bob Edwards said the cost of installing the polybutylene system was about one percent of the cost of the homes; about 40 percent less than for the iron system.

The tests were conducted by the Rural/Metro Fire Department, an independent corporation contracted by the city, and were financed by the USFA. Factory Mutual, a national testing laboratory, monitored the results.

In a demonstration of confidence in both systems, executives of Rural/Metro



sat on couches in the living rooms as fires were started in nearby wastebaskets. In one house the sprinkler was actuated in 1:17 minutes and in the other house, at 2:55 minutes.

Sentry Insurance Company observers estimated that the damage would have averaged about \$3,500 in each home (in this specific fire test) had there been no sprinkler systems. In actuality, damage was estimated at only \$1,000 in one home in which the sprinkler was actuated first and \$1,500 in the other.

In another comparative test, cake pans of cooking oil were heated on an electrical stove with open flames occurring three to four minutes later. After the sprinkler heads were actuated to extinguish the fires, damage was estimated at \$2,400 in one house and \$3,600 in the second house. If sprinkler systems had not been installed, the insurance com-

(Continued from page 1)

which, if needed, can drop the water temperature as low as 38 degrees during the summer. The chilled water is circulated through the pipe in the slab to cool the house.

Not only does the radiant heating system provide an excellent means of using the medium temperature heat from the solar panels, but it also reduces the total energy requirements. The radiant slab and water storage tank can store enough heat in winter to maintain desired room temperatures for several sunless days before requiring back-up from the flash boilers which are installed as part of the overall system.

"Rancho Algodon vividly demonstrates that solar is not just a tool of the affluent," said Salquist. "It is even more essential in situations where tight incomes cannot compensate for rocketing utility bills, and the Housing Authority of the County of Kern is one of the first agencies to take this into account." Trident estimates a utility savings of about 75%.

The radiant slabs are constructed by placing a plastic vapor barrier over a sand base eight inches above the grade. This is covered with another inch of sand and a wire mesh. Before the coils of half-inch Duraflex polybutylene pipe are placed into the desired position for each zone, lime is sprinkled over the sand to show crews where to set the pre-fab walls.

pany estimated damage would have been \$6,500 in the first house and \$12,500 in the second house. (Estimates of losses without sprinkler equipment were based on normal fire department responses in terms of time, manpower and equipment. Estimates of damage with sprinkler operation were based on review of actual conditions after each test.)

Besides local media coverage, more than 170 representatives of fire departments, local governments and builder associations witnessed the tests. The test descriptions were recorded and posted for the audience while videotape

Approximately one linear foot of one-half-inch CTS polybutylene pipe per square foot of space was embedded in the slab of each house. Trident chose Duraflex polybutylene pipe for its combination of high temperature properties and flexibility.



"A three man team can lay the pipe for the slabs of four houses in a day," said Geoff McNeilly, Trident crew

replays were also shown. In a majority of the tests, only one sprinkler head was actuated.

Among the interested observers were representatives of the Cobb County (Georgia) Fire Department. Cobb County recently conducted extensive fire sprinkler tests that resulted in building code amendments for multi-family dwellings authorizing the use of polybutylene pipe in sprinkler systems.

The tests demonstrated that effective protection against extensive damage and deaths caused by fires can be economically added to an existing home.

manager at Rancho Algodon. Ties were used to attach the pipe to the wire mesh and maintain desired zone spacing.

There are four or five zones in each of the houses with positive shut-off valves controlling the flow through each zone. Continuous coils of pipe used in each zone were connected to return and supply valves in a manifold box installed just below the concrete surface in the garage. The pipe was laid so that the supply water circulates from the perimeter of the zone to the center before returning to the manifold box.

The Kern County Building Inspection Department tested the system by applying an air pressure of 30 psi for 30 minutes. Under operating conditions, only 3 psi pressure is needed to circulate about four gallons per minute of water throughout the 1000-1200 feet of pipe. Following inspection, about 25 cubic yards of concrete were poured for the standard 4" slab of each house and its garage.

A computerized controller will monitor the air inside the home, the water in the storage tanks and the collectors on the roof. A digital readout indicates the temperature of each. The controller automatically operates the system to collect and store all available solar energy and to maintain the desired setting on a solar dial. Another dial setting establishes the lowest acceptable inside air temperature and maintains it during periods of low solar conditions.

The California Department of Housing and Community Development is providing construction funding of about \$3.2 million, including the cost of installing the Trident Energy Systems' solar heating and cooling. Kern County Community Development block grant funds will be used for the land purchase cost of about \$207,000.

Elimination of a central air conditioning system, furnace and ductwork will offset a portion of the installation cost for the system. The net installation cost for the Trident system at Rancho Algodon is about \$2,000 a house more than a conventional system.

Rancho Algodon is a project of Lewis Development, Inc. of Carmichael, California. Lucky Bell Corporation, also of Carmichael, is the contractor.

*(Continued from cover)*

transport, and installed by pulling them all the way up through a shaft in the middle of the building. Anchor plates provide a clamp on each floor. Thermal expansion and contraction are accommodated by the flexibility of the pipe.

Duraflex polybutylene pipe's light weight enables one man to carry up to a 500-foot coil of pipe over his shoulder. Project manager Al Boree, of W. W. Gay, has not calculated the time savings for installation yet, but he states, "We are just learning to use polybutylene and, in the long run, we do expect there will be considerable savings in installation time."



Boree views the polybutylene pipe installation as a pilot project to test the pipe's corrosion-resistance and simple, low-cost installation.

According to Boree, "Many normal domestic systems in Jacksonville, using copper or galvanized steel, will leak through electrolysis or corrosion within a few months after initial operation."

Boree mentions an additional benefit offered by polybutylene: its elasticity lessens the effects of water shock. "On this job we are using two shock stops per floor; normally we need two in each bedroom." And, although freeze damage to pipes is not a major problem in Jacksonville, Boree says that the pipe's freeze resistance provides another extra benefit in that the pipe will "never break because of bad weather."

Sundale Manor was completed in October, 1982, with a total of 8,180 feet of Duraflex polybutylene pipe in place at that time. The long-term benefits of polybutylene pipe in this particular building are not yet proven. But, says Jimmy Lasco, "If this works as well as we hope, we'll be using it all the time."

## Code bodies grant approval for polybutylene pipe.

Recent code approvals for Duraflex polybutylene pipe for use in hot and cold water plumbing service include:

State of New Hampshire  
State of New Mexico  
Bay County, Florida  
Montgomery County, Maryland  
Prince George County, Maryland  
Clark County, Nevada

Waccom County, Washington  
Bellingham, Washington  
Sioux City, Iowa  
Las Vegas, Nevada  
Scottsdale, Arizona

## Where to buy polybutylene pipe

Shell Chemical does not manufacture pipe, but the following independent manufacturers produce pipe from polybutylene resin:

Bristolpipe  
P.O. Box 184  
Bristol, Indiana 46507  
219/848-4402  
Attn: Mr. Tony Ernst

Delta Faucet Co.  
55 East 11th Street  
P.O. Box 40980  
Indianapolis, Indiana 46280  
317/848-1812  
Attn: Mr. George Davis

Trojan Plastics, Inc.  
2211 N. 38th Street  
Tampa, Florida 33605  
813/242-4211  
Attn: Mr. Brand Laseter

U.S. Brass  
Qest Plumbing Systems  
901 Tenth Street  
Plano, Texas 75074  
214/423-3576  
Attn: Mr. B.E. Smith

Vanguard Plastics, Inc.  
P.O. Box 346  
McPherson, Kansas 67460-0346  
316/241-6369  
Attn: Mr. Keith Swinchart

Westflex Manufacturing Co.  
P.O. Box 4009  
Richmond, California 94802  
415/233-6670  
Attn: Mr. J. Nusbaum

Western Products Company  
P.O. Box 803  
Union City, California 94587  
415/471-8856  
Attn: Mr. W. J. McGlinchy

Wrightway Mfg. Co.  
Beatrice Plumb Products Group  
1050 Central Avenue  
Park Forest So., Illinois 60466  
312/534-0500  
Attn: Mr. Ralph W. Arboe

The Duraflex Polybutylene Pipe is published periodically by the Plastics Business Center of Shell Chemical and is available to anyone wishing to receive it. Comments and questions are welcome.

Address correspondence, including requests for additional copies, to Shell Chemical Communications, Room 1227, One Shell Plaza, Houston, Texas 77002.

Printed in U.S.A. 1983,  
Shell Chemical Company.



DURAFLEX™ POLYBUTYLENE

# PERFORMANCE REPORT

SHELL CHEMICAL COMPANY



Comparison tests confirmed:  
Installed cost  
of polybutylene plumbing  
was 44% less than that  
of copper.

# DURAFLEX™ POLYBUTYLENE PERFORMANCE REPORT

SHELL CHEMICAL COMPANY

Recent quantitative comparison tests have concluded that the total labor and material costs to install a plumbing system with Duraflex™ polybutylene pipe were 44% less than those of copper in virtually identical installations.

The tests were conducted in the Pleasant Valley subdivision located west of Fairfax, Virginia and Washington, D.C., by the National Association of Homebuilders Research Foundation, Inc., an independent research firm. Homes in the subdivision range from modest to luxury offering a variety of handsome energy efficient designs.

For the tests, plumbing installations in two similar, 2 1/2 bath, single-family homes were compared. One home had a full basement and was plumbed with copper plumbing using the traditional cut, fit and solder installation method. The other home had a crawl space and was plumbed with Duraflex™ polybutylene plumbing pipe, using insect fittings and aluminum crimp ring connections. The houses were plumbed by a plumber who was experienced in copper installation and who had previously installed five plumbing systems using Duraflex polybutylene.

The polybutylene plumbed house had more cramped working conditions in one area and required slightly more pipe than

\*Duraflex™ is a trademark of Shell Chemical Company for its polybutylene resins. Shell Chemical does not manufacture pipe.

the copper house because the crawl space limited direct routing. This meant a slight advantage for the copper installation. The only other difference in the two houses was the location of the water heater and the water meter.

### Objective and fair testing yields relevant results

The 44% cost savings realized in the polybutylene plumbed house are based on the material and time savings. Total installed material and labor costs for the polybutylene plumbed house were \$138 less than the copper installation. It took 7 hours and 39 1/2 minutes to plumb the copper house, but only 5 hours and 55 1/2 minutes to plumb the polybutylene house. Material costs included all indoor supply piping and fittings running from the meter yokes to the fixture connections, but did not include valves.

Armed with a stop watch, a specially ruled recording book, a camera and a pen, Hila Anderson, Senior Industrial Engineer with NAHB Research Foundation, Inc., observed, measured, counted and recorded the work performed, actions made, and materials used by the plumber.

To ensure objective, comparable and applicable results, Anderson used several established sampling and factoring methods common in gathering and compiling this type of research data. These included an averaging of the plumber's

efforts and conditions with other plumbers in general. Thus, the results are applicable for an adequately trained plumber to perform the installation with an acceptable amount of personal time and breaks.

NAHB Research Foundation, Rockville, Maryland, a wholly-owned subsidiary of the National Association of Home Builders which operates separately as an autonomous unit, conducted the study. Over 80% of their work is for clients other than the NAHB and its members. Anderson said, "We're interested in anything that helps the building industry, verifying a new product or technique, and telling the industry about it."

### Strength and flexibility set Duraflex pipe apart.

The real difference between polybutylene pipe and other plastic pipe is the Duraflex polybutylene resin. Duraflex



Hila Anderson observed and recorded the plumber's actions and materials used.

is a durable, tough plastic. But unlike many other plastics, polybutylene is flexible rather than stiff or brittle. As a result, the pipe made from Duraflex resin can easily withstand household water pressures at elevated temperatures and its flexibility and light weight allow plumbers to curve it around obstacles and bends with fewer connections. Because it is chemically inert, there will be no problems with corrosion, electrolysis, or scale buildup.



Connections and fittings can be made by one of several mechanical methods which are easily learned and performed. Gary Peed, the plumbing contractor for the test houses, said, "The first time I put the pipe (polybutylene) in was slow, but you pick up how to work with it pretty easily. My time is much better now." Each of the installation methods takes advantage of the flexible nature of polybutylene to make quick, strong, and permanent connections. As Gary Peed puts it, "You don't have to solder anything or use any glue. There's less time, energy and equipment involved."

### A durable pipe full of advantages.

How does Peed feel about polybutylene pipe in general? "I like it better than copper. It's easier, faster and it's lower in cost. I use it for almost all of my work now."

Other advantages to polybutylene pipe, both builders and plumbers cite: corrosion and scale resistance; self-insulating,

thus energy efficient for hot water lines; and if water freezes in it, the pipe won't break.

Those were the reasons Don Crosen, Superintendent for R.J.L. Associates' Pleasant Valley subdivision, selected polybutylene pipe. Crosen has realized the cost savings which the NAHB Research Foundation tests revealed, stating:

"We're saving on the average of about \$150 to \$200 per house." Another big advantage Crosen cited... "is customer satisfaction. That's very important to us. We want our owners to be happy with the house they buy. This polybutylene pipe helps us supply that satisfaction."

### Comparison Tests—Results:

| Materials                     | Copper System                       | Polybutylene System                |
|-------------------------------|-------------------------------------|------------------------------------|
| Pipe                          | \$156.93                            | \$64.84                            |
| Solder & Flux                 | \$ 20.73                            | negligible                         |
| Fittings                      | \$ 21.79                            | \$19.12                            |
| Suspension Clamps             | \$ 1.98                             | \$ 4.81                            |
| <b>TOTALS</b>                 | <b>\$201.43</b>                     | <b>\$88.77</b>                     |
| <b>Labor at \$15/hr</b>       |                                     |                                    |
| Cut & install pipe & fittings | (176.0 min.)<br>\$ 44.00            | (146.5 min.)<br>\$36.63            |
| Connect pipes & fittings      | (162.5 min.)<br>\$ 40.62            | (88.0 min.)<br>\$22.00             |
| Misc.                         | (51.5 min.)<br>\$ 12.88             | (53.5 min.)<br>\$13.37             |
| Mounting Blocks               | (41.5 min.)<br>\$ 10.37             | (39.5 min.)<br>\$ 9.87             |
| Set-up & Layout job           | (28.0 min.)<br>\$ 7.00              | (28.0 min.)<br>\$ 7.00             |
| <b>TOTALS</b>                 | <b>(459.5 minutes)<br/>\$114.87</b> | <b>(355.5 minutes)<br/>\$88.87</b> |

|   | Copper System | Polybutylene System                       |
|---|---------------|---|
| Total Costs Material & Labor for supply piping installation | \$316.30      | \$177.64                                  |
| Polybutylene Savings  |               |   |
| Time  |               | 104.0 minutes less to install than copper |
| Money (includes labor costs savings)                        |               | \$138.66                                  |

Note: For each \$1.00 wage rate differential increase above the \$15/hour figure used in the comparison, polybutylene's advantage increases \$1.73 in savings.



Test homes' subdivision superintendent, Don Crosen, cited customer satisfaction as a polybutylene pipe advantage.

#### Polybutylene pipe supplies customer satisfaction.

"One of the biggest complaints in a new house is noise in the plumbing," Crosen continued. "This pipe is quiet, no hammer, no vibration. You don't even hear water running. So polybutylene eliminates that source of complaints, and satisfies our customers."

Another problem solved by polybutylene pipe involves hanging the sheet rock. According to Crosen, occasionally a rigid pipe will get bumped hard enough during sheet rock installation to cause it to break, crack and leak. "Often that leak won't show up until after the construction is completed, or worse... after the owner moves in. That's an expensive repair. But because this polybutylene pipe is so flexible, it doesn't break if it gets bumped or knocked. So once again, customer satisfaction," he said.

#### Satisfaction for builders, too.

Crosen has found satisfaction with polybutylene pipe in many ways, summing up, "It's less expensive. Better for customers. Easier to install, repair and add extra fixtures to later. It won't corrode and minerals won't adhere to it. We get less call-backs for repairs because of polybutylene pipe. It's another way to please our customers."

Crosen added, "It's good for builders and supervisors, too. Supervisors have to deal with the problems. They're less problems with polybutylene pipe."



Come to  
Shell for answers

#### Warranty

Polybutylene pipe is manufactured from a material produced by Shell Chemical Company. All products purchased from Shell are subject to terms and conditions set out in the contract, order acknowledgement and/or bill of lading. Shell warrants only that its product will meet those specifications designated as such herein or in other publications. All other information supplied by Shell is considered accurate but is furnished upon the express condition that the customer shall make its own assessment to determine the product's suitability for a particular purpose. No warranty is expressed or implied regarding such other information, the data upon which the same is based, or the results to be obtained from the use thereof; that any product shall be merchantable or fit for any particular purpose; or that the use of such other information or product will not infringe any patent.

#### Shell Chemical Company Sales Offices Polybutylene

|  |   |
|--|---|
| <b>Northeast</b><br>(914) 694-1116     | 2 Corporate Park Drive, Suite 404<br>White Plains, New York 10604 |
| <b>Southeast</b><br>(404) 955-4600     | 320 Interstate N. Parkway<br>Atlanta, Georgia 30339               |
| <b>Central South</b><br>(713) 241-3897 | One Shell Plaza<br>Houston, Texas 77002                           |
| <b>West</b><br>(209) 952-1908          | P.O. Box 7637<br>Stockton, California 95207                       |

#### For international sales, contact: Pecten Chemicals, Inc.

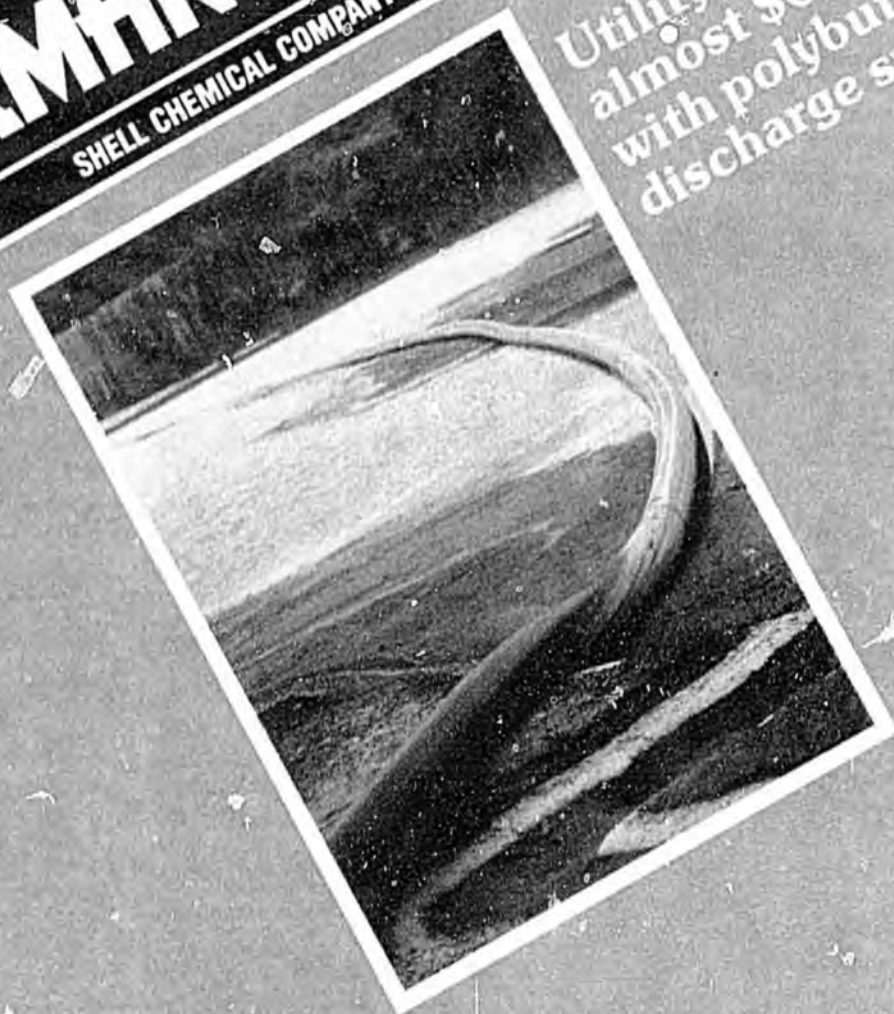
(713) 241-6161 One Shell Plaza  
Houston, Texas 77002



DURAFLEX™ POLYBUTYLENE

# PERFORMANCE REPORT

SHELL CHEMICAL COMPANY



Utility saves  
almost \$67,000  
with polybutylene  
discharge system

# DURAFLEX™ POLYBUTYLENE PERFORMANCE REPORT SHELL CHEMICAL COMPANY

Installation of pipe made from Duraflex\* polybutylene resin for discharge systems at two of Duke Power Company's coal-fired stations resulted in a cost saving of almost \$67,000 compared with a traditional steel pipe system and helped create an efficient method of waste disposal.



The discharge lines, which were attached as extensions to existing cast iron lines, were laid at Duke's Riverbend Steam Station near Charlotte, North Carolina, and at the Cliffside Station. Duke engineers estimated that the company saved \$17,000 in material costs with the Riverbend installation and almost \$50,000 at Cliffside because steel supports were not required for the polybutylene pipe.

\*Duraflex™ is a trademark for polybutylene resins made by Shell Chemical Company. Shell Chemical does not manufacture pipe.

## Increased waste disposal

The use of polybutylene pipe for discharge lines came after the utility completed a \$50-million program to control emission from the coal-fired plants. The company faced a major task in the ultimate disposal of increased volumes of fly ash and other residual byproducts of the coal burning process. At Riverbend, for example, Duke engineers estimated about 180 tons of abrasive fly ash and 45 tons of sharp-edged bottom ash would be produced daily.

Duke's solution to the problem was a system using existing settling ponds in combination with the novel utilization of large-diameter polybutylene pipe. More effective use of the settling ponds was made possible



by the installation of the flexible polybutylene discharge lines that help distribute evenly the high volume of residual materials captured by the emission control devices.

The SDR 13.5 polybutylene pipe was made from resin produced by Shell Chemical Company.

At the Riverbend Station, as with other coal-fired generating stations, unburned material previously was mixed with water. The slurry then was pumped from the station through a durite pipe, cast stainless steel of 550 brinnell, to a cast iron discharge pipe on into settling ponds. After the particulate matter settled out, environmentally acceptable waste water was fed into the nearby Catawba River.

The added volume of material captured by electrostatic precipitators at Riverbend caused the debris to build up at the outlet of the discharge pipe, just inside the dike enclosing the 2.5-acre pond. This hampered dispersal of solids in the effluent.

## Old system too expensive

A standard response to the dispersal problem would have been construction of a



mounted steel pipe, joined with goosenecks to permit mobility, that would have carried slurry to the far reaches of the impoundment. The system would have been both expensive and cumbersome.

Instead, Duke engineers, attracted by polybutylene's toughness, resistance to scour and abrasion, flexibility and light weight, decided to install 1,600 feet of 12-inch butt-welded pipe in the pond to serve as a conduit for dispersing the effluent.

Use of the polybutylene pipe, instead of the traditional steel pipe hookup, produced a \$17,000 saving on just one installation.

## Requires no supports

An added advantage of the pipe manufactured from Duraflex polybutylene is that since it is less dense than water, it



requires no additional supports, only an anchoring system at its terminus that is moved periodically to direct slurry discharge into areas of the pond that otherwise would be left unfilled.

Temperature in the line at Riverbend ranges from 79° to 100° F, depending upon the temperature of the river from which the plant draws water. The percentage of solids carried by the line can range up to 85 to 90 percent, but the average is less than half that number. Flow velocity in the line is 3.5 fps.

Duke Power engineers

estimate that since the installation in October, 1977, the effluent line has carried more than 140,000 tons of fly ash and over 50,000 tons of bottom ash.

The polybutylene line, which was inspected at the flange joining the metal pipe two months after installation and at its outlet frequently since then, still shows no appreciable wear after two years of service.

## Second line installed

Impressed by both the economy and effectiveness of the slurry line, Duke engineers installed a second polybutylene line at the Riverbend



station to carry mill tailings (stones and other impurities delivered with coal) out to the settling pond. The second line is 10 inches in diameter and 800 feet long. It, too, connects to a cast iron pipe that formerly discharged directly into the water from the pond side of the dike.

Mill tailings, carried with water through the line at a flow velocity of 5.8 fps, range in size from one-half to three-quarters inch in diameter. Although abrasive, they do not have the scouring effect of the particulate matter flowing through the larger line.

The mill tailings line has been in use almost two years. As the ponds become full, Duke reclaims the surface and relocates the installation.

Based on the success of the Riverbend facility, the power company decided to install similar systems at two additional coal-fired power stations, Cliffside and Allen, in the Carolinas.



At Cliffside, two 14-inch lines, each 3,500 feet long, were installed to carry bottom and fly ash and mill tailings from about 5,000 tons of coal a day. The ash line operates at 350 psi, with jet pump and booster, and with an open discharge. This line represents an additional saving for the power company. Since the polybutylene line could be laid directly on the ground, its use resulted in a construction cost saving of almost \$50,000 because 117 steel supports that would have been required by a steel pipeline were not needed.

The similar Allen installation is scheduled to be operational around the first of the year.



**Shell Chemical Company  
Polybutylene Sales Offices**

**Eastern**            2 Corporate Park Drive.  
**(914) 694-1116**    Suite 404  
                          White Plains, New York 10604

**Western**            One Shell Plaza  
**(713) 241-6719**    Houston, Texas 77002

**For international sales, contact:**

**Pecten**             One Shell Plaza  
**Chemicals, Inc.**    Houston, Texas 77002  
**(713) 241-5161**

**Warranty**

Polybutylene pipe is manufactured from a material produced by Shell Chemical Company. All products purchased from Shell are subject to terms and conditions set out in the contract, order acknowledgement and/or bill of lading. Shell warrants only that its product will meet those specifications designated as such herein or in other publications. All other information supplied by Shell is considered accurate but is furnished upon the express condition that the purchaser shall make its own assessment to determine the product's suitability for a particular purpose. No warranty is expressed or implied regarding such other information, the data upon which the same is based, or the results to be obtained from the use thereof; that any product shall be merchantable or fit for any particular purpose; or that the use of such other information or product will not infringe any patent.

February, 1982

Come to   
**Shell for answers**



**EXECUTIVE SUMMARY**

Widespread use of plastics has added both convenience and hazards to modern living. Below is a study of the dangers of toxic gases produced by the combustion of plastic pipes . . .

# Toxicity of Gases From Polybutylene And Douglas Fir

By **CARLOS J. HILADO & PATRICIA A. HUTTINGER**  
Product Safety Corporation

Because of their versatility and performance advantages, plastics have found their way into numerous applications. This widespread use has in-

evitably brought them into many applications in which safety upon exposure to heat or fire is an important consideration, and their response characteristics need to be known.

One aspect of safety which has caused considerable concern is the possible generation of toxic gases upon exposure to heat or fire. It is

impossible to simulate all possible conditions under which such exposures could occur, but manufacturers conscious of their responsibilities to the consumer and to the general public nonetheless make an effort to evaluate their products by means of available technology to obtain some degree of assurance that there would be no unreasonable risk. Screening of materials is needed, because investigation of every possible formulation for every possible exposure is not feasible.

A laboratory toxicity screening test method has been developed by the authors to serve as a means for comparing materials on the basis of relative toxicity under specified test conditions, using apparatus, facilities and personnel which would be within the capabilities of most laboratories. With the purpose of screening in mind, this method is intended to indicate which materials are more toxic under spe-

Table 1. Toxicity Test Data on Polybutylene Pipe and Douglas Fir (PSC Condition 1 or NASA-USF Procedure B)

| material      | test no. | time to staggering min | time to convulsions min | time to collapse min | time to death min |
|---------------|----------|------------------------|-------------------------|----------------------|-------------------|
| DURAFLEX 4127 | 1        | 16.32 ± 0.88           | 17.75 ± 1.02            | 20.22 ± 2.44         | 24.35 ± 3.20      |
|               | 2        | 16.53 ± 0.27           | 17.54 ± 1.34            | 18.70 ± 1.73         | 22.39 ± 2.77      |
|               | mean     | 16.42 ± 0.15           | 17.64 ± 0.15            | 19.46 ± 1.07         | 23.37 ± 1.39      |
| DURAFLEX 4121 | 1        | 16.45 ± 0.45           | 16.88 ± 0.73            | 18.47 ± 0.14         | 21.49 ± 0.95      |
|               | 2        | 16.33 ± 1.08           | 17.77 ± 0.96            | 18.45 ± 0.88         | 21.93 ± 0.54      |
|               | mean     | 16.39 ± 0.08           | 17.32 ± 0.63            | 18.46 ± 0.01         | 21.71 ± 0.31      |
| Douglas fir   | 1        | 10.92 ± 2.18           | 14.98 ± 0.58            | 16.09 ± 1.05         | 18.57 ± 0.79      |
|               | 2        | 12.29 ± 0.69           | 14.04 ± 0.52            | 14.41 ± 0.42         | 16.77 ± 0.40      |
|               | mean     | 11.60 ± 0.97           | 14.51 ± 0.66            | 15.25 ± 1.19         | 17.67 ± 1.27      |

cified test conditions and not necessarily to explain why they are more toxic (1-11).

A large selection of test conditions can be used. The toxicity screening program used by the Product Safety Corporation employs 16 different sets of test conditions: the rising temperature program at 40°C/min from 200 to 800°C and seven fixed temperatures at 100°C intervals (200, 300, 400, 500, 600, 700, and 800°C), both without forced air flow and with nominal 1 L/min air flow. This program has been used with polyethylene (12), polypropylene (13), polystyrene (14), polycarbonate (15), polyoxymethylene (16), polyethersulfone (17), polyetherimide (18), polytetrafluoroethylene (19) and Douglas fir (20).

Experiments at a succession of fixed temperatures have research value in that they determine the material responses at particular temperatures. The rising temperature method offers the potential for more cost-effective screening by attempting to integrate the effect of successive tem-

peratures, and provides the ability to compare test results with those obtained for over 300 materials previously evaluated under the same rising-temperature conditions.

This report presents the toxicity test data obtained for two samples of polybutylene pipe and one sample of Douglas fir wood, evaluated under the routine screening test conditions of rising temperature at 40°C/min from 200 to 800°C without forced air flow. These test conditions have been described as Procedure B of the NASA-USF toxicity screening test method, and are included in the BART specifications for seat cushioning materials (21).

#### MATERIALS

The materials evaluated were two samples of polybutylene pipe received from Shell Oil Company, Houston, Texas. The samples were identified as follows:

- DURAFLEX Polybutylene 4127 (grey)
- DURAFLEX Polybutylene 4121 (black)

For purposes of comparison, a sample of Douglas fir wood was obtained from Underwriters Laboratories, Santa Clara, California. This material met the requirements of UL Standard 127 for testing of fireplace inserts.

#### DATA AND DISCUSSION

The times to various animal responses are presented in Table 1. Reproducibility was generally good.

Average times to death with the polybutylene pipe samples ranged from 21.5 to 24.4 minutes, compared to 16.8 to 18.6 minutes for Douglas fir wood. On the basis of time to death, the polybutylene pipe samples appeared to be significantly less toxic than Douglas fir under these particular test conditions.

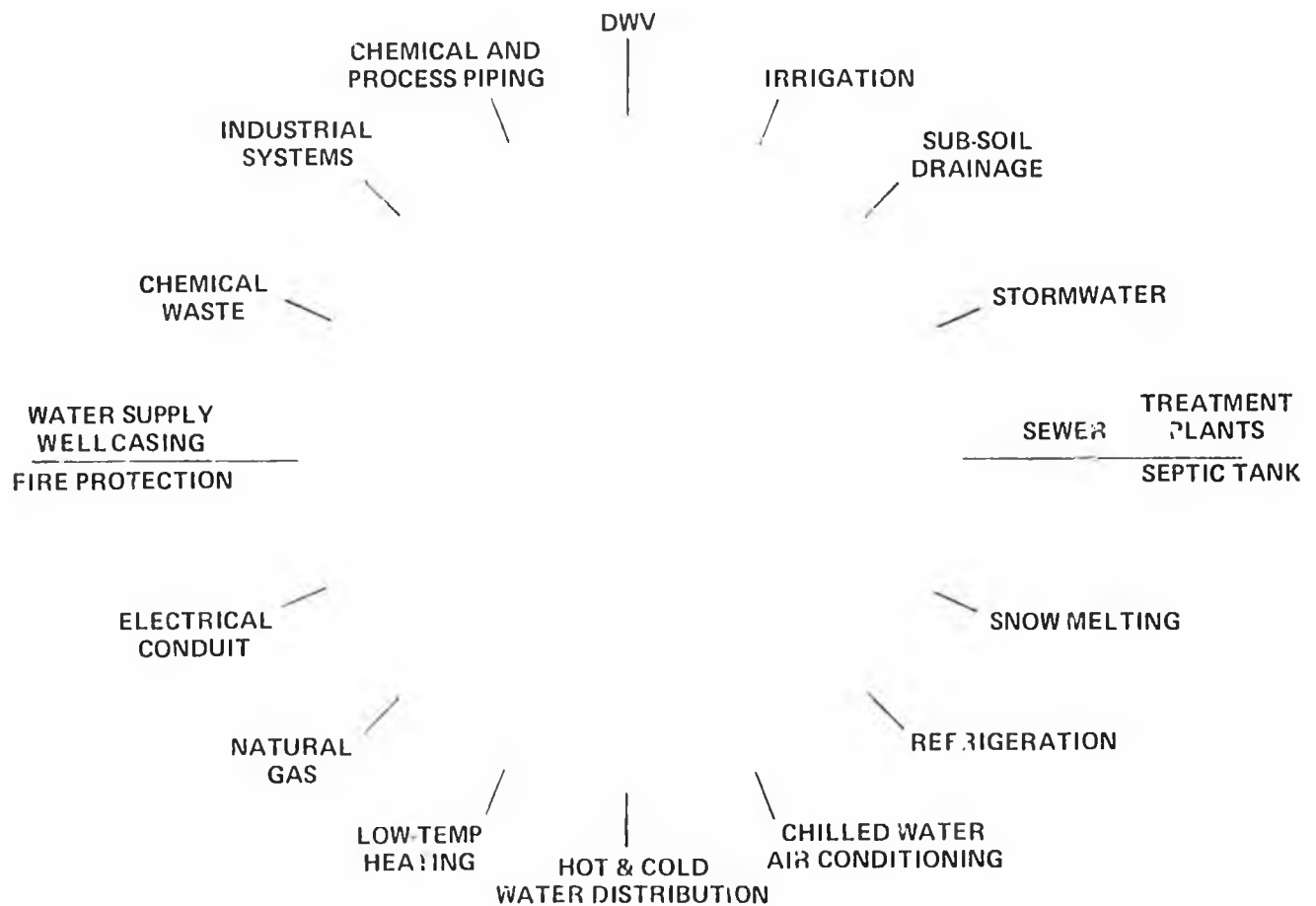
#### CONCLUSIONS

The polybutylene pipe samples evaluated appeared to exhibit significantly less toxicity than Douglas fir under these particular test conditions.

#### REFERENCES

1. C.J. Hilado, "Screening Materials for Relative Toxicity in Fire Situations," *Modern Plastics*, Vol. 54, No. 7, 64-66, 68 (July 1977).
2. C.J. Hilado, H.J. Cumming, and C.J. Casey, "Relative Toxicity of Materials in Fire Situations Determined in New Testing," *Western Fire Journal*, Vol. 30, No. 2, 32-33 (February 1978).
3. C.J. Hilado, H.J. Cumming, and C.J. Casey, "Relative Toxicity of Materials in Fire Situations," *Modern Plastics*, Vol. 55, No. 4, 92, 94, 96 (April 1978).
4. C.J. Hilado, "Toxicity of Pyrolysis Gases from Materials," *SAMPE Quarterly*, Vol. 9, No. 3, 14-15 (April 1978).
5. C.J. Hilado and H.J. Cumming, "Relative Toxicity of Pyrolysis Gases from Materials: Effects of Chemical Composition and Test Conditions," *Fire and Materials*, Vol. 2, No. 2, 68-79 (April 1978).
6. C.J. Hilado, H.J. Cumming, and C.J. Casey, "Toxicity of Pyrolysis Gases from Natural and Synthetic Materials," *Fire Technology*, Vol. 14, No. 2, 136-146 (May 1978).
7. C.J. Hilado, H.J. Cumming, and A.M. Machado, "Relative Toxicity of Pyrolysis Gases from Materials: Specific Toxicants and Special Studies," *Fire and Materials*, Vol. 2, No. 4, 141-153 (October 1978).
8. C.J. Hilado and D.P. Brauer, "How Test Conditions and Criteria Effects Impact on Pyrolysis Gas Toxicity Findings," *Modern Plastics*, Vol. 56, No. 3, 62-64 (March 1979).
9. C.J. Hilado, H.J. Cumming, and J.E. Schneider, "Relative Toxicity of Pyrolysis Gases from Materials: Effects of Temperature, Air Flow, and Criteria," *Fire and Materials*, Vol. 3, No. 4, 183-187 (December 1979).
10. C.J. Hilado and P.A. Huttlinger, "Concentration/Time Relationships in Oil Gas Toxicity," *Fire Technology*, Vol. 16, No. 3, 192-203 (August 1980).
11. C.J. Hilado and P.A. Huttlinger, "Rising vs. Fixed Pyrolysis Temperature in Evaluating Toxicity," *Modern Plastics*, Vol. 57, No. 9, 89, 94 (September 1980).
12. C.J. Hilado and D.P. Brauer, "Polyethylene: Effect of Pyrolysis Temperature and Air Flow on Toxicity of Pyrolysis Gases," *Journal of Combustion Toxicology*, Vol. 6, No. 1, 63-68 (February 1979).
13. C.J. Hilado, J.E. Schneider, and D.P. Brauer, "Toxicity of Pyrolysis Gases from Polypropylene," *Journal of Combustion Toxicology*, Vol. 6, No. 2, 109-116 (May 1979).
14. C.J. Hilado, E.M. Olcomendy, and D.P. Brauer, "Effect of Pyrolysis Temperature and Air Flow on Toxicity of Gases from a Polystyrene Polymer," *Journal of Combustion Toxicology*, Vol. 6, No. 1, 13-19 (February 1979).
15. C.J. Hilado and D.P. Brauer, "Bisphenol A Polycarbonate: Effect of Pyrolysis Temperature and Air Flow on Toxicity of Pyrolysis Gases," *Journal of Combustion Toxicology*, Vol. 6, No. 2, 81-85 (May 1979).
16. C.J. Hilado, J.E. Schneider, and D.P. Brauer, "Toxicity of Pyrolysis Gases from Polyoxymethylene," *Journal of Combustion Toxicology*, Vol. 6, No. 1, 30-36 (February 1979).
17. C.J. Hilado and E.M. Olcomendy, "Toxicity of Pyrolysis Gases from Polyether Sulfone," *Journal of Combustion Toxicology*, Vol. 6, No. 2, 117-123 (May 1979).
18. D.E. Floryan and G.L. Nelson, "Fire Performance Studies on Polyetherimide," *Journal of Fire and Flammability*, Vol. 11, No. 4, 284-301 (October 1980).
19. C.J. Hilado and J.E. Schneider, "Toxicity of Pyrolysis Gases from Polytetrafluoroethylene," *Journal of Combustion Toxicology*, Vol. 6, No. 2, 91-98 (May 1979).
20. C.J. Hilado, E.M. Olcomendy, and D.P. Brauer, "Effect of Pyrolysis Temperature and Air Flow on Toxicity of Gases from Douglas Fir in USF Toxicity Test," *Journal of Combustion Toxicology*, Vol. 6, No. 1, 48-57 (February 1979).
21. C.E. Jenkins and H.S. Procter, "BART Seat Specification Development," *Proceedings of the California Conference on Fire Toxicity*, Vol. 2, 80-109 (1980). ★

PLEASE NOTE: THE FOLLOWING PAGES WERE TREATED  
AS A UNIT IN THE ORIGINAL DOCUMENT



**A COMPREHENSIVE LISTING OF  
COMMON APPLICATIONS OF PLASTIC PLUMBING SYSTEMS  
COVERED BY NATIONAL CONSENSUS STANDARDS**

Published by

**Plastic Pipe and Fittings Association**

999 North Main St. • Glen Ellyn, IL 60137 • Phone: 312/858-6540

## INTRODUCTION

You will find plastic plumbing materials to be an excellent value because of initial cost, ease of installation, low maintenance cost, long life, and their significant energy savings in manufacture and use. Plastics pipe and fittings compare favorably with all other materials.

This brochure provides engineers, code officials and consumers with basic information about plastics piping. Used successfully in the United States since 1943, these "engineered" plumbing materials, often called plastics piping systems, have met the challenge of providing improved technological advancements needed in the construction industry.

Plastics vary greatly in their characteristics and properties from one to another. These differences are utilized in plastics piping to the advantage of the consumer in two ways: first, through proper design each plastic raw material is properly applied and controlled (see ASTM Standards); and, second, a competitive market exists within plastics piping systems since the suitable characteristics and properties of different plastics often overlap in piping applications.

Plastic plumbing materials commonly in use are:

- ABS     ACRYLONITRILE-BUTADIENE-STYRENE, hard, strong, smooth interior surface, chemically resistant, not affected by contact with water or soil.
- PE     POLYETHYLENE, excellent resistance to chemicals, corrosive environments and rupture from mechanical shock.
- PB     POLYBUTYLENE, higher temperature strength combined with long-term strength and chemical resistance.
- PVC     POLYVINYL CHLORIDE, hard, strong, smooth interior surface, chemically resistant, not affected by contact with water or soil.
- CPVC   CHLORINATED POLYVINYL CHLORIDE, higher heat and chemical resistance than PVC.
- PP     POLYPROPYLENE, excellent rigidity, high strength and chemical resistance.
- SR     STYRENE RUBBER, high in tensile strength and stiffness, also, resistant to both corrosive soils and sanitary wastes.

Plastics piping do not conduct electricity and are not susceptible to galvanic or electrolytic corrosion.

The following chart shows the general categories of piping applications of plastic materials covered by applicable national consensus standards:

| Piping Application        | Plastic Material |    |    |     |      |    |    |
|---------------------------|------------------|----|----|-----|------|----|----|
|                           | ABS              | PE | PB | PVC | CPVC | PP | SR |
| Tubular waste             | X                |    |    | X   |      | X  |    |
| Outside sewers and drains | X                |    |    | X   |      |    | X  |
| Drain, waste & vent (DWV) | X                |    |    | X   |      |    |    |
| Water piping              | X                | X  | X  | X   | X    |    |    |
| Gas piping                | X                | X  | X  | X   |      |    |    |
| Septic fields - sub-soil  |                  | X  |    | X   |      |    | X  |
| Chemical waste piping     | X                | X  |    | X   |      | X  |    |
| Industrial process piping | X                | X  | X  | X   | X    | X  |    |
| Other piping applications | X                | X  | X  | X   | X    | X  | X  |

Dear Reader:

Welcome to the *Growing World of Plastics Piping!* This pamphlet is an introduction to one of the truly exciting, growth industries in America. Since 1960, the use of plastics in piping applications has multiplied 46 times! There are millions of plastics plumbing installations in service all across the country.

It has been estimated that 95% of all new piping installations made in residential construction is plastics. In the early stages of its development as a plumbing product, plastics were primarily used in drain-waste-vent applications. Over the years plastics piping has grown not only by dominating the DWV market, but by adding new materials and applications as well.

Plastics are now used extensively in water service piping and in water distribution systems. Additionally, many other plumbing products are now manufactured partially or completely with plastics materials.

The use of plastics in plumbing has grown because its use is economical and efficient. Its characteristics are also superior to competitive materials in a variety of important ways.

Even though the feedstocks of most plastics are derivatives of oil, plastics piping uses are highly energy efficient because it takes far less energy to manufacture comparable lengths and sizes of plastics pipe than metal piping products.

We are pleased to provide this easy reference guide to the *Growing World of Plastics Piping* giving the reader the basics of plastics in plumbing and its many, many applications.

Sincerely,

The Plastic Pipe and Fittings Association

## THE MAJOR BENEFITS OF USING PLASTICS PIPING MATERIALS

● **Plastics piping is energy efficient.** In a recent study it was estimated that during 1977, 324 trillion B.T.U.'s more energy would have been required to make metal piping to replace the plastics piping which was manufactured. That equals a savings of about 56 million barrels of oil because of plastics pipe. Additionally, in hot water distribution systems, plastics piping serves as an insulator itself to reduce heat loss. While plastics piping is made from petroleum based products, it is truly doing its share to reduce energy consumption.

● **The initial cost of piping materials** is important to users. Here, again, plastics piping receives high marks. Its initial cost is significantly less than the cost of other material.

● **Installation costs** of plastics versus other materials represent further savings to the user. Cutting, joining and installing plastic pipe is far simpler than the same processes for other materials. At today's labor rates, increased productivity is vital.

● **The ease of handling plastics pipe** is a tremendous benefit. Not only does its light weight present real benefits to the installer when working in tight places, but a normal length of DWV pipe can be carried by one man whereas two men or a machine are required to move heavier metal piping.

● **The long life of a material** is important to the consumer of the material. Millions of plastics piping installations have been in service for over a quarter of a century and are still functioning the way they did the day they were installed.

● **Plastics piping is corrosion resistant and free flowing.** Plastics piping systems are resistant to normal household chemicals and many other substances which might enter a sanitary drainage system. DWV piping does not "gum up" as does some other materials. The smooth wall of the plastics makes transport of wastes and water more effective. Plastics water piping also resists the kind of interior build up that sometimes plagues metal piping systems.

● **Plastics piping is usually marked to aid in identification.** Manufacturers making pipe and fittings according to ASTM standards and having the material tested to those standards usually mark the pipe and fittings to show the use and the applicable standard. This procedure makes it simple for users to properly identify the many kinds of plastics pipe and fittings which are available for different applications.

That's a pretty impressive list of benefits for any material. If you have not used plastics piping before, it may be time you did. If you have not been served by plastics piping, you are missing the many benefits which are available through its use. Our industry is proud of the materials which it offers for so many varying piping applications. We stand ready to serve our customer to bring them the benefits of **The Growing World of Plastic Piping.**

## CODE ACCEPTANCE

Plumbing codes are the basis for acceptance of materials for specific plumbing installations and for the methods of installation. Model plumbing codes, sponsored by associations of building and plumbing code officials or other industry groups, are the basis for most of the over 14,000 local codes in this country.

The following organizations (and their model plumbing codes) accept the use of plastics for piping applications:

Building Officials and Code Administrators International,  
Basic Plumbing Code

International Association of Plumbing and Mechanical  
Officials, Uniform Plumbing Code

International Conference of Building Officials,  
Plumbing Code

National Association of Plumbers/Heating, Cooling,  
Contractors/American Society of Plumbing  
Engineers, National Standard Plumbing Code

Southern Building Code Congress International,  
Standard Plumbing Code

Plastics piping is also an approved material for use in U.S. Government building projects according to directives of the U.S. Department of Housing and Urban Development.

Regardless of the material you choose to use, check your local plumbing code for approved materials and accepted installation practices.

---

The material contained herein was assembled through the efforts of the Plastic Pipe and Fittings Association for general informational purposes only. The PPFA, nor any of its members, make any warranties or representations of any kind whatsoever regarding the products or the materials described or referenced herein.

Additional information on plastics piping in plumbing applications may be obtained from the Plastic Pipe and Fittings Association, 999 North Main St., Glen Ellyn, Illinois 60137.

Additional information on plastics piping use for water and sewer mains may be obtained from the Uni-Bell Plastics Pipe Association, 2695 Valla Creek Dr., Suite 164, Dallas, Texas 75234.

General information on plastics piping for other purposes may be obtained from the Plastic Pipe Institute, 355 Lexington Ave., New York, New York 10017.

# PPFA

## Plastic Pipe and Fittings Association

999 North Main St. • Glen Ellyn, IL 60137 • Phone: 312/858-6540

| APPLICATION   | PLASTIC MATERIAL | RIGID FLEXIBLE | ASTM STANDARD   | SCOPE  |
|---|------------------|----------------|---|--|
| DRAIN, WASTE & VENT (DWV)—<br>Building drain and waste, building storm and rainwater piping | ABS              | rigid          | D2661 & F628<br>D2235<br>F402                             | Pipe & Fittings<br>ABS solvent cement<br>Safe handling of S.C.   |
|   | PVC              | rigid          | D2665<br>D2564<br>F402<br>D2855                           | Pipe & Fittings<br>PVC solvent cement<br>Safe handling of S.C.<br>Making S.C. joints   |
|   | PVC              | rigid          | D2949<br><br>D2564<br>F402<br>D2855                       | Pipe & Fittings<br>(3.25 o.d.)<br>PVC solvent cement<br>Safe handling of S.C.<br>Making S.C. joints  |
| HOT & COLD WATER<br>DISTRIBUTION SYSTEMS  | CPVC             | rigid          | D2846<br>F493<br>F402                                     | Pipe, Tubing & Fittings<br>CPVC solvent cement<br>Safe handling of S.C.  |
|   | PB               | flexible       | D3309   | Pipe, Tubing & Fittings  |
| OUTSIDE SEWERS AND DRAINS —<br>Building sewer,<br>building storm sewer                      | ABS              | rigid          | D2751 & F628<br>D2235<br>F402<br>D3212<br>D2321<br>F477   | Pipe & Fittings<br>ABS solvent cement<br>Safe handling of S.C.<br>Elastomeric joints<br>Underground installation procedures<br>Elastomeric seals                                 |
|   | PVC              | rigid          | D3033<br>D2564<br>D2855<br>F402<br>D2321<br>F477<br>D3212 | Pipe & Fittings, Type PSP<br>PVC solvent cement<br>Making S.C. joints<br>Safe handling of S.C.<br>Underground installation procedures<br>Elastomeric seals<br>Elastomeric joints |

| APPLICATION   | PLASTIC MATERIAL | RIGID FLEXIBLE | ASTM STANDARD  | SCOPE  |
|---|------------------|----------------|--|--|
| WATER PIPING —<br>Water supply, water distribution,<br>yard sprinkler, swimming pool<br>piping, chilled water piping, low-<br>temp heating, irrigation systems,<br>industrial process piping, ice rinks,<br>ice melting, water well casing. | ABS              | rigid          | D1527<br>D2468<br>D2469<br>D2465<br>D2235<br>F402          | Pipe, Schedules 40 & 80<br>Fittings, Schedule 40, socket-type<br>Fittings, Schedule 80, socket-type<br>Fittings, Schedule 80, threaded<br>ABS solvent cement<br>Safe handling of S.C.                            |
|   | ABS              | rigid          | D2282<br>D2235<br>F402<br>D2468<br>D2469                   | Pipe, SDR-PR, o.d. controlled<br>ABS solvent cement<br>Safe handling of S.C.<br>Fittings, schedule 40, socket-type<br>Fittings, schedule 80, socket-type   |
|   | ABS              | rigid          | F480   | Water Well Casings & Couplings, SDR  |
|   | PE               | flexible       | D2239<br>D2609   | Pipe, SDR-PR, i.d. controlled<br>Fittings, insert type   |
|   | PE               | flexible       | D2104<br>D2609   | Pipe, Schedule 40<br>Fittings, insert type   |
|   | PE               | flexible       | D3035  | Pipe, SDR-PR, o.d. controlled  |
|   | PE               | flexible       | D2737<br>D3261   | Tubing, SDR-PR<br>Fittings, butt-type, heat fusion   |
|   | PE               | flexible       | D2447<br>D3261   | Pipe, Schedules 40 & 80<br>Fittings, butt type, heat fusion  |
|   | PB               | flexible       | D2662<br>D2609   | Pipe, SDR-PR, i.d. controlled<br>Fittings, insert type   |
|   | PB               | flexible       | D2566  | Tubing, o.d. controlled  |
|   | PB               | flexible       | D3000  | Pipe, SDR-PR, o.d. controlled  |
|   | PVC              | rigid          | D1785<br>D2564<br>D2855<br>F402<br>D2466<br>D2467<br>D2464 | Pipe, Schedules 40, 80 & 120<br>PVC solvent cement<br>Making S.C. joints<br>Safe handling of S.C.<br>Fittings, Schedule 40, socket-type<br>Fittings, Schedule 80, socket-type<br>Fittings, Schedule 80, threaded |

|  |     |          |  |   |
|--|-----|----------|--|---|
|  |     |          | D2804<br>D2855<br>F402<br>D2321<br>F477<br>D3212 | PVC solvent cement<br>Making S.C. joints<br>Safe handling of S.C.<br>Underground installation procedures<br>Elastomeric seals<br>Elastomeric joints |
|  | PVC | rigid    | D2729<br>D2564<br>D2855<br>F402<br>D2321         | Pipe & Fittings<br>PVC solvent cement<br>Making S.C. joints<br>Safe handling of S.C.<br>Underground installation procedures                         |
|  | SR  | rigid    | D2852<br>D3122<br>F402<br>D2321<br>F477<br>D3212 | Pipe & Fittings<br>SR solvent cement<br>Safe handling of S.C.<br>Underground installation procedures<br>Elastomeric seals<br>Elastomeric joints     |
| SEPTIC DISPOSAL FIELDS &<br>SUB SOIL DRAINAGE —<br>Perforated Piping   | PE  | flexible | F405<br>F481                                     | Corrugated Tubing & Fittings, Perforated<br>Installation  |
|  | PVC | rigid    | D2729<br>F481                                    | Pipe & Fittings, Perforated<br>Installation   |
|  | SR  | rigid    | D3298<br>F481                                    | Pipe, Perforated<br>Installation  |
| TUBULAR WASTE —<br>Tube & fittings for accessible waste<br>connections | ABS | rigid    | F409<br>D2235<br>F402                            | Tube & Fittings<br>ABS solvent cement<br>Safe handling of S.C.  |
|  | PVC | rigid    | F409<br>D2564<br>D2855<br>F402                   | Tube & Fittings<br>PVC solvent cement<br>Making S.C. joints<br>Safe handling of S.C.  |
|  | PP  | rigid    | F409<br>D2657                                    | Tube & Fittings<br>Heat joining   |

thermoplastic pressure pipe under-  
ground see ASTM D 2774. For  
information on joints for plastic  
pressure pipe using elastomeric seals  
see ASTM D 3139. For procedures  
on flaring PE and PB Tubing see  
ASTM D 3140.

|      |       |  |   |
|------|-------|--|---|
| PVC  | rigid | D2241<br>D2564<br>D2855<br>F402<br>D2466<br>D2467<br>D3036 | Pipe, SDR-PR, o.d. controlled<br>PVC solvent cement<br>Making S.C. joints<br>Safe handling of S.C.<br>Fittings, Schedule 40, socket-type<br>Fittings, Schedule 80, socket-type<br>Line Couplings, Schedules 40 & 80,<br>socket-type |
| PVC  | rigid | D2672<br><br>D2564<br>F402<br>D2855                        | Pipe, Schedule 40, Bellend, & Pipe,<br>SDR-PR, o.d. controlled<br>PVC solvent cement<br>Safe handling of solvent cement<br>Making S.C. joints   |
| PVC  | rigid | D2740  | Tubing, SDR-PR, o.d. controlled   |
| PVC  | rigid | F480   | Water Well Casings and Couplings, SDR   |
| CPVC | rigid | F441<br>F493<br>F402<br>F438<br>F439<br>F437               | Pipe, Schedules 40 & 80<br>CPVC solvent cement<br>Safe handling of S.C.<br>Fittings, Schedule 40, socket-type<br>Fittings, Schedule 80, socket-type<br>Fittings, Schedule 80, threaded  |
| CPVC | rigid | F442<br>F493<br>F402<br>F438<br>F439                       | Pipe, SDR-PR, o.d. controlled<br>CPVC solvent cement<br>Safe handling of S.C.<br>Fittings, Schedule 40, socket-type<br>Fittings, Schedule 80, socket-type   |
| CPVC | rigid | F443<br>F493<br>F402                                       | Pipe, Schedule 40, Bellend<br>CPVC solvent cement<br>Safe handling of S.C.  |

NOTE: Plastic pipe also has many applications for gas piping, chemical/industrial waste piping and chemical/industrial process piping.



Plastic Pipe and Fittings Association

999 North Main St. • Glen Ellyn, IL 60137 • Phone: 312/858-6540

## THE MAJOR BENEFITS OF USING PLASTICS PIPING MATERIALS

● **Plastics piping is energy efficient.** In a recent study it was estimated that during 1977, 324 trillion B.T.U.'s more energy would have been required to make metal piping to replace the plastics piping which was manufactured. That equals a savings of about 56 million barrels of oil because of plastics pipe. Additionally, in hot water distribution systems, plastics piping serves as an insulator itself to reduce heat loss. While plastics piping is made from petroleum based products, it is truly doing its share to reduce energy consumption.

● **The initial cost of piping materials is important to users.** Here, again, plastics piping receives high marks. Its initial cost is significantly less than the cost of other material.

● **Installation costs of plastics versus other materials represent further savings to the user.** Cutting, joining and installing plastic pipe is far simpler than the same processes for other materials. At today's labor rates, increased productivity is vital.

● **The ease of handling plastics pipe is a tremendous benefit.** Not only does its light weight present real benefits to the installer when working in tight places, but a normal length of DWV pipe can be carried by one man whereas two men or a machine are required to move heavier metal piping.

● **The long life of a material is important to the consumer of the material.** Millions of plastics piping installations have been in service for over a quarter of a century and are still functioning the way they did the day they were installed.

● **Plastics piping is corrosion resistant and free flowing.** Plastics piping systems are resistant to normal household chemicals and many other substances which might enter a sanitary drainage system. DWV piping does not "gum up" as does some other materials. The smooth wall of the plastics makes transport of wastes and water more effective. Plastics water piping also resists the kind of interior build-up that sometimes plagues metal piping systems.

● **Plastics piping is usually marked to aid in identification.** Manufacturers making pipe and fittings according to ASTM standards and having the material tested to those standards usually mark the pipe and fittings to show the use and the applicable standard. This procedure makes it simple for users to properly identify the many kinds of plastics pipe and fittings which are available for different applications.

That's a pretty impressive list of benefits for any material. If you have not used plastics piping before, it may be time you did. If you have not been served by plastics piping, you are missing the many benefits which are available through its use. Our industry is proud of the materials which it offers for so many varying piping applications. We stand ready to serve our customers to bring them the benefits of **The Growing World of Plastics Piping.**

## CODE ACCEPTANCE

Plumbing codes are the basis for acceptance of materials for specific plumbing installations and for the methods of installation. Model plumbing codes, sponsored by associations of building and plumbing code officials or other industry groups, are the basis for most of the over 14,000 local codes in this country.

The following organizations (and their model plumbing codes) accept the use of plastics for piping applications:

Building Officials and Code Administrators International,  
Basic Plumbing Code

International Association of Plumbing and Mechanical  
Officials, Uniform Plumbing Code

International Conference of Building Officials,  
Plumbing Code

National Association of Plumbing, Heating, Cooling  
Contractors/American Society of Plumbing  
Engineers, National Standard Plumbing Code

Southern Building Code Congress International,  
Standard Plumbing Code

Plastics piping is also an approved material for use in U.S. Government building projects according to directives of the U.S. Department of Housing and Urban Development.

Regardless of the material you choose to use, check your local plumbing code for approved materials and accepted installation practices.

---

The material contained herein was assembled through the efforts of the Plastic Pipe and Fittings Association for general informational purposes only. The PPFA, nor any of its members, make any warranties or representations of any kind whatsoever regarding the products or the materials described or referenced herein.

Additional information on plastics piping in plumbing applications may be obtained from the Plastic Pipe and Fittings Association, 999 North Main St., Glen Ellyn, Illinois 60137.

Additional information on plastics piping use for water and sewer mains may be obtained from the Uni-Bell Plastics Pipe Association, 2655 Villa Creek Dr., Suite 164, Dallas, Texas 75234.

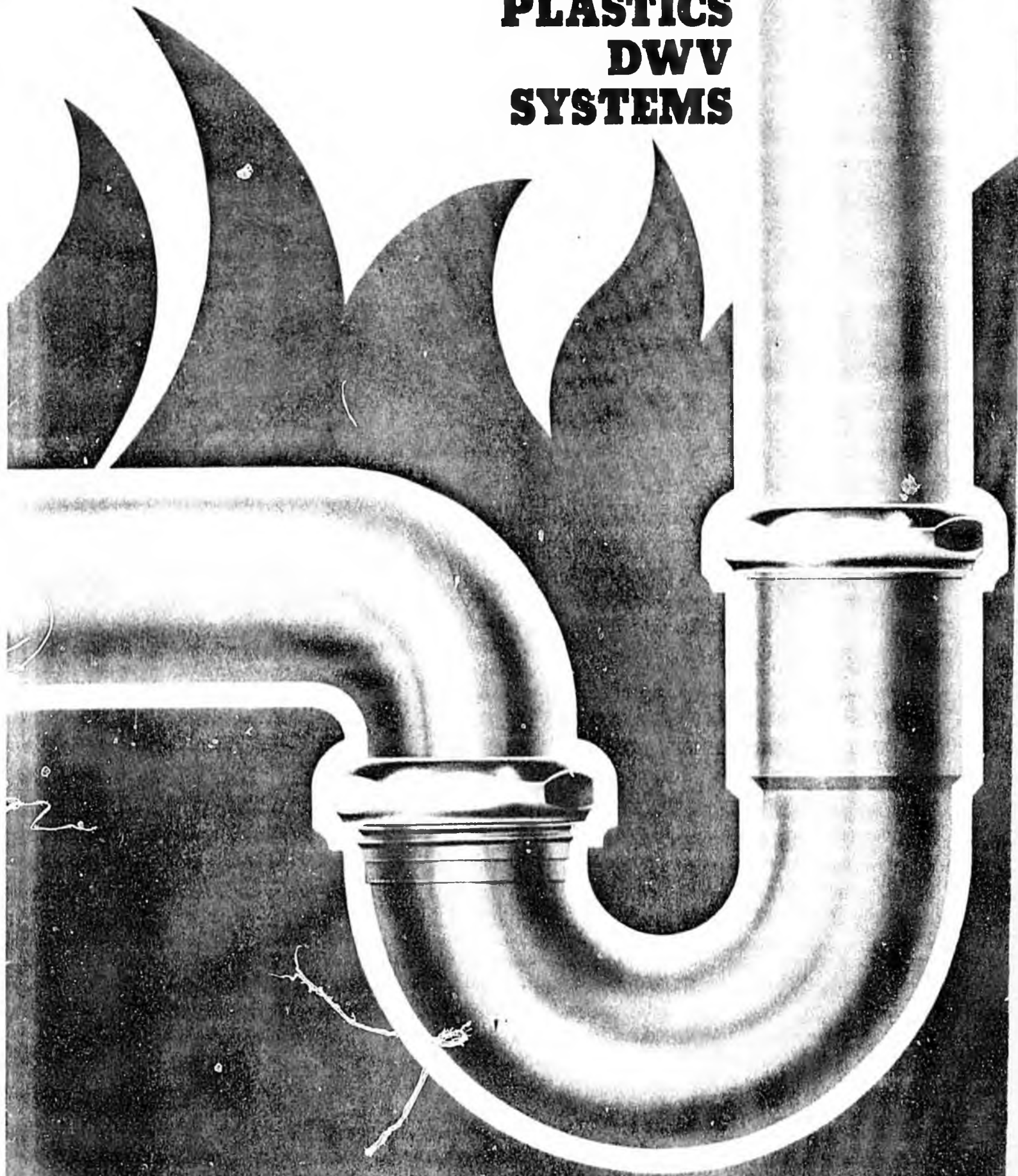
General information on plastics piping for other purposes may be obtained from the Plastics Pipe Institute, 355 Lexington Ave., New York, New York 10017.

# PPFA

## Plastic Pipe and Fittings Association

999 North Main St. • Glen Ellyn, IL 60137 • Phone: 212/858 6540

**FIRE  
TESTING  
PLASTICS  
DWV  
SYSTEMS**



## BACKGROUND INFORMATION

TESTING of ABS and PVC-DWV piping systems to determine their performance characteristics in fire situations has been going on for a number of years. Since 1965, various tests, primarily on small mock-ups of actual installations have been conducted by various agencies.

While the results of such tests were for the most part reassuring to those actually conducting the tests, they were considered by others to be inconclusive since they did not conform to any nationally recognized test method. It was therefore difficult for persons not actually present during the tests to relate the results to his own installation conditions.

The acceptable test method for piping systems has been a major question in the building and fire prevention community during the last several years since there are no tests specifically designed to rate the performance of such systems in fire rated construction.

As a result, a group was formed within the Plastics Pipe Institute to seek out a means of testing ABS and PVC DWV piping systems according to a test method which could, and would, be accepted by regulatory officials.

After lengthy deliberation and consultation with recognized experts in the field of fire technology, it was agreed that ASTM Test Method E-119 would best serve as the basis for an exhaustive research project to be carried out by an impartial and well-credentialed laboratory.

ASTM E-119 is not a test method specifically for piping systems. Rather, it is a method for determining the fire resistance rating (expressed in minutes or hours) of wall and floor assemblies. However, it was decided that useful and valid results could be obtained by testing listed fire-rated wall and floor-ceiling assemblies plumbed with Plastics DWV piping systems.

After due consideration of several facilities, the Building Research Laboratory of Ohio State University (OSU) was selected. The OSU Laboratory has one of the best E-119 test facilities in the U.S. ■

## PURPOSE

DUE to the ever increasing useage of plastics DWV piping systems in fire rated structures, unbiased test data was needed to establish the suitability and acceptance of these systems.

It was with this basic philosophy in mind that the Ohio State University (OSU) test program was undertaken. Obviously, it was the Institute's hope that the tests would establish, to the satisfaction of all, the suitability of plastics DWV systems. Great pains were taken to make sure that the tests were conducted in strict accordance with the ASTM E-119 test method. To do otherwise would have been meaningless.

The primary objective of the program was to learn what happens to a fire-rated wall and/or floor-ceiling assembly when the assembly has been plumbed with plastics DWV piping. Is a one-hour wall still a one-hour wall when it includes a back-to-back lavatory drain assembly made of ABS or PVC DWV? Can a two-hour wall endure a fire for two hours when it contains a plastics DWV System protruding on both sides of the wall?

It is a known fact that ABS and PVC thermoplastics are combustible materials. That, of itself, is not the central issue since other combustibles are also used in fire-rated construction.

Rather, the central issue is whether ABS or PVC DWV, when properly installed, will transmit fire through walls or floors, thereby reducing or otherwise affecting the fire endurance of such walls or floors. This, then, became the primary objective of the OSU fire test program.

A secondary objective was to learn what constitutes proper installation techniques for combustible piping in fire-rated construction. Over the years, various methods have been proposed including the use of metal sleeves or flanges through the walls as well as the exclusive use of metal P traps as opposed to plastic traps. The OSU tests have laid to rest certain long-standing myths. ■

## TEST METHODS

### Test Requirements:

ASTM E-119; the Standard for Fire Tests of Building Construction and Materials (also known as UL 263 and NFPA 251) is a standard to evaluate the performance of walls, floors, columns and other building members under standard fire exposure conditions.

The aim is to secure constructions that are safe and not a menace to neighboring structures, or to the public. To do this, fire resistive properties of building assemblies are measured and specified according to a common standard expressed in hours or minutes of fire resistance. The standard provides the means to measure the fire resistance for these types of building construction during a standard fire exposure.

Fire tests of non-load bearing walls, when conducted in accordance with this standard, are considered successful if the following conditions are met:

(a) The wall or partition shall have withstood the fire endurance test without passage of flame or gases hot enough to ignite cotton waste, for a period equal to that for which classification is desired.

(b) The wall or partition shall have withstood the fire and hose stream test as specified in Section 8 (of E-119) without passage of flame, of gases hot enough to ignite cotton waste, or of the hose stream.

(c) Transmission of heat through the wall or partition during the fire endurance test shall not have been such as to raise the temperature on its exposed surface more than 250F (139C) above its initial temperature.

Load bearing walls when tested according to E-119 are considered successful if the following conditions are met:

(a) The wall or partition shall have sustained the applied load during the fire endurance test without passage of flame

or gases hot enough to ignite cotton waste, for a period equal to that for which classification is desired.

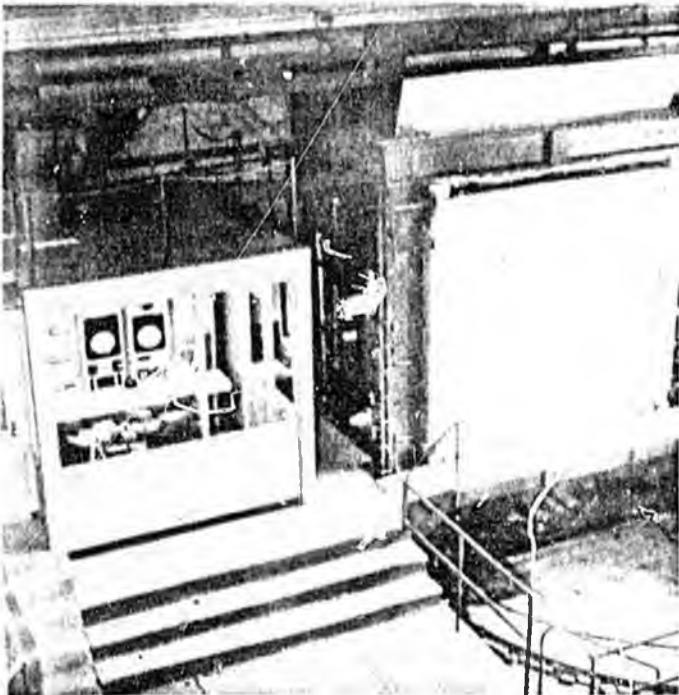
(b) The wall or partition shall have sustained the applied load during the fire and hose stream test as specified in Section 8 (of E-119) without passage of flame, of gases hot enough to ignite cotton waste or of the hose stream, and after cooling but within 72 hours after its completion shall sustain the dead load of the test construction plus twice the superimposed load specified above.

(c) Transmission of heat through the wall or partition during the fire endurance test shall not have been such as to raise the temperature on its unexposed surface more than 250F (139C) above its initial temperature.

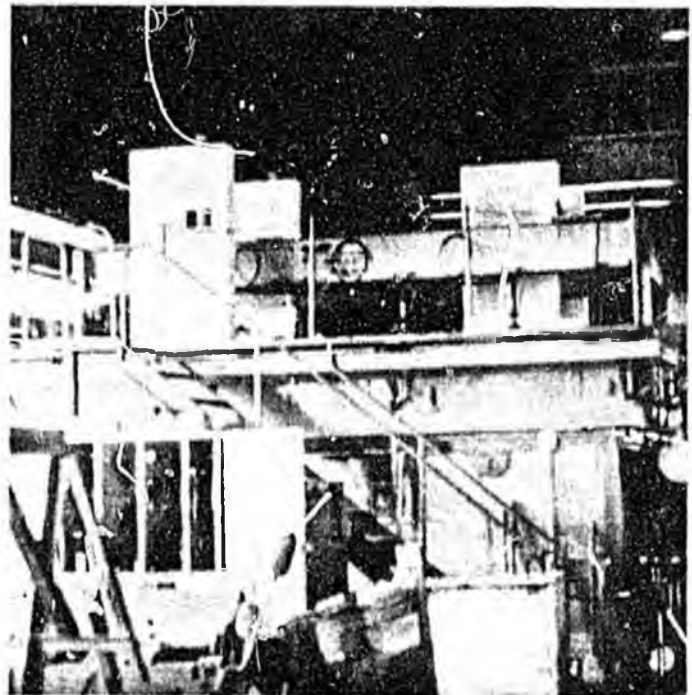
Fire tests of floor and ceiling assemblies, when conducted according to E-119, are considered successful if the following conditions are met:

(a) The construction shall have sustained the applied load during the fire endurance test without passage of flame or gases hot enough to ignite cotton waste for a period equal to that for which classification is desired.

(b) Transmission of heat through the construction during the fire endurance test shall not have been such as to raise the temperature on its unexposed surface more than 250F (139C) above its initial temperature. ■



Wall furnace and control room at Building Research Laboratory of Ohio State University. Sophisticated electronic equipment provides minute-by-minute readings on test conditions. The OSU lab is recognized as one of the nation's leading test facilities.



Section of laboratory where floor-ceiling tests were conducted. Brick section is the furnace. Floor assembly is mounted over furnace. Wall sections with vents-to-atmosphere were placed atop floor to simulate actual installation conditions.

## WALL ASSEMBLIES

The test walls were built of wood framing and gypsum board representing minimum fire-rated construction. Both 2 x 4 and 2 x 6 walls were tested as representatives of the types of walls normally used to accommodate plumbing systems. All walls were constructed in accordance with the details specified in the listing of the fire-rated assemblies.

The standard DWV configurations that would be encountered in a typical multi-story building were used. These systems would of necessity require 4" soil stacks, 3" vent stacks and usually 2" re-vent. Thus, this configuration would necessitate at least a 2 x 6 wall to accommodate these pipe sizes. However, DWV piping for kitchens, utility rooms, and other applications that can be accommodated by smaller pipe sizes, can be installed in a typical 2 x 4 wall.

In DWV systems, the walls are normally penetrated for connections to wall hung fixtures such as lavatories or sinks. These penetrations were provided by a twin ell and trap adapters which afforded a plastic bridge completely through the wall. Both tubular brass and plastic traps were tested. The plastic DWV pipe and fittings used in all of the tests were chosen at random from stock and conformed to existing ASTM Standards for the respective material being tested.

Installation of the piping was in accordance with nationally recognized plumbing codes and manufacturers published recommendations. Care was taken to seal the opening around the penetrations of the plate and the gypsum wall board in accordance with existing building codes.

In all tests the traps were supported with wires to simulate a connection to fixtures and were filled with water to simulate service conditions.

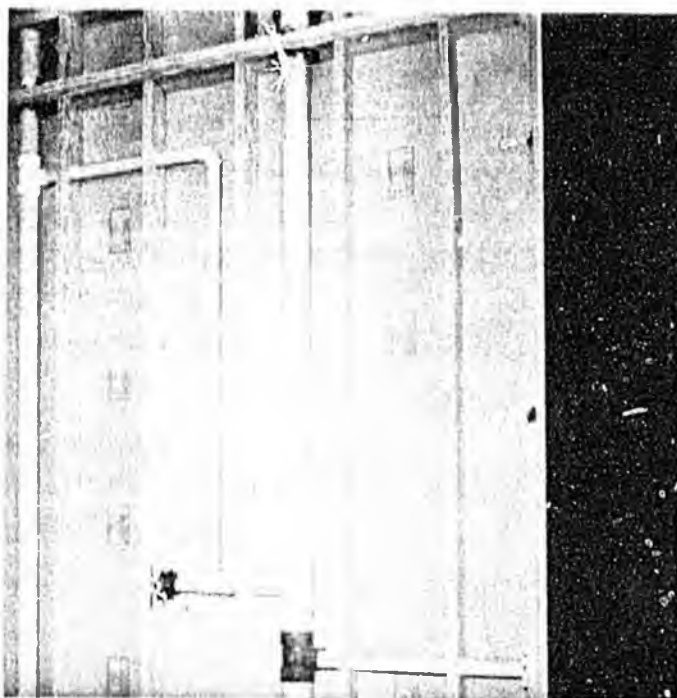
Since DWV systems are always vented to the atmosphere it was essential that the piping systems in the assemblies be

vented during the test. Because the concrete yoke made it impossible to vent vertically, a 1 foot vent section was provided at the top of the test wall by installing a typical double-plate header.

The pipe extending into the vent section was vented by installing a Sanitary tee opening through the unexposed side of the wall. The penetration of the double plate also simulated the passage of piping from floor to floor. ■



Test wall, showing thermocouples and wires which are connected to computer in the control room. Line near top of wall indicates position of plate simulating floor above. Vents rise, penetrate plate and then turn through wall to atmosphere.



DWV configurations in test walls were typical of back-to-back lavatory rough-in. Pipe diameters ranged from 1 1/2" to 4". Walls using both 2 x 4 and 2 x 6 studs were tested. Both one-hour and two-hour rated walls were tested.

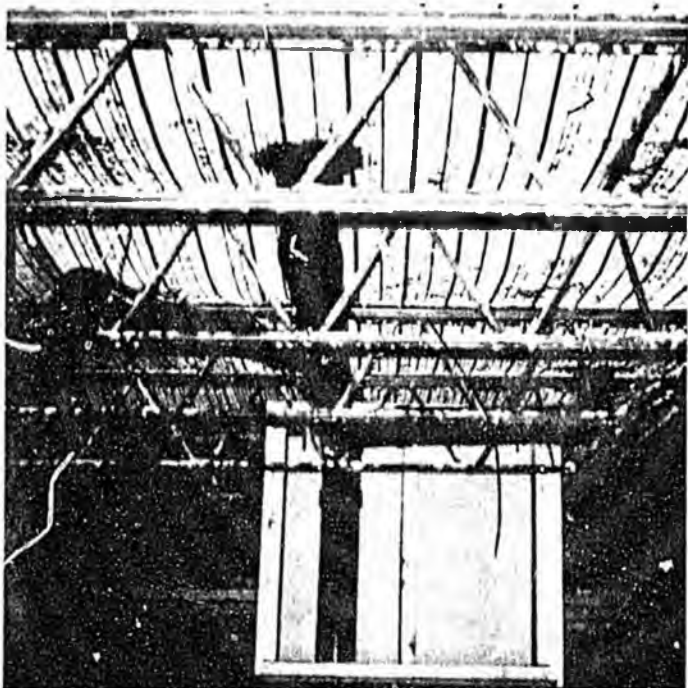
## FLOOR-CEILING ASSEMBLY

The floor-ceiling assembly tested was a typical poured concrete floor on steel bar joists with a suspended acoustical lay-in tile ceiling below. This assembly has a two-hour fire-resistance rating.

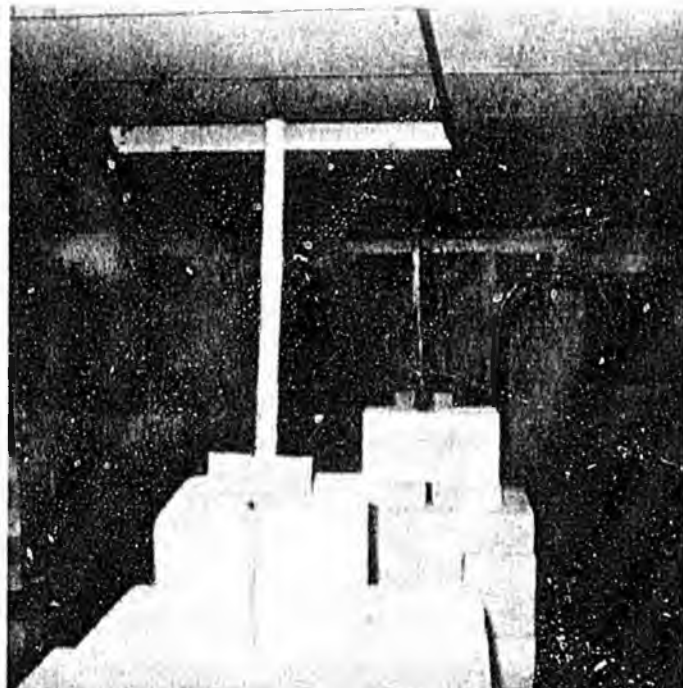
ABS and PVC DWV piping systems were installed at opposite corners of the assembly. Each system consisted of a 4" vertical waste stack, with a 3" horizontal branch line with connections to a water closet and a tub. This branch then continued to a vertical floor penetration to simulate a vent or re-vent stack above the floor. A lavatory opening was installed in this 3" stack.

In order to fully simulate actual DWV piping installations, wall sections were built above and below the floor slab to accommodate the vertical stacks. The vertical piping protruded through the wall sections above the floor to simulate sanitary vents through the roof. Water closets with water-filled traps and tub waste and overflows were installed on their respective openings to simulate service conditions.

Special glass ports were installed in the wall sections above the floor in order to observe passage of flame through the floor should it occur. ■



DWV piping in floor-ceiling tests was connected to water closets above as well as risers which vented to atmosphere. As in the wall tests, great care was taken to simulate actual field conditions. Ceiling system is typical of most commercial construction.



Inside furnace, looking up at finished ceiling which contains plastics DWV. Vertical conduits are thermocouples. One of several gas jets can be seen near the floor. Furnace generated temperatures of up to 1700 degrees F.

## TEST DATA

### One Hour Non-Load Bearing 2 x 4 Wall Test (No. 5615)

These walls were of nominal 2 x 4 wood framing protected with one layer of 5/8" UL classified gypsum wallboard on each face. These walls were plumbed with both ABS and PVC DWV with a maximum pipe size of 2". These walls demonstrated a fire resistance classification of one hour.

### One Hour Non-Load Bearing 2 x 6 Wall Tests (No. 5473-ABS) (No. 5474-PVC)

These walls were of nominal 2 x 6 wood framing protected with one layer of 5/8" UL classified gypsum wallboard on each face. These walls were plumbed with either ABS or PVC DWV with maximum pipe size of 4".

The walls in both tests demonstrated a fire resistance classification of one hour.

### Two Hour Load Bearing 2 x 6 Wall Tests (No. 5560-ABS) (No. 5561-PVC)

These walls were of nominal 2 x 6 wood framing protected with two layers of 5/8" UL classified gypsum wallboard on each face. These walls were plumbed with either ABS or PVC DWV with maximum pipe sizes of 4".

The walls in both tests demonstrated a fire resistance classification of two hours.

### Two Hour Floor-Ceiling Assembly (No. 5539)

This test assembly was a 14' x 16' typical 2½" thick concrete floor on bar joists protected below by a suspended acoustical tile lay-in ceiling.

Complete plumbing installations of both ABS and PVC DWV were installed in two corners diagonally across from one another.

This test terminated at 112 minutes caused by failure of the exposed grid suspension system which allowed premature loss of ceiling panels. However, at this point, no passage of flame through the floor had occurred. ■



In wall tests, collapse of piping above simulated floor plate sealed off opening which prevented upward spread of fire or smoke. This points up importance of closing of opening around pipe after installation as required by most building codes.



At the conclusion of wall tests, P-traps were always intact and still capable of holding water. Even during tests, they were cool enough to touch with bare hands. Because of plastics' low thermal conductivity, furnace temperatures never made it through the wall.

## CONCLUSIONS

1. The performance of all five wall assemblies in the fire endurance and hose stream tests was, in all essential features, identical to that of the same wall assemblies without the ABS or PVC DWV plumbing systems incorporated.

2. These tests demonstrated that plastics piping, within walls, is not involved in the early stages of a fire. This was evident from the appearance of the piping after the hose stream tests.

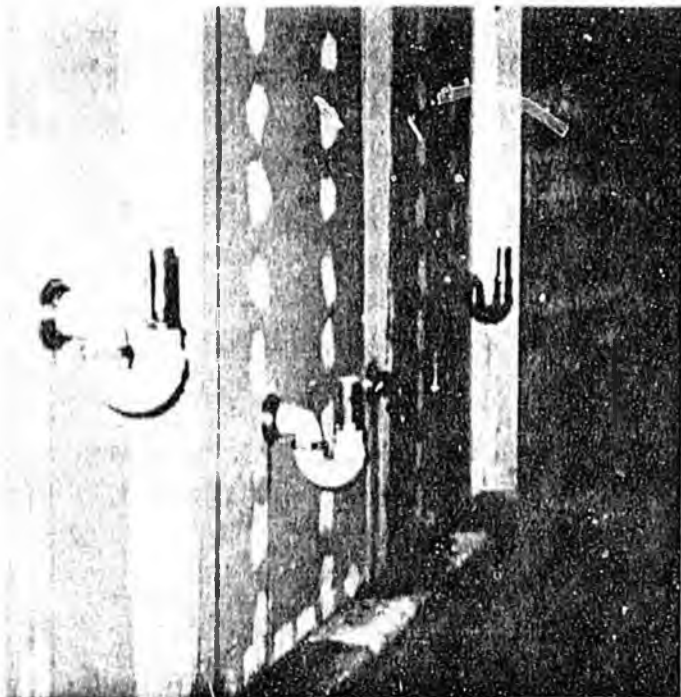
3. Fire consumption of the plastics piping, within the wall, is very slow. In those tests where measurements were taken over 50% of the plastics remained by actual weight.

4. Passage of flame through vertical and horizontal penetrations is minimized with plastic piping. Heat softened plastics tends to close openings thus reducing heat and flame transmission and flue effects through such penetrations.

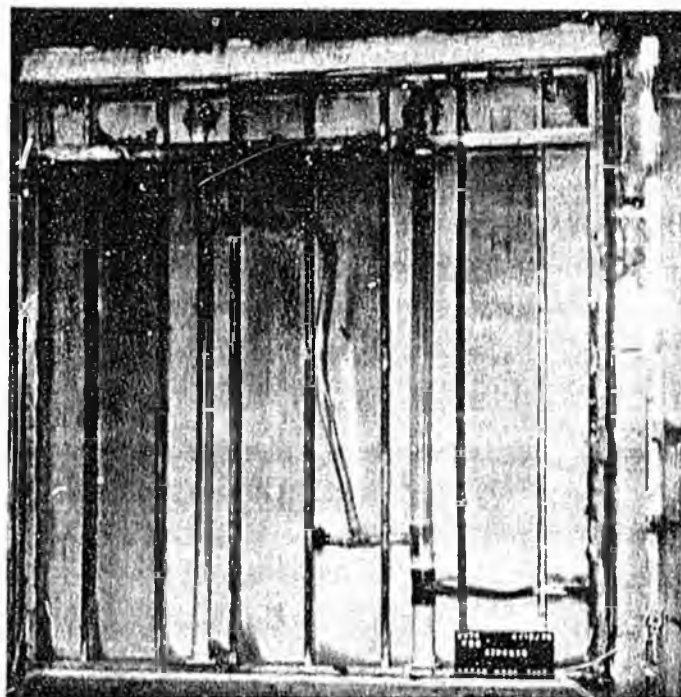
5. Plastics traps proved to be equal to, if not better than, the brass tubing traps. In these tests, while both were used successfully, less heat transmission was observed with the plastic traps.

6. Sealing openings around penetrations with non-combustible sealants is essential. These tests indicated that without sealing, no piping material could be expected to pass the test.

7. Properly installed plastics plumbing systems will not conduct flame through a fire-rated concrete floor of the type tested. Fixtures act as their own barriers. Properly sealed stack penetrations effectively retard flame passage. ■



A variety of DWV configurations were tested using both ABS and PVC plastics. Both materials performed equally well. OSU tests proved conclusively that claims of superior fire performance for one plastic over another are not valid.



After 30 minutes of exposure to fire, this plastic DWV piping shows only mild heat distortion. Such tests layed to rest myths about plastic pipe igniting quickly and serving as a conduit for the rapid spread of flame through walls and floors.

## GLOSSARY OF TERMS

ABS — Acrylonitrile-Butadiene-Styrene plastic.

ARM — Horizontal drainage line connecting fixture into stack.

BACK-TO-BACK INSTALLATION — Fixture openings exactly opposite one another requiring double opening fitting.

BRANCH — Horizontal line taken off of main stack or main horizontal line.

BRIDGE — Horizontal connection penetrating both sides of wall in line with each other.

DWV — All of the drainage waste and vent system within the building.

EXPOSED — The face of the assembly in the furnace.

FIRE ENDURANCE — A specified period of time or until failure.

FIRE STOPPING — Sealing off air passage around penetrations.

HOSE STREAM -- Application of hose stream under standard pressure to a duplicate wall assembly after fire exposure for a period equal to one-half of the fire endurance rating.

LOAD BEARING — A test assembly that sustains an applied design load during the entire test.

NON LOAD BEARING — A test assembly with no applied load during test.

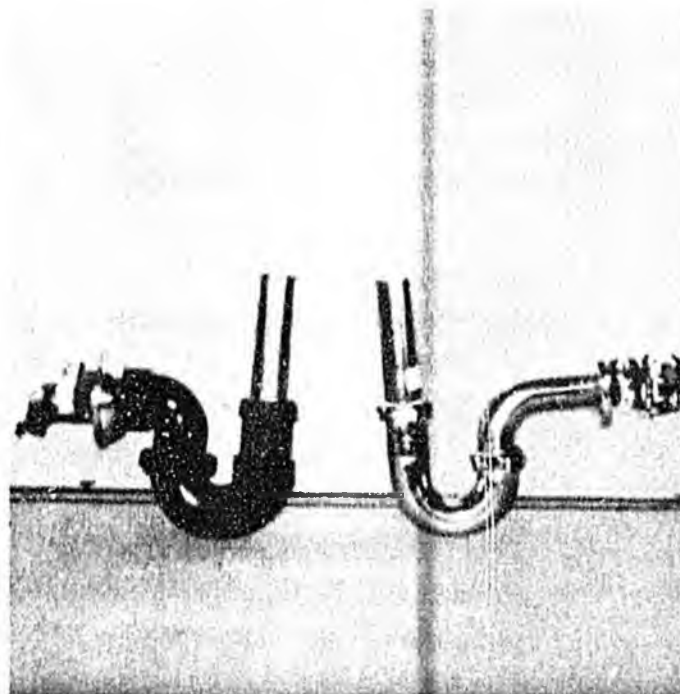
PVC — Polyvinyl Chloride plastic.

STACK — Vertical soil, waste or vent piping.

UNEXPOSED — That side of the assembly away from flame exposure. ■



E-119 test requirements call for separate hose stream tests. After exposure to fire for one-half the time rating of the test assembly is opened and a 30-psi hose stream is applied to the burnt side. No water must penetrate wall. None did.



In order to develop comparative data, both metal and plastics P-traps were used on test walls. Because metal traps quickly melted and fell away, they provided no additional fire protection. Plastics P-traps performed as well or better than metal traps.

Fire Protection Engineers  
Building Code Consultants

June 18, 1974

Plastics Pipe Institute  
A Division of the Society of the  
Plastics Industry, Inc.  
250 Park Avenue  
New York, New York 10017

Attention: Mr. Ray Durazo, Executive Director

PPI - BUILDING ASSEMBLY FIRE TEST PROGRAM

Gentlemen:

Rolf Jensen & Associates was engaged by the Plastics Pipe Institute to act as a third-party consultant in a Fire Test Program to qualify plastics (ABS & PVC) drain-waste-vent pipe in fire resistive building construction. We provided guidance in the design and instrumentation of the test assemblies, witnessed the actual fire tests, and verified that the tests were conducted in accordance with ASTM E119-1971, Standard for Fire Tests of Building Construction and Materials.

The tests have demonstrated that plastics DWV pipe, when properly installed can be used in building assemblies of up to two hours fire resistance without degrading the fire resistance rating of such assemblies. The wall tests were conducted on load-bearing stud construction and the results led us to conclude that metal-stud wall assemblies will also perform satisfactorily.

One floor test was conducted which was an exact duplicate of an earlier fire test which resulted in publication of Underwriters' Laboratories, Inc., Design G216 (formerly designated as Floor & Ceiling Design No. 72 - 2 Hour), except that ABS and PVC drain-waste-pipe were installed to determine their effect on the fire resistive performance

of the floor. From an analysis of the results of this test, we have concluded that plastics DWV pipe can be used in fire resistive floor construction without adverse effect.

The original floor assembly earned a 2 hour rating when the floor surface temperature failed at 2 hours, 21 minutes. The duplicate assembly, incorporating the plastics DWV pipe, failed at 1 hour, 52 minutes, because several of the acoustical ceiling tiles fell out. Prior to the tile fall-out, temperatures throughout the assembly were approximately the same as in the original test. Examination of the floor after the test revealed that the cross tees supporting the acoustical tile had not expanded properly into the slots of the main runners. Instead, the cross tees sagged down and, late in the test, twisted and caused premature fall-out of the tiles and the early demise of the assembly. Had the cross tees performed as was intended, the rating of the original assembly would have been duplicated.

In summary, the results of the 17 tests conducted lead us to conclude that the use of plastics DWV piping, when properly fire-stopped, does not weaken the performance of fire resistive building assemblies having up to two hour fire resistance.

Very truly yours,

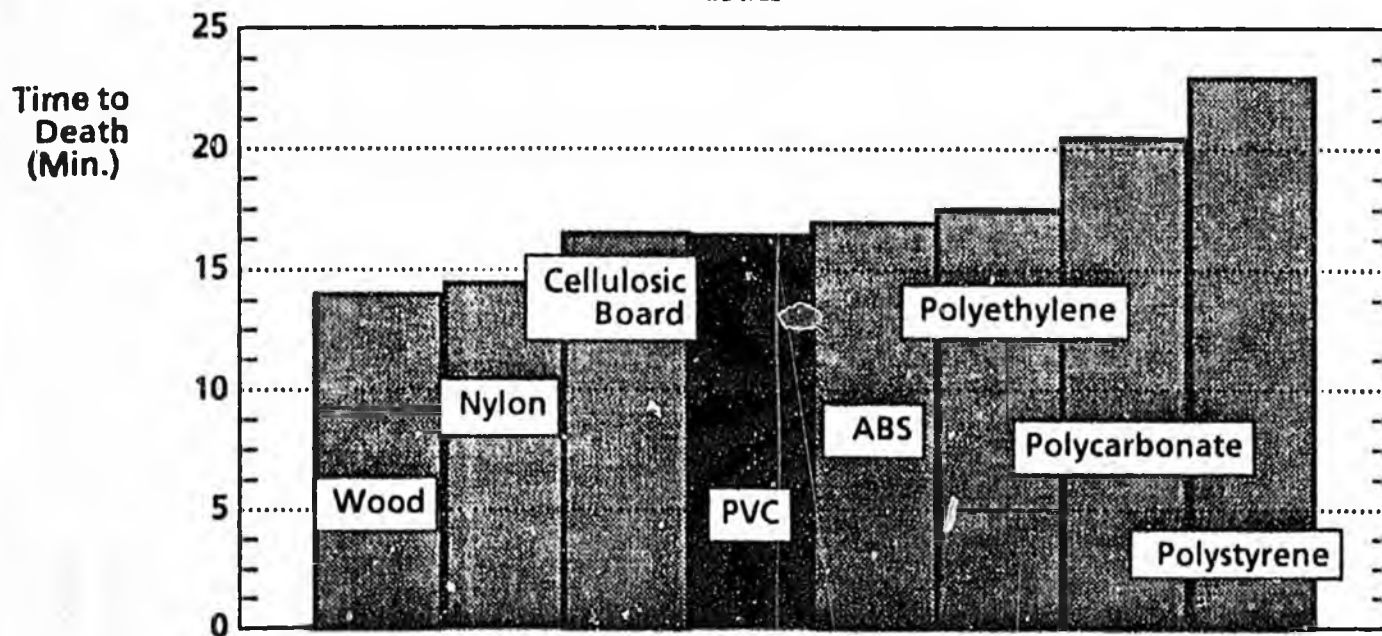
*Roland F. Bellman*

Roland F. Bellman, P. E.  
Consulting Engineer

# TOXICITY TESTING

- The test results below show the off-gases of PVC and other synthetics to have a toxicity very similar to that of wood.
- The National Bureau of Standards (a non-partisan, government agency) test results corroborate those shown below. Jack Snell of the Bureau, however, cautions: "This report is primarily intended for research...It is not suitable for use by itself for evaluating the fire safety of materials in use since a number of additional factors must be considered in a specific situation. Further development and evaluation of this test method and, in our view, all others currently available is necessary to determine their suitability or utility for regulatory purposes presuming the intent of course, is fire-safe material/product design, selection, or evaluation."

## TOXICITY OF OFF-GASES Wood and Plastics



REFERENCE: Hilado, C.J., Huttlinger P.A., "Toxic Hazards of Common Materials", Fire Technology, Aug. 1981, pp. 117-182 (Table VI p. 181) Carlos J. Hilado is the director of the Fire Safety Center, University of San Francisco, and is well known for his work in the toxicity of materials.

Conoco Chemicals Company 3/83  
For more information contact: Ed Kieschnick 713-531-3522



CITY OF PHOENIX

TO Roscoe J. Hildebrandt  
Building Safety Director

FROM Alan V. Brunacini *AVB*  
Fire Chief

SUBJECT Proposed Amendments to Plumbing Code

DATE January 19, 1983

Item 18 - p.13  
Formal Agenda  
January 25, 1983

*PS*

The Fire Department has reviewed the proposed changes to the Plumbing Code which would permit the use of plastic pipe and fittings in drain waste and vent systems, wherever combustible construction is allowed by the Construction Code. This has been an area of ongoing concern and continuing analysis for our staff over the last few years.

While the Fire Department has an ongoing concern with the growing use of plastics in buildings, our analysis indicates that this proposal is not unreasonable. Plastics generally tend to burn more rapidly than "conventional materials", give off more heat, produce more smoke and give off more toxic products of combustion. All of these are certainly major concerns to this department and we have stated many times that plastics are a major contributor to the increasing fire danger in our built environment. Our codes need to reexamine this whole area, particularly with regard to the toxicity of products of combustion produced by burning plastics.

In spite of our basic concern with the increased use of plastics, we are not opposing this change in the Plumbing Code. It appears that the limited amount of plastics which would be added to buildings, and the fact that the piping would be within concealed spaces which are already permitted to be combustible construction, make the impact of this change insignificant. The amount of plastics in most occupancies, in the form of furnishings and fixtures which are not governed by any code, is much more significant from a fire safety perspective.

In this case our philosophical concern with the addition of any more plastics is outweighed by a serious consideration of the actual impact. We feel that allowing plastic DWV pipe in combustible construction does not add to the hazards already present in most occupancies. Our experience with these materials in residential occupancies, where it has been permitted for several years, indicates no particular problems.

Thank you for inviting us to comment on the proposal.

AVB:JGR:cap

cc: Mayor & City Council

Mr. Andrews  
Mr. Starratt  
Mr. Howlett  
Mr. Tevlin  
Mr. Fairbanks  
Mr. Baumert  
Chief Brunacini  
Mr. Hildebrandt  
Ms. Hoyos  
CAO  
City Clerk

# SIZE UP

## What about the hazards of burning plastics?

In the early 1970s, the fire service became concerned about the hazards of burning plastics. People were apprehensive about the new and unknown products of combustion given off by plastics. Gradually this concern waned as more and more fire departments began to realize the safety benefits of self-contained breathing apparatus. Now the pendulum is swinging back. Once again we are seeing an emphasis on the toxicity of burning plastics.

Why this escalation of concern after several years of relative quiet about the problems of burning plastics? The emergence of new information might be the logical answer. But there are more subtle reasons, such as the one revealed in an article in the February 7, 1983, issue of *Fortune* Magazine titled "The Dubious War on Plastic Pipe." This well-researched article documents one company's battle against plastic pipe. The company is Allied Tube & Conduit Corp., the nation's largest producer of rigid metal pipe used for electrical conduit. In case you don't have the opportunity to read the article, a short report appears in this issue, beginning on page 22.

*Fortune* published the article to show how a company has used "half-truths and misinformation" and "unfair tactics in the marketplace" to retain its share of the \$190 million conduit market. We call the article to your attention because there are some lessons in it for the fire service. Here are a few of the more salient points and some comments.

○ The article admits that burning PVC and other plastics produce toxic gases, but it also explains what any firefighter knows, that anything that burns gives off toxic gases. Comment: It would be helpful to know more about the hazards of burning plastics, but for firefighters the problem hasn't changed. Plastics may burn faster and produce different gases but, whatever is burning, the rule for firefighters should be: "Wear your SCBA." The key to public safety in hotels and homes lies in public education, using EIGHTH, for example; more built-in protection, such as smoke detectors and automatic sprinklers; and a keener awareness of the hazards of burning materials of any type—wood, plastic, gasoline, and so on. This overemphasis on the hazards of plastic may cause the public to forget that burning wood, cotton, and wool also give off toxic gases. We have learned to live with other hazardous products—gasoline, for example. Why shouldn't we learn to live with plastics while we try to improve their fire safety?

○ The article says that Allied provides about 75% of the funding for the Foundation for Fire Safety and that foundation personnel have not always represented the dangers of plastics objectively. Comment: The work the foundation is doing in toxicity could be helpful in saving lives in the future, but a vested interest such as this raises questions about the objectivity of its work, particularly when the ethics of the funding source is so questionable. Furthermore, toxicity is not the only issue. What about burning characteristics such as ease of ignition and flame spread?

○ The *Fortune* article explains how Allied and others in the metal industry packed the 1980 NFPA Electrical Code committee meeting to vote down the acceptance of PVC conduit into the code. This was done by purchasing 100 new NFPA memberships just to cast votes against PVC conduit. Comment: NFPA's standards and code system has been criticized before. If companies with cash to spare can buy enough memberships to influence code and standards writing in this way, it is a situation that ought to be corrected. But we must be careful about changing the system. It's the best we've got. It works by consensus—the American, democratic way. A standard set by a consensus of concerned interests cannot be a perfect document, but it works because it was established through a democratic, give-and-take process. The system has its faults, one being the NFPA's vested interest in building its membership. But let's work to improve the system we have.

The *Fortune* article shows how far some businesses will go to win the battle of the marketplace. It also reveals some important lessons for the fire service: (1) Know the source of your information—vested interests may not lie, but they may not tell the whole truth either. (2) NFPA's code- and standard-making system needs scrutiny. (3) The modern world is a hazardous place. In the end, the public will determine the balance between safety and the standard of living it wants.

Let's put plastics into perspective. They don't deserve all this special attention. Like other things that burn, they give off toxic fumes. Let's encourage research to learn more about them, but keep our emphasis on prevention measures that we know work—automatic sprinklers, smoke detectors, public education and, for firefighters, wearing SCBA.

Bill Randall

## **Improper Wiring Is Cited In MGM Grand Hotel Fire**

LAS VEGAS, Nev. (AP) — The final Clark County Fire Department report on the MGM Grand Hotel fire says that the primary cause of the blaze that killed 84 persons and injured 700 was an improperly installed electrical system that overheated because it was not grounded correctly.

"It is the opinion of the officers reporting that not one but several factors were present which contributed to the cause of the fire, and that the primary cause was electrical," said the report, which was released Monday.

A preliminary Building Department report on the fire listed hundreds of alleged building-code violations discovered after the Nov. 21 blaze, which forced the shutdown of the hotel. The Strip resort is scheduled to reopen July 30.

The final report concluded, as had the preliminary report, that the blaze had started behind a wall in the hotel's delicatessen. It said that insulation on two copper wires running through an aluminum conduit or "raceway" had deteriorated, allowing the wires to make contact with the conduit.

Although the conduit was supposed to be grounded, the report said, it was not.

FEBRUARY 7, 1983

\$3.00

# F O R T U N E

## APPLE'S BID TO STAY IN THE BIG TIME



TOIL AND  
TROUBLE AT  
CONTINENTAL  
ILLINOIS

THE EXPLOSION  
OF INTERNATIONAL  
BARTER

THE DUBIOUS  
WAR ON  
PLASTIC PIPE

Apple  
Computer's  
Steven  
Jobs



Cover © Time, Inc., 1983  
PRINTED IN U.S.A.

# THE DUBIOUS

BUILDING MATERIALS/STEVEN FLAX



■ Fire horrors billowing smoke on stretch

bags—the sights arouse a deep-seated urge to control the like the hotel fire below can also be a marketing windfall to fight competing products by playing on the fear of fire.

This is the story of a company that has done so with an extraordinary outpouring of half-truths and misinformation. Its target: plastic pipe. Allied Tube & Conduit Corp. of Harvey, Illinois, is the largest U.S. producer of rigid metal pipe used to contain and protect electrical wiring. Plastic conduit, mainly made of polyvinyl chloride (PVC), has made heavy inroads, partly because it's easier to install. According to Predicasts, a market-research firm, its share of the conduit market widened from an estimated 9% in the late 1960s to 54% in 1980. Meanwhile, steel conduit's share fell, from nearly 50% to 32% of a business worth hundreds of millions a year. But Allied, a privately owned company with 1982 sales of about \$300 million, has not been content to fight back with conventional salesmanship.

Since the late Seventies, Allied has run a campaign to publicize the supposedly unusual fire hazards of PVC, pitching it at consumers, contractors, legislators, and officials who write building codes. To give its effort the appearance of impartiality, Allied has set up a not-for-profit organization, the Foundation for Fire Safety. Supposedly the foundation, with offices in Rosslyn, Virginia, is dedicated to disseminating impartial scientific information. But with about 75% of its \$750,000 budget coming from Allied, it has often served as a vehicle for anti-PVC propaganda. The foundation's officials frequently travel the country citing plastics as contributing to some of the deaths in prominent fires, even though there's no proof that their combustion products were responsible.

Allied has also lobbied heavily against the inclusion in the National Electrical Code, which serves as a guide for local codes, of a new, flexible type of PVC conduit. The new

conduit—that's a sample above—is even cheaper to install. Allied's efforts have prompted the Carlon division of New York-based Indian Head Inc.—in turn controlled by Curaçao-based Thyssen-Bornemisza N.V.—to sue it for restraint of trade. The Society of the Plastics Industry, which has long retained the public relations firm of Hill & Knowlton, has also redoubled its efforts to present its side of the controversy. Carlon, with 1982 sales of \$150 million, introduced the flexible conduit in 1980; it's also the leading maker of rigid PVC conduit. Other makers include CertainTeed Corp. of Valley Forge, Pennsylvania, and Robintech Inc. of Fort Worth, both publicly owned. Leading suppliers of PVC are B.F. Goodrich, Tenneco, and Du Pont.

**A**LLIED SAYS IT HAS "a moral and legal responsibility" to oppose products that constitute "an inherent, immediate, and substantial danger to the public." Asserts Theodore H. Krengel, 57, Allied's founder, president, and controlling shareholder: "The plastics produced now kill." Allied's awareness that plastics are hazardous goes back to 1972, he says. "We began to hear more and more about the problems of toxicity, flammability, and smoke of plastics." Buildings, warns Krengel, are becoming "plastic bombs—they go up in a matter of seconds." Allied's general counsel, John Lison, adds ominously: "Any company that knowingly puts a harmful product into the stream of commerce is liable for punitive damages."

Allied is not the only campaigner against plastic pipe. Carol Bellamy, New York City's RESEARCH ASSOCIATE *Ford S. Worlhy*

PHOTO: BRAD SPALE

# ON PLASTIC PIPE

cally ambitious city council president, a fuss last year about new PVC conduit led in subways. At her insistence \$2 million is being spent to rip out some and re- it with metal, though most of the sub- system's PVC will be left where it is. es' growing use in plumbing, primarily ater and drain pipes, has also come in criticism. Allied's crusade against PVC een especially vehement, however. A icant proportion of its sales are threat- The last straw may have been Carlon's le conduit, aimed at a \$190-million-a- market that steel had all to itself. ouldn't deny we have a commercial in-

terest," says Allied's President Krengel. "It's a big market. If you include cable, conduit, ducts, and pipe, you're talking in the multibillions of dollars." If the competition gets much worse, Krengel adds, Allied might switch to plastics—"if we could find one that is proven safe." Krengel goes on to declare: "I'm not going to make any Three Mile Islands or any Love Canals. I'm not going to make anything where I can't sleep nights because we've made a product that's unsafe. I don't want that on my conscience."

Krengel could be speaking his convictions, of course. But doubt is fanned by a curious fact recently discovered by FORTUNE: Allied

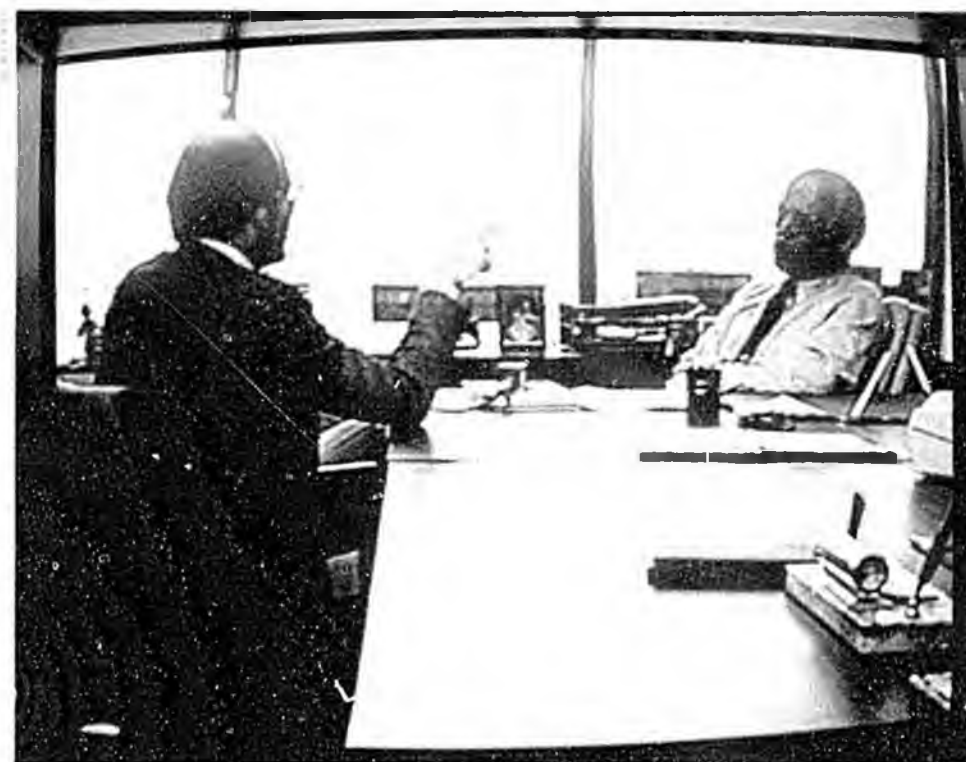
itself has marketed PVC conduit on and off in recent years. In fact, it's still selling PVC-coated products.

PVC is hazardous when it burns, as the plastics industry admits. So is everything else that burns. PVC may give off, among other things, hydrogen chloride, a corrosive gas that is lethal in high concentrations. But burning natural materials also give off a host of dangerous substances, such as carbon monoxide and acrolein. When wool carpeting or upholstery catches fire, it can produce deadly cyanide gas. Furthermore, a government-sponsored study has shown that Douglas fir, widely used in construction, is every bit as hazardous when it burns as PVC.

Still, wouldn't it make sense to ban plastics and use just noncombustible metal for conduit? The answer, according to experts not financed substantially by either side in this dispute, is a surprising no. There is much more to fire hazards than the toxicity of a material's combustion products. "You may be making the situation worse by having metal conduits," says Dr. Edward Radford of the University of Pittsburgh's Graduate School of Public Health. "Many fires result from electrical short circuits. One common type occurs as a result of improperly grounded metal conduits." Adds Radford, a leading authority on what kills in fires: "There is no evidence that PVC plays a major role in whether an individual dies in a fire."

Since no material is hazard free, the real issue is whether PVC is more hazardous than others. Here again the answer, according to impartial authorities, seems to be no. According to Jack Snell, director of the Center for Fire Research at the National Bureau of Standards, PVC conduit would probably be among the least of the worries in most fires. "Plastics would not create a significant additional hazard to life," says Snell. "Typically it's the contents of a building—in contrast to construction, plumbing, and electrical materials—that represent the largest fuel load. You would need a large fire before the conduit became involved, and by that time the burning contents of the room would

**Neptune stood helpless as flames ravaged the MGM Grand Hotel in Las Vegas on November 21, 1980, leaving 85 dead. Allied Tube & Conduit has cited this and other fires to publicize the supposedly extraordinary hazards of the lethal products given off when plastic pipe catches fire. The final report on the fire, however, did not blame plastics for any of the deaths.**



**Caught with his funding showing, Michael Olsen (right), then managing director of the Allied-supported Foundation for Fire Safety, admitted in an interview for TV that the bulk of his support came from the metal industry. At left on this April 1982 broadcast on Houston's KHOU-TV is reporter Roger Lindberg, interviewing Olsen at the foundation's headquarters.**

have caused the occupants to succumb."

Snell's opinion is tersely endorsed by Irwin Benjamin, an eminent fire researcher and now a private consultant after many years at the Bureau of Standards. Says Benjamin, "If the public has been terrified about plastic conduit, that's completely ridiculous."

Surprisingly, these opinions are echoed even by Merritt Birky, director of research at the Allied-supported Foundation for Fire Safety. "Plastic conduits play little role in an ordinary hotel fire," Birky conceded in a recent interview. "It is unlikely," he adds, "that plastic conduit played any role in, for example, the fire at the Westchase Hilton in Houston." He refers to a March 1982 fire that took 12 lives.

A toxicologist with a Ph.D. in chemistry from the University of Virginia, Birky until January 1982 headed combustion toxicity studies at the National Bureau of Standards. He has generally been careful in his public utterances. Yet some of them, both before and after he changed jobs, have been used by Allied to give spurious scientific credibility to its campaign against PVC.

One of Allied's chief exhibits is the November 1980 fire at the MGM Grand Hotel in Las Vegas, which killed 85 people and injured hundreds of others. The cause of the fire, it should be noted, was a short circuit in the hotel's metal conduit. But burning PVC plumbing, Allied asserts, has been implicated

in some of the deaths. The company has seized on a statement made by Birky while he was still with the Bureau of Standards and involved in the investigation of the blaze. The carbon monoxide levels in the victims' blood, Birky speculated at that time, were too low to have caused all the deaths.

This implied that something else caused them, and Allied has repeatedly pointed to plastics ever since. In a September 1982 news release headlined "Plastics in Construction Add to Fire's Tombstones," the company's public affairs vice president, Laurence Zoeller, declared: "There is mounting evidence that decomposing plastics contributed to the vast majority of fatalities in such recent tragic fires as at the MGM Grand Hotel."

This release did not mention that in November 1981 the National Fire Protection Association, an investigative and code-writing body, had issued its final report on the fire. It said that 79 out of the 85 victims died primarily from a combination of smoke inhalation and carbon monoxide or smoke inhalation only. Burns and smoke inhalation killed three more, while the remaining three each died of a different cause: burns, skull fracture, and heart failure. As Birky emphasizes, the report's findings are vague. But they are a far cry from implicating plastics.

Birky may nevertheless have done a bit of out-and-out propagandizing, though he vigor-

ously denies it. He had taken up his post at the Foundation for Fire Safety when he was interviewed by reporter Rolando Santos of KPIX-TV in San Francisco. Santos reported last March 23: "The leading researcher in the study of the deaths at the MGM, Dr. Merritt Birky, told me in these cases the toxic gases had to come from the plastics in the room, probably cyanide." Birky claims that Santos misquoted him. Santos says that he and Birky had a detailed conversation prior to the broadcast, and that Birky said exactly what was reported.

Whatever Birky may have said about cyanide, Allied brandished this scare word before the final report on the MGM fire was out. In one May 1981 advertisement in the trade press, the company said: "The Clark County Coroner reported that five victims, who were among the first autopsied, showed evidence of cyanide in their bodies. Cyanide is produced from burning plastic pipe frequently used for drain, vent, and waste disposal, as well as plastic that is commonly used for decorative wall coverings." Allied omitted to say that cyanide is also given off when other synthetic materials burn. In any event, the presence of cyanide is no proof that it killed anyone. The final investigation report on the MGM fire never mentioned synthetic materials—plastic pipe or whatever—as the primary cause of any death.

One of the Foundation for Fire Safety's officials has resorted to innuendo in discussing the Westchase Hilton fire in Houston. Birky, as noted, says it's unlikely that plastic conduit caused any deaths there. Yet Michael Olsen, then the managing director of the foundation, got on KHOU-TV in Houston a month after the fire, offering his "preliminary report" that "toxic gases in addition to carbon monoxide must be considered as cause of death." The TV reporter told his audience, "The Fire Safety Foundation believes some of those deadly gases can come from plastics."

**A**S A RULE, the foundation's spokesmen have not volunteered the source of their funds during such interviews. Unfortunately for Olsen, KHOU-TV's reporter Roger Lindberg was one of the few to ask him where the money came from. Olsen admitted, listeners were told by another reporter, that "he was funded largely by the metal industry." Olsen insisted that his report was unbiased. KHOU-TV then presented Dale Everitt of the Houston Fire Department, who dismissed Olsen's views. Said Everitt, "When you have a group like this, I think they're going to be interested in keeping those funds coming in." Olsen has since

left the foundation. Conveniently for Allied, some professional firefighters have strong opinions against plastics and will state them publicly. Shortly after the Westchase Hilton fire, Andrew Casper, then chief of the San Francisco Fire Department, appeared on KPIN-TV. Casper sketched a simple causal sequence in the MGM Grand fire: "More plastics, more fires, more deaths caused by the inhalation of toxic fumes." Later he went on the payroll of the Foundation for Fire Safety, which he has since left.

**W**HILE AN EX-FIRE CHIEF has credentials to speak out, this can hardly be said for another PVC opponent financed by Allied. Deborah Wallace is president of the Public Interest Scientific Consulting Service, another organization mainly backed by the company, to the tune of \$17,000 a quarter. With a Ph.D. in environmental physiology, Wallace has little expertise in deaths from fires. Yet she travels the country preaching the dangers of PVC and calling herself "an expert on fire toxicology."

She also made a pretrial deposition in 1980 as an "expert witness" in the litigation arising from a May 1977 fire at the Beverly Hills Supper Club in Southgate, Kentucky, in which 165 died. Later she testified that autopsy reports, hospital admission records of survivors, and questionnaires strongly suggested that PVC was responsible for the deaths and injuries at the fire. On this point she was disputed during the trial by the medical examiner of St. Louis County.

The Foundation for Fire Safety has lobbied repeatedly. Several states have been considering bills that would require that all materials be tested for their combustion toxicity before they can be considered for approval in building codes. Since metal conduit can't burn, it would pass such tests; PVC might not. Unfortunately, satisfactory testing procedures don't yet exist. Yet on May 6, 1982, Birky appeared before the fire safety subcommittee of the New York State senate finance committee and declared that they do. An inhalation test protocol that he helped develop at the National Bureau of Standards, he said, is able to prove that one material is more toxic than another.

One reputable authority disputes Birky. "There's no correlation between the test method and what happens in a real fire," says Irving Einhorn, an adjunct professor at the University of Utah, who has published 100 papers on combustion toxicology. "Yet Birky is going around the country trying to ban materials based on incomplete tests." The Bureau of Standards adds that even if its test

protocol were ready to be used, which it isn't, it alone would not justify banning some materials from building codes.

The plastics industry and Carlon have charged Allied with using questionable tactics within the National Fire Protection Association. Prior to an NFPA vote in May 1980 that would have recommended the inclusion of Carlon's flexible PVC conduit in the National Electrical Code, they say, Allied and other companies and trade organizations in the steel industry purchased scores of (and perhaps as many as 100) \$50 memberships in the organization. When the vote came up, these new members helped to defeat Carlon's conduit by 394 to 390.

**S**EVERAL NFPA MEMBERS were outraged by the way the outcome was achieved. One, Nathaniel Addleman, a registered fire protection engineer with Boeing Co., was particularly incensed when he addressed the group after the vote: "I had occasion to have lunch with a gentleman who is a salesman for one of the steel companies and he didn't know why he was here. He was going to go to a meeting at 12:30 to find out why he was here and he told how to vote. This is what's happening here today. We cannot let the NFPA degenerate to that type of thing."

Before and after Allied helped vote Carlon's conduit out of the electrical code, it was selling PVC products. Even though Allied President Kregel claims that he was aware of plastics' hazards as far back as 1972, his company sold PVC conduit during the mid-Seventies through distributors. Asked how he could sell a product that he considers hazardous, Kregel says, "Maybe we began to realize how bad it was later. Anyway, as soon as we began to realize how bad it was, we got out of the business."

Allied's general counsel, John Lison, says Allied got out of the PVC business for a different reason: it lost its supplier. He adds, "Our suppliers could not keep us price competitive. There wasn't enough profit margin in 1975." Allied got back into the PVC market during the summer of 1980. Kregel and other Allied officers worked out a deal in which Robintech would produce rigid plastic conduit for Allied on a private label basis. Kregel now says he wasn't aware that Allied was in the PVC business a second time. Asked if subordinates had put Allied back into PVC without his knowing about it, he responds: "Look, it was a nothing kind of thing. It was incidental and momentary. When we knew what was going on we backed off."

Actually Allied sold PVC conduit from about September 1980 to March 1981. It did so, moreover, without warning users of the

fire hazards it professes to be concerned about. According to Lison, Kregel got out of the business because this time he *really* found the material hazardous. "Ted was amazed by the horrors of the MGM fire, and then the others," says Lison.

Allied's suppliers remember a completely different story. When Allied concluded its relationship with Robintech, Pat Madormo, Robintech's executive vice president, met Bernie Auerbach, Allied's product development manager, and asked why Allied was calling it quits. According to Madormo, Auerbach told him that Allied felt that PVC was a different market from those it was used to. "The PVC market got pretty tough around then," says Madormo, "and there wasn't enough margin for them to buy from Robintech and resell."

Allied returned to the PVC business for a third time in November 1981. It acquired Elcen Metal Products Co. of Franklin Park, Illinois, one of whose product lines is PVC coated. A current product, called Strut, is a hanging PVC-coated pipe holder. If the big hotel fires convinced Kregel he should get out of the business, why is Allied selling something like this? "Look," says Lison, "we don't know why people die from fires in this country." But wouldn't PVC be dangerous in this sort of application? "We don't have a corner on the wisdom of the world," Lison says, "and Factory Mutual [a testing organization that does inspections for the insurance industry] kept telling us that this stuff is fine, that it'll be included in all the codes. You know, for lots of applications PVC is better than our stuff."

Despite this strange admission, Allied's war on PVC has continued without letup. Last September the newsletter of the American Council on Science and Health, a consumer education group, published an article headlined "The Merchandising of Fear" on some less than savory aspects of Allied's campaign. Zoeller's quick reply was morally lofty: "Although Allied obviously has an interest in this issue, we had every opportunity to enter the PVC market and chose not to on safety grounds. We believe this issue concerns human life and safety, and therefore transcends the commercial interest of any company or industry. We believe our record shows this concern."

■ Allied's record is something rather different—a rare, well-documented example of unfair tactics in the marketplace. Companies battling new products often play rough, with high-pressure salesmanship, aggressive pricing, antagonistic ads. But a few go further, in ways that sidestep notice. Allied has called attention to itself by overreaching. □

# frost

## CONSTRUCTION

January 25, 1983

Phoenix City Council

Gentlemen:

This study was prepared to determine the amount of plastic pipe that exists in relation to the total square footage in three types of apartment units currently being constructed in the City of Phoenix. If flammability is an issue, determine the quantity of A.B.S. plastic pipe relative to the other types of materials used in combustible construction systems.

The precise issue for consideration is the use of plastic pipe for waste and vent piping within combustible construction. The very nature of combustible construction carries with it the code requirements, restrictions and parameters that provide reasonable and prudent uses of this type of construction.

### CASE I STUDIO APARTMENT

439.10 Square Feet

EXACT AREA OF VERTICAL WASTE AND VENT PIPING

2 - 1½" NOM

3 - 2" NOM

1 - 3" NOM

7.051 = TOTAL SQUARE INCHES OF ACTUAL PIPE MATERIAL

0.04896 = TOTAL SQUARE FOOT OF ACTUAL PIPE MATERIAL

$.04896 \div 439.10 = .01115\%$

### CASE II ONE BEDROOM APARTMENT

652.03 Square Feet

EXACT AREA OF VERTICAL WASTE AND VENT PIPING

2 - 1½" NOM

3 - 2" NOM

1 - 3" NOM

7.051 = TOTAL SQUARE INCHES OF ACTUAL PIPE MATERIAL.

.04896 TOTAL SQUARE FOOT OF ACTUAL PIPE MATERIAL.

$.04896 \div 652.03 = .0075\%$

2113 S. 48th ST. SUITE #106 TEMPE, ARIZONA 85282 - TELEPHONE (602) 894-9871

January 25, 1983  
Page Two  
Phoenix City Council

CASE III TWO BEDROOM APARTMENT

885 Square Feet  
EXACT AREA OF VERTICAL WASTE AND VENT PIPING

1 - 1½" NOM  
3 - 2" NOM  
2 - 3" NOM

8.48 = TOTAL SQUARE INCHES OF ACTUAL PIPE MATERIAL.

.0588 = TOTAL SQUARE FEET OF ACTUAL PIPE MATERIAL.

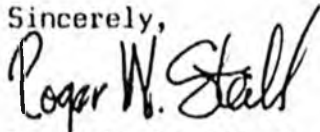
.0588 ÷ 885 = .00665%

CONCLUSION:

In combustible types of construction, plastic pipe is an extremely minute element when you consider the total amount of combustible products that make up a typical unit.

Taking that one step further, averaging the three cases, plastic pipe is one part in 12,437.

Sincerely,



Roger W. Steill, A. I. A.

UNIT TYPE 'A' - STUDIO

$$23'-0" \times 20'-4" - (4'-4" \times [20'-4" - 8'-8"]) + (4'-0" \times 5'-6") = 439.10 \text{ G.S.F.}$$

PLUMBING VERTICALS:  $1\frac{1}{2}" \text{ V} \ \& \ 2" \text{ W.}$  ,  $2" \text{ V} \ \& \ 3" \text{ W.}$  ,  $1\frac{1}{2}" \text{ V.} \ \& \ 2" \text{ W.}$

UNIT TYPE 'B' - ONE BEDROOM, ONE BATH


$$28'-8" \times 24'-6" - (4'-8" \times [24'-6" - 9'-0"]) + (4'-0" \times 5'-6") = 652.03 \text{ G.B.F.}$$

PLUMBING VERTICALS:  $2" \text{ V} \ \& \ 5" \text{ W.}$  ,  $1\frac{1}{2}" \text{ V.} \ \& \ 2" \text{ W.}$  ,  $1\frac{1}{2}" \text{ V} \ \& \ 2" \text{ W.}$

UNIT TYPE 'C' - TWO BEDROOM, TWO BATH.

$$26'-0" \times 35'-0" - (4'-0" \times [35'-0" - 23'-5"]) + (4'-0" \times 5'-6") = 885.00 \text{ G.S.F.}$$

PLUMBING VERTICALS:  $2" \text{ V.} \ \& \ 3" \text{ W.}$  ,  $1\frac{1}{2}" \text{ V} \ \& \ 2" \text{ W.}$  ,  $2" \text{ V} \ \& \ 3" \text{ W.}$

|                        |   |                                  |            |            |      |      |
|------------------------|---|----------------------------------|------------|------------|------|------|
| $1\frac{1}{2}" \ \phi$ |  | $1\frac{1}{2}" \text{ O.D. NOM}$ | 1.90" O.D. | 1.61" I.D. | WALL | .145 |
| $2" \ \phi$            |   |                                  | 2.375 O.D. | 2.067 I.D. | "    | .154 |
| $3" \ \phi$            |   |                                  | 3.50 O.D.  | 3.068 I.D. | "    | .216 |

$$1\frac{1}{2} (1.90 \div 2)^2 (3.1416) - (1.61 \div 2)^2 (3.1416) = 2.8353 - 2.0368 = .7985$$

$$2 (2.375 \div 2)^2 (3.1416) - (2.067 \div 2)^2 (3.1416) = 4.4301 - 3.3556 = 1.0745$$

$$3 (3.5 \div 2)^2 (3.1416) - (3.068 \div 2)^2 (3.1416) = 9.6212 - 7.3927 = 2.2285$$

# FROST CONSTRUCTION CORPORATION

2113 South 48th St. Suite 106  
 TEMPE, AZ 85282  
 894-9871

JOB \_\_\_\_\_  
 SHEET NO. 2 OF 2  
 CALCULATED BY \_\_\_\_\_ DATE \_\_\_\_\_  
 CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_  
 SCALE \_\_\_\_\_

UNIT 'A' = 439.10 G.S.F.

|         |        |            |                 |
|---------|--------|------------|-----------------|
| STUBS : | 1 1/2" | 2 x .7995  | = 1.5990        |
|         | 2"     | 3 x 1.0745 | = 3.2235        |
|         | 3"     | 1 x 2.2285 | = <u>2.2285</u> |

$$7.051 \text{ SL} \div 144 = 0.048965 \text{ S.F.}$$

439.10 G.S.F.

$$.048965 \text{ S.F.} \div 439.10 \text{ S.F.} = .0001115 = .01115 \%$$

$(439.10 \times 144) \div 7.051 = 8967.58$   $\therefore$  for each sq in of PLASTIC PIPE there is 8967 sq in of APT.

UNIT 'B' = 652.03 S.F.

|            |        |            |                 |
|------------|--------|------------|-----------------|
| ONE B.R. : | 1 1/2" | 2 x .7995  | = 1.5990        |
|            | 2"     | 3 x 1.0745 | = 3.2235        |
|            | 3"     | 1 x 2.2285 | = <u>2.2285</u> |

$$7.051 \text{ SL} \div 144 = 0.048965 \text{ S.F.}$$

$$.048965 \div 652.03 \text{ S.F.} = .000075$$

$$(652.03 \times 144) \div 7.051 = 13316$$

$\therefore$  each sq ft of PLASTIC PIPE there is 13,316 SF OF APT.

UNIT 'C' = 885 G.S.F.

|            |        |            |                 |
|------------|--------|------------|-----------------|
| TWO B.R. : | 1 1/2" | 1 x .7995  | = .7995         |
|            | 2"     | 3 x 1.0745 | = 3.2235        |
|            | 3"     | 2 x 2.2285 | = <u>4.4570</u> |

$$8.48 \text{ SL} \div 144 = .05888 \text{ S.F.}$$

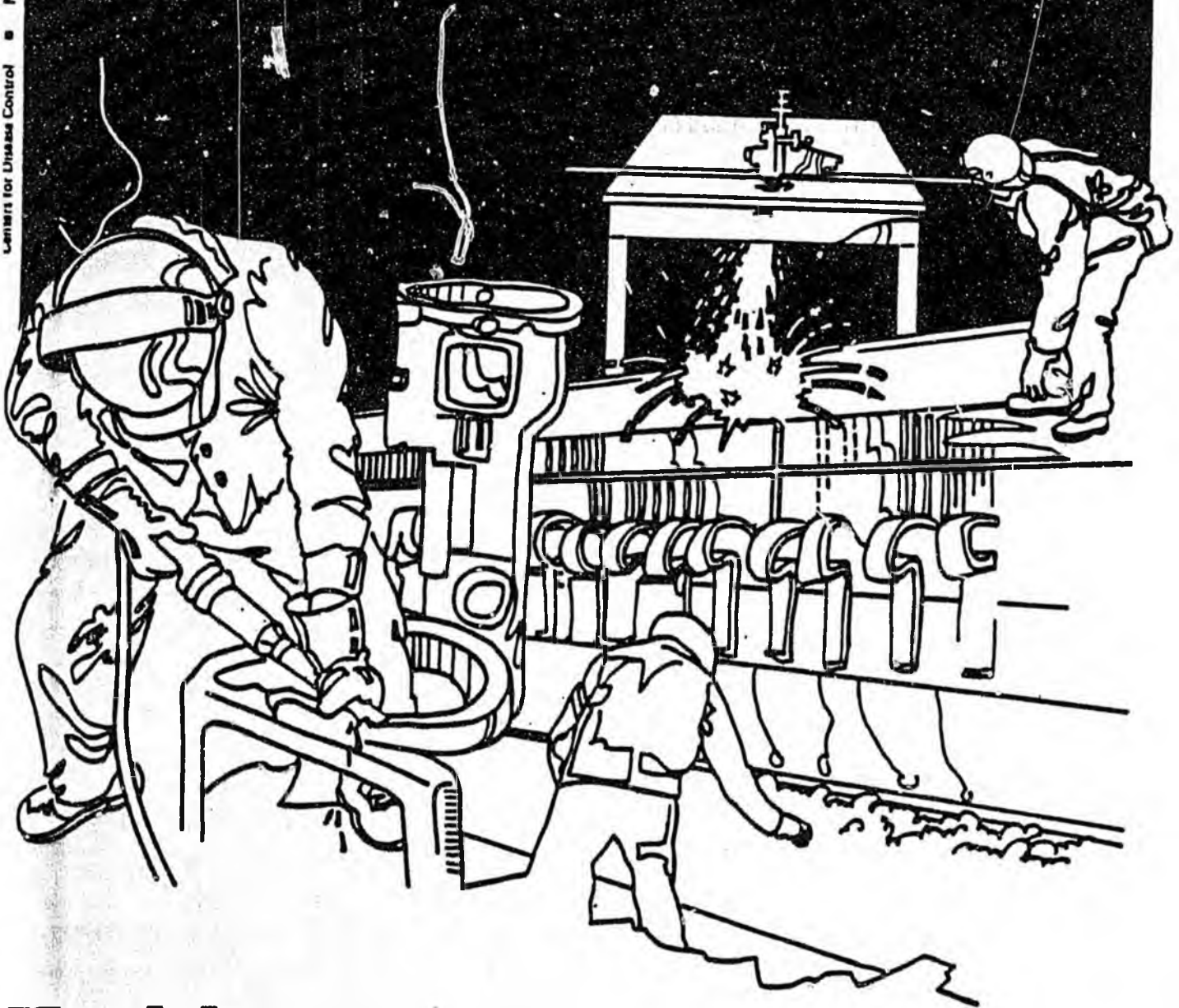
$$.05888 \div 885 = .0000665$$

$$(885 \times 144) \div 8.48 = 15,028$$

MAR 16 1983

Centers for Disease Control ■ National Institute for Occupational Safety and Health

# NIOSH



## Health Hazard Evaluation Report

HETA 81-336-1237  
PLUMBERS AND GASFITTERS LOCAL UNION 12  
BOSTON, MASSACHUSETTS





BUILDING AND HOUSING DEPARTMENT

City of Chula Vista  
CALIFORNIA

June 5, 1981

Mr. Jack Lancaster  
P. P. S. A.  
Route 1, Box 370  
Brighton, TN 38011

RE: Construction of Bay General Hospital, 435 "H" Street  
Chula Vista, CA

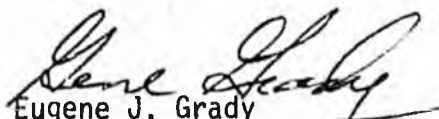
Dear Jack:

I am sending you complimentary the slides taken of the installation of plastic DWV and PVC cold water lines at the Bay General Hospital, Chula Vista, California.

The following is a background of the project. The original one-story reinforced grouted brick masonry hospital was constructed in 1969. The plumbing in the original was cast iron DWV and copper water lines. On May 5, 1969, a building permit was issued for a four (4) story, 70,000 sq. ft. addition of reinforced grouted brick masonry. (Architects, Burman and Rasmussen, 1451 E. Chevy Chase Drive, Glendale, California.) The permit valuation for the structure was \$2,000,000. With the consent of the owners, a request was made to the Chula Vista Board of Appeals and Advisors to allow the use of ABS, DWV, and PVC cold water lines. The seven-member board unanimously approved the request. Kitzman Plumbing Company of La Mesa, California did the installation; however, they chose not to use ABS underground but to continue with the existing cast iron. The building was given final approval on November 17, 1971. The building engineer for the hospital has nothing but praise for the selection of ABS and PVC and wishes it had been used underground.

Sorry for the delay in sending the slides.

Sincerely,

  
Eugene J. Grady  
Director of Building and Housing

EJG:js

Encl.



ADMINISTRATIVE BUILDING COUNCIL  
OFFICE OF THE STATE BUILDING COMMISSIONER  
300 GRAPHIC ARTS BUILDING  
215 NORTH SENATE AVENUE  
INDIANAPOLIS, INDIANA 46204

November 13, 1980

Jack Lancaster  
Plastic Pipe & Fittings Association  
999 North Main  
Glenn, Illinois 60137

Re: Your letter of October 8, 1980  
concerning code acceptance of plastic  
plumbing systems

Dear Mr. Lancaster:

On November 4, 1976 the Administrative Building Council adopted the 1976 Edition of the Uniform Plumbing Code with an amendment to Table A "Plumbing Material Standards", allowing CPVC or PVDC, Chlorinated Polyvinyl Chloride Water Piping ASTM D 2846-70 and also with an amendment to Subsection 401(a) allowing the use of ABS & PVC for sanitary plumbing. There is a note with this amendment to the effect that limits on ABS or PVC are not adopted as a part of this Code. To this date we have had no apparent problems with installations using these materials and the State of Indiana has found them to be acceptable when installed in accordance with the amended Plumbing Code and Manufacturer's recommendations.

If there are further questions concerning this matter please feel free to refer them to either myself or Mr. Hoyt Perry of this office.

Sincerely,

John W. Carmack, Director  
Code Research Division

JWC:tw

cc: file



United States  
of America

(NOT PRINTED AT GOVERNMENT EXPENSE)

# Congressional Record

PROCEEDINGS AND DEBATES OF THE 90<sup>th</sup> CONGRESS, FIRST SESSION

Vol. 113

WASHINGTON, THURSDAY, DECEMBER 14, 1967

No. 205

## House of Representatives

### PLASTIC PIPE: LOW COST AND HIGH RELIABILITY

Mr. HECHLER of West Virginia. Mr. Speaker, some years ago when a friend of mine came into my office and showed me a piece of plastic pipe, and said it might some day be widely used in plumbing and other piping, I thought the suggestion was a little fantastic. But it has held up under the stresses and the strains, resistance to chemical attack, and in many other ways proven to be the kind of tough competitor which continues to make great new advances every year.

The Federal Housing Administration, after analysis of the testimony presented, decided in 1961 to proceed with the insurance of homes equipped with plastic pipe. This is a particular type of plastic pipe known as "ABS". In case anyone wonders, Mr. Speaker, those letters stand for "acrylonitrils-butadiene-styrene." This particular form of plastic was invented in 1944.

#### WHAT ABOUT THE BUGGYWHIP MAKERS?

Whenever any new invention suddenly hits the market, it is quite natural in our competitive system that the product it replaces struggles to retain its competitive position. This is certainly true of metal pipes, still widely used in residential construction. An interesting sidelight on the great struggle is the fact that in the process more and more public attention has been attracted to the potential uses of ABS.

Many plumbing codes, which have become obsolete since the development of ABS plastic pipe, have not yet recognized ABS. This appears to be the primary reason why cast iron is used in residential construction. Of course there have also been some efforts to discourage union acceptance of the new and less costly plastic pipe.

#### HISTORY OF ABS DEVELOPMENT

There is a 20-year history of solid development in the use of ABS plastic pipe. That is a short period of time, but giant strides have been made in that short period, as evidenced by the following timetable:

1944. ABS (acrylonitrils-butadiene-styrene) plastic invented.

1947. Initial use of ABS pipe—in highly corrosive applications, such as chemical process piping, water purification plants, and sewage treatment plants. ABS performs successfully where metal pipe failed.

1960. ABS drainage pipe accepted by the mobile home industry. Completely displaced metal drainage pipe because of light weight, thermal stability and toughness. Over one million mobile homes now have ABS pipe.

1961. Federal Housing Administration insures loans on homes equipped with ABS drain, waste and vent pipe (DWV).

1964. Formation of ABS Council representing basic raw material producers such as Marbon and Unroyal Chemical, as well as manufacturers of ABS pipe and fittings. Specific purpose: code revision to permit use of ABS drainage pipe.

1966. All regional and national codes ac-

cept ABS DWV pipe. 200,000 new homes installed with this material.

1967. ABS drainage plumbing now accepted by 13 states and by local jurisdictions in 32 states. ASTM specification issued. ABS accounts for 17% of new home construction. Total residential installations now exceed 500,000.

#### RESISTANCE TO CHEMICAL ATTACK

Mr. Speaker, yesterday I had the interesting experience of witnessing a unique experiment visually conducted before a congressional committee. Dr. Robert L. Bergen, Unroyal chemist, poured equal quantities of diluted mercuric chloride into two plumbing traps—one of metal and one of ABS plastic. In order to protect the rug in the Rayburn Building committee room, which is the pride and joy of the chairman, transparent plastic bags were carefully draped over the plumbing traps to avoid any chemicals being spilled on the rug. Within minutes, the metal trap was cracked and leaking; the ABS trap was intact.

Dr. Bergen explained to the committee that the demonstration had been presented in order to refute evidence which had been offered to the same committee last July by spokesman for metal-pipe interest.

Dr. Bergen further explained that any material can be caused to fail under laboratory conditions of stress, time, and environment. Any test to be useful, he said, must simulate actual use conditions, and only such tests are valid in predicting the service life of a material from laboratory data.

Dr. Bergen said:

In plumbing systems, aggressive chemicals such as the photographic fluid used in the demonstration are invariably diluted and the exposure time is minimal due to flushing action.

He said stress corrosion has been known for decades to be common to all materials, including metals and plastics. The term refers to the fact that materials are more subject to chemical attack under conditions of applied stress.

He continued:

In a laboratory, totally unrealistic conditions of stress can be established and a material can also be subjected to full concentration of active reagents for protracted periods, but such stresses simply do not occur in plumbing drainage systems. Aside from the fact that reasonably good workmanship can be expected from a skilled trade, and that the public normally has the protection of plumbing inspection, the very flexibility of ABS pipe minimizes any stress from bending at the fittings.

Laboratory methods have been developed for predicting the long term life of ABS which show that a useful service of over 100 years can be expected. Such laboratory data is substantiated by actual case histories where ABS chemical handling systems have rendered trouble-free service for 20 years. Such systems were installed where metal pipe

had failed from stress corrosion.

Dr. Bergen concluded:

The existence of 1,500,000 successful ABS drainage plumbing installations, with no evidence of stress corrosion or chemical attack, is the best evidence of the complete suitability of ABS pipe for drain, waste and vent service.

ENTER A WEST VIRGINIAN

I will always call E. R. Thompson, Jr., a West Virginian, Mr. Speaker, even though he is now technically a constituent of the gentleman from Missouri [Mr. BOLLING]. Perhaps Mr. Thompson was born in Paola, Kans. Perhaps he did receive his civil engineering degree from the same institution that granted an animal husbandry degree to my own father, the University of Missouri. Perhaps he was a civil engineer with the Los Angeles Department of Water and Power from 1958 to 1960. But no individual can deny, Mr. Speaker, that Mr. Thompson came to West Virginia in 1960, and he joined the Marbon Chemical Division in my own congressional district. At first, he was in charge of the pipe testing program in Marbon's technical department, and in 1962 moved on to become applications engineer in charge of pipe products. After this flowery introduction, I should add that Mr. Thompson is now sales manager of Borg-Warner pipe products for Borg-Warner Corp.

All this is leading up to testimony which I personally heard Mr. Thompson present yesterday to a congressional committee. He related the fact that the Federal Housing Administration had first been approached in November, 1960 to discuss the merits of plastic drain waste and vent pipe and fittings, in order to establish a suitable specification for use of this material for FHA-mortgaged homes. A second meeting was held with FHA officials in Washington on March 2, 1961, at which additional information was presented on chemical resistance, dimensional stability with respect to hot water, and crush strength. A Use of Materials Bulletin was published by FHA on December 15, 1961, authorizing permission to use ABS pipe in homes with FHA-insured mortgages.

FEDERAL HOUSING ADMINISTRATION DEFENDS PLASTIC PIPE

On February 10, 1966, I personally attended a further hearing and presentation to Assistant Secretary of Housing and Urban Development and Federal Housing Commissioner Philip N. Brownstein. Mr. Brownstein subsequently wrote to our colleague from Connecticut, the Honorable JOHN S. MONAGAN:

Our review of the material presented at the February 10, 1966 meeting in my office has been completed and, in addition, we have the results of an independent laboratory test. On the basis of the findings, we have no basis for changing the conclusion reached in 1961 when Materials Bulletin #33 was issued.

Commissioner Brownstein further reported:

We have recently surveyed all our field offices to learn if there had been any complaints from owners of homes with ABS drain waste and vent piping. The results showed that not a single complaint had been received.

The above quotations and factual developments were all reported by Mr. E. S. Thompson, Jr., who, despite the fact he is now a Missourian, I will always recall as a key official at the Washington, W. Va., plant of the Marbon Chemical Division of Borg-Warner Corp.

WHAT ABOUT COST COMPARISONS?

Aside from the cost comparisons of construction materials at the present time, long-term trends are much more significant. The cost disadvantage of all types of metal pipe versus ABS is bound to widen, because of the high labor cost in manufacture and the increasing scarcity and higher cost of raw material. All

products which are inherently high in direct labor content are at an increasing economic disadvantage as wage scales continue to rise. This difference between steel, iron, or copper as opposed to ABS is dramatic.

The copper, iron, and steel industries are becoming increasingly dependent on ores from foreign sources. This tends to increase cost as well as instability of supply. By contrast, the petrochemical plants producing the acrylonitrile, butadiene, and styrene ingredients for ABS are almost literally placed over the oil and natural gas fields in the United States which are the source of these hydrocarbons.

The disparity in labor costs begins with the mineral deposit in the earth. The extraction, smelting ore reduction, and rail transportation of metal raw materials all require a high proportion of direct labor. By contrast, oil and natural gas are produced from wells and delivered to processing plants by pipeline. The chemical industry ranks among the lowest in labor content of all types of manufacturing.

METAL PIPE FABRICATION COSTLY

Fabrication into pipe also offers a striking contrast. Factory labor is typically over one-third the value of finished product in a cast-iron soil-pipe foundry. It is less than 10 percent in a well-managed ABS pipe extrusion plant. The light, tough ABS plastic then offers further savings in transportation, handling, and installation. The weight is a fraction of metal pipe, the chemically welded connections are faster, and mechanical damage is reduced because of the inherent toughness of ABS.

A concept of the ABS Council is that ABS helps to improve the productivity of labor on the job site, thereby helping to support the high and rapidly increasing standard of living of the journeyman plumber. The only alternative to increasing the productivity of onsite construction labor is prefabrication of materials at the factory. The chemically welded ABS joints required a skilled mechanic.

Aside from the economic aspects, Mr. Speaker, ABS owes much of its success to the performance advantages of greater permanence due to superior chemical resistance, toughness, and the chemical weld which is the strongest part of the pipe.

ULTIMATE RESOLUTION OF ISSUE

The obvious answer to the materials battle being fought for economic reasons is the complete diversification of the cast iron and copper industries into ABS pipe. This development is already well under way. Today, every major copper or cast iron pipe company is either in the plastic pipe business, distributing the product or studying the move. When this diversification is complete, the campaign of disparagement of ABS should be behind us.

The roster of cast iron companies now producing plastic drain waste and vent—DWV—includes industry leaders such as U.S. Pipe & Foundry, James B. Clow & Sons, Glamorgan Pipe & Foundry, American Brass & Iron Foundry, and Charlotte Pipe & Foundry.

The copper pipe and fitting industry is now represented in plastic DWV by Triangle Conduit & Cable, Nibco, and Mueller Brass.

It is also significant that in Canada the leading copper producer, Moranda Minco, as well as the largest cast iron pipe foundry, Canada Iron, are both well into the ABS DWV business.

No doubt these progressive and far-sighted metal pipe manufacturers will soon be joined by others.

material in fire are quantity, density, location, ventilation and the particular combination of materials.

Many plastics are more difficult to ignite than wood. Rigid PVC (polyvinyl chloride), for example, will not burn until fire temperatures reach over 700 degrees Fahrenheit. Also, PVC will not continue to burn unless supported by a direct flame. Likewise, neoprene and certain modified polyurethanes used for cushioning in public transportation resist both smoldering and flaming ignition.

**Q** Are there unique combustion products from plastics which are more of a hazard than the combustion products of natural materials?

**A** No. Science has yet to develop firm, unequivocal correlations between combustibility factors and toxic effects in evaluating overall fire hazards of materials. There is no evidence that smoke emitted by burning plastics presents any more of a hazard than smoke from wood, wool, leather or other natural materials. Smoke, from any fire source, can be toxic. This has been confirmed by studies conducted at Johns Hopkins University, Columbia University, Harvard University, Southwest Research Institute, and other independent research establishments.

**Q** Do plastics burn hotter and faster than natural materials, such as wood?

**A** Combustion rates of materials are related to both their form and composition. For

example, a solid oak log will burn more slowly than oak shavings. Similarly, some foam plastics will burn much faster than a piece of solid plastics material. There are whole families of plastics that will not support combustion by themselves — that is, they must be subjected to a continuing flame source to sustain combustibility.

**Q** Are small scale combustion-toxicity tests adequate for setting fire safety standards for materials?

**A** The most current scientific evidence indicates that laboratory toxicity tests should not be used, by themselves, in developing pass-fail criteria for evaluating materials. Such small scale tests do not correlate the large number of variable factors involved in real fire situations. It is not possible to judge the safety merits of a material simply by identifying the toxicants generated when burned. The "toxic threat" in fires is determined by all of the materials burning, in terms of their resistance to ignition and flame spread, their total volume and several other important factors that must be considered.

**Q** Should combustion-toxicity criteria be included in major building codes?

**A** No, not at this time. Toxicity measures were removed from building code requirements in 1976 because there was no consistent and scientifically accurate test method to determine reliably whether one material presents a greater toxic hazard than another in fire. This situation has not changed.

**Q** Are there model building codes which effectively address fire safety?

**A** Yes. The most serious problem involving fire safety and building codes is not their adequacy, but rather the inconsistency of enforcement and adoption of code revisions. Plastics face some of the most rigorous standards of any materials covered in the nation's building codes.

**Q** What is the plastics industry doing about fire safety?

**A** The Society of the Plastics Industry and its member companies have supported actively the nation's goal to reduce deaths and property losses due to fire. The industry has cooperated in this crusade with many Federal agencies, as well as state and local code groups, legislative bodies, standard-setting organizations, members of the fire service community and academia.

The result has been a broad industry-supported fire safety program which includes:

- scientific analysis of hazards posed by various elements of the fire problem
- collection and analysis of fire incident data
- research into the combustibility characteristics of materials
- promotion of stricter enforcement of building codes
- improved education and training materials for fire service personnel
- promotion of a comprehensive systems approach featuring devices for fire detection, suppression and safe escape

For further information, contact:



The Society of the Plastics Industry, Inc.  
355 Lexington Avenue, New York, N.Y. 10017

# PLASTICS

## The Facts about FIRE

### THE FACTS ARE THESE:

- Both natural and man-made materials give off toxic combustion products when burned.
- The primary causes of fire fatalities today are smoke and carbon monoxide, the same as before the age of plastics.
- As yet, no test has been developed to "rate" adequately the toxicity of various combustion products in real fires.
- Fire safety depends primarily on fire prevention coupled with reliable detection, suppression and evacuation systems.

### THE FACTS SHOW:

The U.S. fire death rate has decreased substantially over the last forty years while the use of plastics has increased dramatically.

gases. They always have been. Probably they always will be. The question today is whether the smoke and gases produced by burning man-made materials are any more hazardous than the smoke and gases produced by burning *natural* materials in the pre-plastics era.

Since before the age of man-made materials, carbon monoxide has been, and still is, identified as the dominant toxic gas.

There are those who claim that the introduction of man-made materials into our living environment exposes us to exotic gases from accidental fires, somehow placing us at greater risk.

Such a notion is without scientific foundation, contradicting the basic fact that the fire death rate is falling in the United States, and has been for years.

Fire and the hazards it presents make for a complex problem. Ease and type of ignition, the rate of fire growth, and amounts and types of smoke and gases generated, all must be considered.

In laboratory-scale testing, fire conditions can be controlled and certain phenomena can be observed and measured. But real fires are extremely complicated, each different from every other. Reliance upon small-scale toxicity tests that cannot be related to real fires will not lead to increased fire safety.

As the Federal Trade Commission pointed out in the early 1970's — and many other government and private agencies have verified

behavior of materials or assemblies in real life situations can be misleading.

Extensive laboratory research has been done on the nature of smoke and gases from burning materials. In addition, there have been a number of scientific examinations of smoke and gases produced in actual fires, as well as post-mortem studies of fire victims.

All of the studies have reinforced the position that carbon monoxide is the primary toxic gas.

Plastics and other man-made materials burn. They produce smoke and gases. And the smoke and gases from burning plastics will kill a person who inhales too much.

*Exactly the same statements can be made about burning natural materials such as wood, paper, wool or leather.*

Plastics are involved in more fires today than years ago simply because there are more plastics in the environment — construction, packaging, furnishings, transportation, apparel and so on.

If burning plastics were giving off unusually hazardous smoke and gases, the fire death rate would be expected to be rising, not falling.

Fire safety demands concentration on proven measures to reduce fire losses: smoke alarms and other detection devices, sprinklers and similar suppression systems, code enforcement, and a populace educated about fire hazards and evacuation procedures.

**Q What is the cause of most fire deaths?**

**A** The Fire Protection Handbook states that fire fatalities from inhalation of fire gases and hot air are far more common than are fire deaths from all other causes combined. Extensive investigations have shown carbon monoxide to be the primary toxicant.

**Q Is the fire death problem related to the growing use of man-made materials such as plastics?**

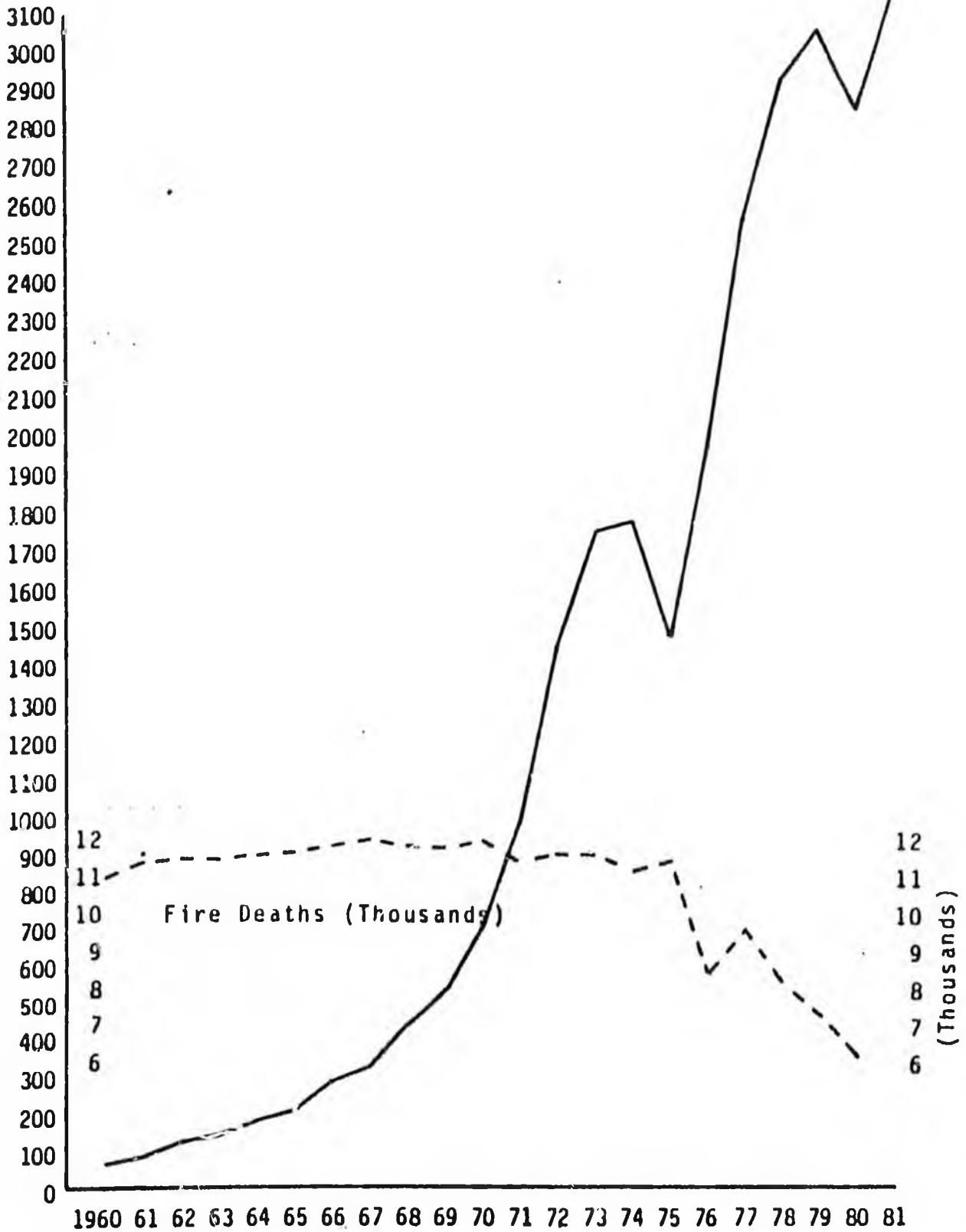
**A** No. Despite the sharp increase in the use of man-made materials in homes and public buildings, the number of fire deaths in the United States is declining. For example, the use of plastics in building construction has increased by more than 900 percent since the mid-1950's. During the same period the fire death rate actually decreased by more than 40 percent. Also, according to National Fire Protection Association statistics, between 1977 and 1981, the number of U.S. fire deaths occurring in residential and non-residential buildings dropped from 6655 to 5860.

**Q Do man-made materials such as plastics pose a greater hazard than natural materials?**

**A** No. All organic materials — wood, wool, cotton, paper, and plastics — react differently in real fires. Among the factors that can affect the behavior of a

**FIRE DEATHS DECREASE  
AS USE OF  
PLASTICS PIPE & FITTINGS INCREASE  
1960 - 1980**

Plastic Pipe  
and Fittings  
Millions of Pounds  
Shipped (U.S.A.)



\*In 1976, the methodology of reporting fire deaths changed.

\*\*From 1974 onward, includes plumbing pipe only, not fittings.

SOURCES: National Fire Protection Assoc., and Plastic Pipe & Fittings Assoc.

## PLASTIC INDUSTRY

### FIRE EXPERIENCE

#### OVERVIEW

1. THERE HAS BEEN NO SURGE IN FIRE CAUSED DEATHS FROM COMMERCIALIZATION OF PLASTICS FROM 1940 TO THE PRESENT TIME.
2. IN FACT, THE TOTAL NUMBER OF FIRE DEATHS HAS REMAINED QUITE STEADY FROM THE 1930'S TO THE PRESENT TIME. N.F.P.A. HAS RECENTLY RE-EVALUATED AND LOWERED THEIR ESTIMATE OF ANNUAL U.S. FIRE DEATHS.
3. THIS HAS OCCURRED IN SPITE OF THE MORE THAN DOUBLING OF THE POPULATION OF THE U.S. SINCE 1940. DEATHS PER CAPITA HAVE DROPPED.
4. HOLDING STEADY - FIRE DEATHS - IS NOT ALL GOOD BUT CAN BE GREATLY ATTRIBUTED TO THE GAIN IN EFFICIENCY AND SOPHISTICATION IN THE FIRE SERVICES.
5. NEVERTHELESS, STATEMENTS ARE BEING MADE ABOUT THE DIRE CONSEQUENCES RESULTING FROM PLASTICS USE, AND CPVC, PVC AND POLYBUTYLENE IN PARTICULAR, IN ONE BUILDING CONSTRUCTION USE -- IN PLUMBING. THIS DOES NOT MAKE SENSE.
6. IT DOES CERTAINLY SEEM POSSIBLE THAT THE PROLIFERATION OF POLYMERS IN BUILDINGS, HARD TO IGNITE CPVC AND PVC PRODUCTS IN PARTICULAR, HAVE HELPED RATHER THAN HINDERED ON THE FIRE SCENE.



# SOUTHERN BUILDING CODE CONGRESS INTERNATIONAL, INC.

900 MONTCLAIR ROAD

BIRMINGHAM, ALABAMA 35213

(205) 591-1853

"THE STANDARD CODES"

## OFFICERS

President

THOMAS M. MOSES  
Director/Manager  
Lata Buma Vista, Florida

President-Elect

CHRIST Y. SAVIDAS  
Building Official  
Shelby County, Tennessee

## TRUSTEES

C. D. HOWARD, JR.  
Director of Inspections  
Monticello, Alabama

J. E. ALTMAN, P.E.  
Building Official  
Columbia, South Carolina

C. M. NORTHGUTT  
Director of Inspections  
Zoning Administrator  
Valdosta, Georgia

BILL NEESE  
Building Official  
Orlando, Florida

DON FOX  
Building Official  
Victoria, Texas

## IMMEDIATE PAST PRESIDENT

JOHN A. PARNAM  
Inspector Superintendent  
Durham, North Carolina

## STAFF

WILLIAM G. VASVARY  
Executive Director

WILLIAM J. TANDYE, P.E.  
Director of Engineering Services

BILL P. MANNING, P.E.  
Director of Education

April 14, 1980

APR 17 '80

Mr. Jack Lancaster  
Plastic Pipe and Fittings Association  
490 Pennsylvania Avenue  
Glen Ellyn, Illinois 60137

Dear Jack:

Reference is made to your letter dated March 28, 1980 regarding the acceptance of plastic piping materials in the Standard Plumbing Code.

The 1979 edition of the Standard Plumbing Code approves the use of the following plastic piping materials:

1. SCH 40 ABS-PVC DWV - above and below ground use, with no height limitations
2. ABS sewer pipe
3. PSP-PVG sewer pipe
4. PSM-PVG sewer pipe
5. PVC - thin wall sewer pipe (outside use only)
6. ABS & PVC pressure pipe
7. Polybutylene pressure pipe & tubing (hot & cold water)
8. Polyethylene pressure pipe & tubing
9. CPVC pressure pipe (hot & cold water)

When installed properly these materials perform their intended functions and we have no record of complaints or reported failures of these materials.

If we can be of further assistance, let us hear from you.

Yours very truly,

  
William G. Vasvary  
Executive Director

WGV/jp

**PLEASE NOTE: THE PRECEDING PAGES WERE TREATED  
AS A UNIT IN THE ORIGINAL DOCUMENT.**

## Mr. Levi Goes to Juneau

with Steve Levi,  
Legislative Aide



Last week — and this week, for that matter — there is the annual mad scramble for capital projects.

After protracted negotiations between the Alaska House and Senate — with an eye on estimated revenue figures — legislative leaders came out with a target amount and then allocated the money toward specific capital projects.

The general consensus at this point is to quite literally give the governor enough rope to hang himself.

Assuming the capital project bills are passed fairly quickly, which virtually is guaranteed, the governor will be faced with the dilemma of either signing the bills intact or risking the wrath of both the House and the Senate by vetoing negotiated projects.

It's interesting to note that many of the projects were the top priority projects vetoed out of last year's capital bill.

In other words, in an attempt to sooth relations with the governor, the House and Senate are not attempting to override the governor's veto of last year's capital projects, but are taking the more moderate road.

But if the governor again plays havoc with the appropriations, Juneau will heat up quickly and considerably.

For the business community, last week also brought to the fore another chapter in the episode known as the "plastics debate." Focus of this debate is House Bill 508.

The underlying question was whether Alaska should adjust its plumbing codes from 1979 to 1982 standards. For many it appeared to be a simple, quick bill. But that was until the day of the hearing.

The first witness before the House Labor and Commerce Committee noted that while no one was particularly opposed to the overall bill, there was grave concern over the use of plastic pipe.

It was noted that plastic can be burned, which would release toxic fumes and, if not properly installed, spread a fire from one apartment to another. Therefore, builders should not be allowed too much latitude in the use of plastic pipes in buildings.

The industry witness, however, said that while plastic can catch fire, Douglas fir burns at 300 degrees below plastic pipe.

locates an underground plastic pipe and the effects of glue holding pipes together on humans who come in constant contact with it — the use of plastic for piping is spreading.

But as Dwight Perkins of the United Association of Plumbers & Pipefitters Local Union 262 said, "We feel plastic pipes are a hazard to the health of our workers as well as the people who are in constant contact with the glue used (with plastic) pipes, and we expect to testify against the bill in the future."

Another matter of concern last week was the upcoming Alaska Power Authority hearing on Anchorage concerning the "four-dam pool" in Southeast Alaska.

Basically, the power authority is counting on the cooperation of Petersburg, Wrangell, Ketchikan, Kodiak and Glen-

nallen in resolving what would be the fatal flaw in hydroelectric financing in Alaska.

The problem is that the cost of hydroelectric power without a state subsidy might be higher than the same power generated by fossil fuels.

There are three problems:

First, there is the "Susitna Blackmail Clause," also known as the "Susitna Equity Clause," which states if the proposed Susitna Dam Project is not under construction by 1985, a great number of power authority grants immediately convert to loans.

The financial burden of this metamorphosis might put Alaska Power Authority out of business.

Second, the communities of Southeast Alaska, when faced with taking electricity from Tye Hydroelectric Project, for instance, at a much higher rate than the established utilities, are concerned that once on the system, electric costs could escalate repeatedly.

Third, the long-range picture is that if the four-dam hydroelectric project is found to be uneconomical, it will mean that all future projects, and specifically the Susitna Project, may come under increasing fire.

Bonding could suffer from the legislature's point of view, this might mean the would be the final fiscal



# City and Borough of Sitka

304 LAKE STREET. SITKA, ALASKA. 99835

May 9, 1984

TO: MEMBERS OF THE  
SENATE LABOR & COMMERCE COMMITTEE  
HONORABLE SENATOR DICK ELIASON, CHAIRMAN

FROM: CITY AND BOROUGH OF SITKA  
HARRY CHARTIER  
BUILDING OFFICIAL

Honorable Senators,

As the attached information indicates, the City and Borough of Sitka has, for some time, been interested in the development, adoption and enforcement of building codes.

A particular area of interest and research in recent months has been the Uniform Plumbing Code.

As a result of that research and interest, two primary areas of concern have developed;

1. In the interest of maintaining state-of-the-art building codes, municipalities often adopt uniform codes before those codes can be adopted at the state level.

The Administrative Sections of these codes provide for a Board of Appeals to review materials and methods of installation of materials that have been nationally reviewed, tested, and approved for use during the years since the currently adopted codes were written.

The State of Alaska has excluded this appeals process, from the code it has adopted, leaving municipalities with no formal interface with the State to provide for state-of-the-art materials and so on.

Municipalities need either to be recognized by the state as administrative authorities or the state needs to retain that section of the Uniform Plumbing Code that provides for an appeals process.

2. From our research and piping experience, the City and Borough of Sitka feels that the debate over the use of ABS/PVC piping materials is a mute point.

Arguments against the use of these materials appear to be based on parameters other than research and sound engineering judgement.

Please refer to enclosures.

The City and Borough of Sitka supports the adoption of the 1982 edition of the Uniform Building Code as written.

Thank you for your time and for your considerations.

Sincerely,



Harry Chartier  
Building Official

HC:cj

September 13, 1983

A working paper:

STRINGENCY REVIEW OF ACRYLONITRILE-BUTADIENE-STYRENE (ABS)  
AND POLYVINYL CHLORIDE (PVC) DRAIN, WASTE, AND VENT (DWV)  
PIPING AND FITTINGS

Any review comparing ABS/PVC piping used in construction projects with cast iron (CI) or ductile iron (DI) piping must begin with fire safety. The first section of this working paper then, will review published reports addressing ABS/PVC DWV system performances under standard fire exposure tests.

A second area that must be examined is a piping material's ability to move fluids. Roughness coefficients, corrosion resistance, and other parameters will be compared.

Fire Exposure Performances Examined:

Extensive examinations of ABS/PVC DWV plumbing trees have been made of bearing and non-bearing, one and two hour rated fire wall assemblies, and in two hour rated floor/ceiling assemblies. These examinations have been made by both the College of Engineering of Ohio State University at Columbus' Engineer Experiment Station, and by the firm Rolf Jensen and Associates, Inc., fire protection engineers and building code consultants of Deerfield, Illinois. Over the years other testing organizations and consultants have examined fire performances of plastic pipe.

Details of the construction techniques used, material specifications, and testing parameters incorporated in the fire exposure procedures can be gleaned from the body of the published reports (see appendix) and will not be covered in depth in this paper. The reports will however, be quoted.

Ohio State University's fire exposure test program had two (2) primary objectives as outlined in the "purpose" section of their test publication:

1. "...the central issue is whether ABS or PVC DWV, when properly installed, will transmit fire through walls or floors, thereby reducing or otherwise affecting the fire endurance of such walls or floors. This, then, became the primary objective of the OSU Fire Test Program."
2. "A secondary objective was to learn what constitutes proper installation techniques for combustible piping in fire-rated

construction. Over the years, various methods have been proposed including the use of metal sleeves or thimbles through the walls as well as the exclusive use of metal "P" traps as opposed to plastic traps. The OSU tests have laid to rest certain long-standing myths."

ASTM E-119; the standard for fire tests of building construction and materials (also known as UL 263 and NFPA 251), was the standard fire exposure condition used at O.S.U.

The aim of fire exposure testing is to secure constructions that are safe and not a menace to neighboring structures, or to the public. To do this fire resistive properties of building assemblies are measured and specified according to common standards that are expressed in hours or minutes of fire resistance.

The wall sections and plumbing trees tested all performed well. The OSU fire exposure resulted in fire-resistive rating of up to two (2) hours on bearing and non-bearing walls incorporating ABS/PVC pipe materials exposed to temperatures reaching 1700°F.

Conclusions of the OSU program follow:

1. The performance of all wall assemblies in the fire endurance and hose stream tests was, in all features, identical to that of the same wall assemblies without the ABS/PVC DWV plumbing systems incorporated.
2. These tests demonstrated that plastic piping, within walls, is not involved in the early stages of a fire.
3. Fire consumption of the plastic piping, within the wall is very low.
4. Passage of flame through vertical and horizontal penetrations is minimized with plastic piping. Heat softened plastics tend to close openings thus reducing heat and flame transmission and flue effects through such penetrations.
5. Plastics traps proved to be equal to, if not better than, the metallic tubing traps. In these tests, while both were used successfully, less heat transmission was observed with the plastic traps.
6. Sealing openings around penetrations with non-combustible sealants is essential. These tests indicated that without sealing, no piping material could be expected to pass the tests.

7. Properly installed plastics plumbing systems will not conduct flame through a fire rated floor of the types tested.
8. Plastic fixtures act as their own flame barriers.

The results at OSU were consistent with the other building assembly fire test results reviewed, all incorporated the industry standard test procedure, ASTM-E 119. None of the tests reviewed contained any failures of plastic plumbing assembly due to fire exposure.

The summary of plastic materials performance written by H. F. Van Der Voort for the National Fire Protection Association best addresses the relevant points to consider when evaluating the proposed use of plastic plumbing assemblies. His remarks are quoted below:

1. "There are no documented cases of plastic conduit, insulated wire, or piping contributing unusual life hazards to a fire problem."
2. "These materials will produce combustion products that are different from, but no more toxic than those from other organic materials allowed in construction."
3. "Since the relative amount of plastic conduit, insulated wire, and piping used in construction is less than one percent of the total fuel load, it presents a minimal fire problem".
4. "Plastic's unique combination of flame resistance, corrosion resistance, and insulative properties makes it an excellent material for conduit, wiring, and piping."
5. "Proposal to limit the use of plastic conduit, insulated wire, and piping on the basis of danger to life and property are unwarranted. Normal fire protection and fire-fighting techniques will be effective where these products are exposed to fire."

#### Fluid Transmission Characteristics:

Given piping of equal diameters, installed at the same slopes, the pipe with the smoothest wetted perimeter will move the most fluid in a given period of time. The texture of a pipes interior surface

is rated by its roughness coefficient. The smaller the coefficient the smoother the pipe. Hence, the smaller the number, the more fluid transport occurs.

Cast iron/ductile iron pipe has an established roughness coefficient (n) of 0.013 (good condition). Plastic pipe condition does not deteriorate under normal applications and has roughness coefficient of 0.0090.

When comparing hydraulic flow characteristics of cast iron pipe with those of plastic pipe having congruent diametrics laid to a typical slope; (S=0.004'/ft) it can be seen from a Mannings Nomograph that plastic pipe fluid velocity is approximately 26% greater than the more commonly seen cast iron fluid velocity.

It is clear that hydraulically, plastic pipe is superior in performance to the less smooth piping materials typically used in commercial installations.

ABS and PVC plastic pipes' ability to resist both chemical and electrical corrosion is well accepted in the engineering/construction industries.

Plastic pipe resists corrosion when flooded with a wide range of chemicals commonly found in the typical industrial/commercial installation. Ductile iron and cast iron piping does not resist corrosion as well as the plastics.

Some of these common chemicals include:

- Hydrogen sulfide, gas and condensates
- Methane gas
- Sulphuric acid, gasses, and condensates
- Carbon dioxide gas and related compounds
- Ammonias, gas, condensates, and related compounds
- Detergents
- Non-combustible cleaning solvents

After a ten (10) year history of uncovering existing pipe assemblies, without a single exception coming to mind, all cathodic corrosion I have located would be found in unprotected (and occasionally protected) metallic piping materials; never in unprotected plastics.

Modulus of plasticity (Mp.), a materials tendency to sag in the middle when supported at each end, is a performance characteristic that must be viewed.

A ten (10) foot, 1 inch diameter willow will deflect more at it's center span than would a ten (10) foot, 1 inch diameter piece of reinforcing steel.

Plastic pipe sags more than a comparable section of cast iron pipe.

The 1982 Uniform Building Code clearly outlines allowable vertical and horizontal piping run spans, and specifies bracing locations.

Plastic pipe, when installed properly, produces sag no more evident than sags in properly installed metallic pipe.

Under normal design formats, the design life statistics of plastic piping materials compare very favorably with the design life statistics of metallic pipe materials.

To Summarize:

In this writer's opinion, the word stringent is not an engineering term but a legal term. Equivalent wording often found in specifications are "equal" or "approved equal". The word equal is used to address design and/or performance standards.

From reviewing both technical publications and personal experience with a wide range of commercial pipe installation, it is clear to this writer that plastic pipe materials are not less equal than metallic pipe. Plastic piping actually far out performs the commonly used metallic conduit in the types of uses proposed.

Given the results of massive data produced during the nationally recognized fire exposure test programs of plastic pipe; given the superior fluid transmission qualities of plastic pipe; given the excellent corrosion resistance of plastic pipe; given the usually encountered plastic pipe construction techniques; and given comparable design life of plastic pipe; this building official would be in error if he prevented the commercial installation of plastic pipe where allowed in the 1982 Uniform Plumbing Code.

It is this writer's opinion that the type of information included in this paper was the type of data used by the 1982 Uniform Plumbing Code Review Committee in approving the use of plastic pipe DWV systems in commercial construction.

Harry Chartier  
Building Official

A Working Paper:

STRINGANCY REVIEW OF ABS AND PVC DRAIN, WASTE, AND VENT  
PIPING AND FITTINGS

The following is a list of the publications used in the preparation  
of this paper:

MC GUIRE, J.H., SFPF; "Penetration of Fire Partitions by Plastic  
DWV Pipe".

VAN DER VOORT, H.F.; "Characteristics of Polyvinyl Chloride Conduit,  
Insulated Wire, and Piping in Fire Situations".

DUPONT Co, The; "Fire Research Into Plastics".

NATIONAL BUREAU OF STANDARDS; "Fire Spread Potential of ABS Plastic  
Plumbing".

JENSEN, Rolf and Associates; "Fire Testing Plastics DWV Systems".

"Building Research Laboratory Report No. 5473"

WILEY; "Design for Civil Engineers"



# City and Borough of Sitka

P.O. BOX 79 · SITKA, ALASKA · 99835

September 20, 1983

CERTIFIED 214709  
Return Receipt Requested

Jim Robinson, Commissioner  
State of Alaska  
Department of Labor  
Pouch 1149  
Juneau, AK 99802

SUBJECT: APPEAL TO THE STATE OF ALASKA  
ALLOWING THE USE OF ABS DRAIN, WASTE, & VENT  
PIPING IN COMMERCIAL CONSTRUCTION AS PERMITTED  
IN THE 1982 EDITION OF THE UNIFORM PLUMBING CODE  
IN SITKA, ALASKA

Dear Commissioner Robinson:

As you may know the State of Alaska is currently using the 1979 edition of the Uniform Plumbing Code (U.P.C.). Some Municipalities, including the City and Borough of Sitka, have adopted the more current 1982 edition of the Uniform Plumbing Code.

The use of ABS drain, waste, and vent (D.W.V.) piping material is not specifically listed as an approved material in the 1979 U.P.C., ABS DWV piping is, however, listed as an approved material in the 1982 U.P.C.

Two problems arise from this conflict in materials listings:

1. Builders are potentially placed in "double jeopardy" in being forced to meet the requirements of conflicting or different codes.
2. Prevention of local municipalities from adopting and enforcing the most current editions of nationally recognized building codes.

Jim Robinson  
Commissioner  
State of Alaska  
Dept. of Labor  
APPEAL  
September 20, 1983  
Page 2

The Municipality of Sitka has, and is attempting to resolve these two problems in a number of ways.

In order to give you a clarified history of this issue, I would like to review our steps at addressing this problems.

In mid-June of this year, Department of Labor inspector, Mr. Alan Anaka, informed this building official that the City and Borough could not enforce the 1982 edition of the U.P.C.'s approved materials listing since the updated materials listings were less stringent than those listings in the 1979 U.P.C.

During this mid-June discussion with Mr. Anaka, the Municipality took the following positions:

1. Sitka has the right under state law, and as a recognized administrative authority under the U.P.C., to enforce the nationally recognized building codes it has adopted, and;
2. That Section 201(f), minimum standards, allowed the use of the DWV piping materials not specifically listed in the 1979 U.P.C., if approved by an administrative authority.

In a June 6th letter to Mr. Anaka's supervisor in Anchorage, Mr. Don Cather, the Municipality took these same positions.

To this date, neither Mr. Anaka nor Mr. Cather have addressed Sitka's statutory authority, and both have failed to recognize our administrative authority to allow the use of ABS DWV materials as an accepted alternative material under the provisions of Section 201 of the 1979 U.P.C.

In a telephone conversation with Mr. Cather in late August, he indicated the next step is an appeals request with you, thereby prompting this letter of appeal.

Jim Robinson  
Commissioner  
State of Alaska  
Dept. of Labor  
APPEAL  
September 20, 1983  
Page 3

While Sitka believes it has every legal right to approve the use of this pipe, and that an "appeal" is a misnomer, I feel that something should be done to get the ball moving.

As matters stand now, the Department of Labor is illegally preempting plumbing code enforcement and is performing duplicate inspections in Sitka contrary to A.S. 18.60.735.

Local citizens are faced with the threat of State sanctions for following the local code (1982 U.P.C.) which is as "stringent" as the 1979 version and the State is illegally ignoring Sitka's status as an administrative agency under the 1979 U.P.C. with full power to approve such pipe.

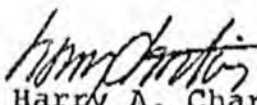
Wishing to bring this issue to the fore, the City and Borough of Sitka is formally requesting that the use of ABS drain, waste, and vent piping materials be reviewed and approved for use in Sitka following the guidelines of the 1982 U.P.C. under Section 20.14 and 201 of the 1979 U.P.C.

Enclosed is a paper addressing the "stringency" of ABS piping for your use and the use of the members of the Board of Appeals.

The Municipality of Sitka would, of course, appreciate being kept current on the status of this issue. Please keep us advised of the date of the Board of Appeals.

If you have any questions or if we can be of any help in this matter, feel free to contact my office.

Sincerely,

  
Harry A. Chartier  
Building Official

HAC:glb

Enclosure: Stringency Review of ABS DWV Piping & Fittings

cc: P. Hallgren, Municipality Attorney  
F. Gutierrez, Administrator

SUMMARY SHEET

PLASTIC PIPE WATER SERVICE FAILURES

Breakdown of Costs:

| <u>LOCATION</u>          | <u>COSTS</u>                |
|--------------------------|-----------------------------|
| Memphis, Tennessee       | 6.2 million                 |
| Napa, California         | \$208,000                   |
| San Antonio, Texas       | 50 million                  |
| El Paso, Texas           | 2 million                   |
| Irvine Ranch, California | 38.1 - 38.25 million        |
| Germantown, Tennessee    | 1.2 million (estimate)      |
| TOTAL:                   | <u>97.5 - 97.65 million</u> |

Problems with plastic pipe - Source Unknown

## SUMMARY OF PLASTIC PIPE

### WATER SERVICE FAILURES

The following is a summary of plastic pipe water service failures which have occurred throughout the United States.

#### MEMPHIS, TENNESSEE

This community used polybutylene from approximately 1972 to 1979. The pipe was used primarily for water service lines to the hookup to individual residences. Failures were recognized as early as 1972, and included stress cracks, pinhole leaks and cramps and creases. The water utility discontinued use, and is replacing the pipe as it fails. Estimated cost to the community is 6.2 million dollars.

#### NAPA, CALIFORNIA

This community used polybutylene and polyethylene from 1972 to approximately January, 1982. Polybutylene was used exclusively from 1972 to 1978, and polyethylene from 1978 to 1982. The city experienced failures which included sidewall cracks, pinholes, penetrations by pebbles, splits on the sides, stress failures and shear breaks at a fitting. The City of Napa is replacing the plastic pipe as it fails, and the use of plastic pipe has been banned by the City Council. Estimated cost for the failures is \$208,000.

#### SAN ANTONIO, TEXAS

This community has used polyethylene and polybutylene 2110. Polyethylene was used from 1966 to 1970, and polybutylene from 1970 to 1978. The pipe was used as standard material for all service lines and was used exclusively for new services as a replacement for copper. The failures which were experienced included pinholes, splits and sheers throughout the system. The city is replacing the plastic pipe en masse. At first, they only replaced it as the pipe failed, but then decided it was necessary to replace the entire system because of the extent of failure. The estimated cost to the city, as determined from a lawsuit which has been filed, is approximately 50 million dollars.

#### EL PASO, TEXAS

This community used polyethylene, 3406, Hyd-molecular. It was used for approximately eight years and began to be phased out in approximately 1979. No plastic pipe is used at this time. The failures included fine stress cracks, longitudinal cracks, caused by stress on the pipe itself. The water utility is replacing the pipes as they fail, and is not doing mass replacement. The estimated cost for the failures is approximately 2 million dollars.

SUMMARY OF PLASTIC PIPE

WATER SERVICE FAILURES

(continued)

IRVINE RANCH WATER DISTRICT,  
CALIFORNIA

This community used polyethylene beginning in 1961 and discontinued use in approximately November, 1980. It was used primarily in new development areas, and was not used to replace copper unless the whole line had to be replaced. Failures included the pipe splitting in half, which was attributed to a stress problem, longitudinal cracking and soil conditions. In addition, there was a hardening and shattering of pipe. A management decision was made to replace the pipe as it fails. The cost from the failures is approximately 38.1 to 38.25 million dollars.

GERMANTOWN, TENNESSEE

This community used polyethylene and polybutylene from approximately 1973 to 1978. Ninety percent of the plastic pipe was polyethylene. It was installed primarily in all new subdivisions. Failures from the pipe included breaking due to brittleness and snapping, usually very close to the connection at the main or the meter where there was the most stress. The pipe split around the circumference rather than longitudinally. Costs from the failures are estimated, due to the fact that this community is also involved in a lawsuit against the manufacturer. Estimated cost is 1.2 million dollars.

TOTAL ESTIMATED COSTS FOR FAILURES FROM THE ABOVE JURISDICTIONS:

97.5 - 97.65 million dollars

1/11/83.

H B

508

# 2

Drafted, but never discussed

Original sponsors: Cowdery and Liska

1 IN THE HOUSE

BY THE LABOR AND  
COMMERCE COMMITTEE

2 SENATE CS FOR HOUSE BILL NO. 508 (L&C)  
3 IN THE LEGISLATURE OF THE STATE OF ALASKA  
4 THIRTEENTH LEGISLATURE - SECOND SESSION

5 A BILL

6 For an Act entitled: "An Act relating to the plumbing code."

7 BE IT ENACTED BY THE LEGISLATURE OF THE STATE OF ALASKA:

8 \* Section 1. AS 18.60.705 is amended to read:

9 Sec. 18.60.705. PLUMBING CODE. Except for provisions incon-  
10 sistent with AS 18.60.706, the [THE] Department of Labor shall adopt,  
11 as the official minimum plumbing code for the state, the Uniform  
12 Plumbing Code, 1982 [1979] edition, adopted at the 52nd [49TH] Annual  
13 Conference, October 1981 [SEPTEMBER, 1978], International Association  
14 of Plumbing and Mechanical Officials, chs. 1 - 13 and appendices,  
15 useful tables, and installation standards, but excluding Part I,  
16 Administration, pages 1a - 6a, all of subsection (e) and its excep-  
17 tion, and the second and third sentences of part (a) of sec. 1004,  
18 ch. 10, page 75, and subject to AS 18.60.710 - 18.60.740.

19 \* Sec. 2. AS 18.60 is amended by adding a new section to read:

20 Sec. 18.60.706. PLUMBING MATERIALS AND INSTALLATION. (a)  
21 Drainage systems in the state may not be made of extra strength vitri-  
22 fied clay or vitrified clay materials.

23 (b) Galvanized wrought iron, galvanized steel pipe,  
24 Acrylonitrile-Butadiene-Styrene (ABS) pipe, or Polyvinyl Chloride  
25 (PVC) pipe may not be used underground and shall be installed not less  
26 than six inches above ground.

27 (c) ABS or PVC pipe is limited to residential construction of not  
28 more than 25 feet in pipe stack height and of pipe thickness no less  
29 than schedule 40 iron pipe size standard steel pipe. ABS or PVC pipe

1 may not penetrate any one hour fire wall unless the pipe is sleeved  
2 with at least 20 gauge metal for six inches or more beyond the wall or  
3 changed to schedule 40 galvanized drainage, waste and vent copper or  
4 cast iron pipe to a metal trap connection.

5 \* Sec. 3. AS 18.60.740(i) is amended to read:

6 (1) "code" means the Uniform Plumbing Code, 1982 [1979]  
7 edition, adopted at the 52nd [49TH] Annual Conference, October 1981  
8 [SEPTEMBER 1978], International Association of Plumbing and Mechanical  
9 Officials as modified by AS 18.60.705 and 18.60.706;  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29

IN THE SENATE

BY P. FISCHER

SUBSTITUTE FOR  
SENATE BILL NO. 214 / HB508

IN THE LEGISLATURE OF THE STATE OF ALASKA  
THIRTEENTH LEGISLATURE - SECOND SESSION

A BILL,

For an Act entitled: "An Act relating to the plumbing code."

BE IT ENACTED BY THE LEGISLATURE OF THE STATE OF ALASKA:

\* Section 1. AS 18.60.705 is amended to read:

Sec. 18.60.705. PLUMBING CODE. The Department of Labor shall adopt, as the official minimum plumbing code for the state, the Uniform Plumbing Code, 1982 [1979] edition, adopted at the 52nd [49TH] Annual Conference, October 1981 [SEPTEMBER, 1978], International Association of Plumbing and Mechanical Officials, chs. 1 - 13 and appendices, useful tables, and installation standards, but excluding Part I, Administration, pages 1a - 6a, all of Subsection (e) and its exception, as well as the second and third sentences of Part (a) of Section 1004, Chapter 10, Page 75, and subject to AS 18.60.710 - 18.60.740. The following amendments to said code shall be adopted:

Provided by Dwight Perkins  
Plumbing Union

- In Chapter 4, Page 37, Section 401(a) and (b), shall be amended by deletion of the words "extra strength vitrified clay pipe" and "vitrified clay".

- In Chapter 4, Page 37, Section 401(a), subparagraphs number (1), (2) and (3), shall be deleted and will be replaced by the following words:

"1. No galvanized wrought iron or galvanized steel pipe or ABS or PVC shall be used under ground, but all such pipe shall be kept at least six inches above ground.

2. ABS or PVC installations shall be limited to residential construction not over 25 feet in stack height. ABS and PVC shall be no less than Schedule 40 iron pipe size standard steel pipe thickness. ABS or PVC shall not penetrate any one hour wall unless it is sleeved with a minimum of 20 gauge metal for a distance of six inches beyond the wall or changed to Schedule 40 galvanized DWV copper or cast iron pipe to a metal trap connection."

- In Chapter 5, Page 45, Section 503(a), subsection number (2), shall be deleted and replaced with the following words:

"2. ABS or PVC installations shall be limited to residential construction not over 25 feet in stack height. ABS and PVC shall be no less than Schedule 40 iron pipe size standard steel pipe thickness. ABS or PVC shall not penetrate and one hour wall unless it is sleeved with a minimum of 20 gauge metal for a distance of six inches