ALASKA LEGISLATURE COMMITTEE FILES 1985-1986 8672

3462 HLAB HB 63

338

("Dallas" continued fro n cover)

Two installers unroll a coil of polybutylene pipe along ceiling beams in an apartment at Alpha Point. A smaller coil, crimping tool and prefabricated drop pipes to sprinkler heads are visible in the foreground.

recommended for approval for concealed, wet, light-hazard fire sprinkler systems. [Editor's note: Since this story was written, these recommendations have been adopted by the City of Dallas.]

In the largest installation to date of polybutylene pipe in a fire sprinkler system in Dallas, more than eight miles of the flexible pipe have been used in the 324-unit Alpha Point Apartments, a series of 13 three-story buildings in northeast Dallas. Alpha Point is built on a slender rectangular tract of land next to the LBJ Freeway and did not qualify for a sprinkler exception because of inadequate fire department access.

Wm. H. LaDew, Inc., which began installing fire protection systems in 1931 and has put in more than 3 million sprinklers, was awarded the contract by the builder.

The Alpha Point project required about 3,200 fast-response sprinklers and more than 40,000 feet of ¾" and 1" polybutylene pipe. The individual one- and two-bedroom units, ranging from about 650 square feet to 900 square feet, each contain an average of 10 sprinklers and 125 feet of pipe.

After design of the sprinkler system, pipe and fittings were assembled at LaDew's plant and tagged for a specific portion of the sprinkler system before being delivered to Alpha Point. On the job site, a two-man crew, guided by the tags identifying the installation location, quickly installed the pipe above and along the beams in the ceiling. Because of the pipe's flexibility, far fewer attachments, elbows and tees were used than would have been needed with copper or black iron pipe. After the main and feeder lines were installed, short drops for the sprinkler heads were attached and the final tie-ins were made.

LaDew pressure-tested each installation at more than 200 psi. This pressure often was left on for two weeks or more, pending final construction of the building. By contrast, only a 2-hour pressure test at 68 psi is required to pass city inspections.

LaDew uses both the heat fusion and crimping methods of joining when installing polybutylene pipe in sprinkler systems. The former is used on the larger pipe and crimp fittings with copper rings are used for the ¾-inch pipe. Pipe sizing is determined by hydraulic calculations based on NFPA 13D requirements of at least 26 gallons per minute in any lateral line (two sprinkler heads operating in any room).

("Desert" continued from page 3)

reduced. On top of that, overhead at fire stations can be lowered so that city budgets for fire protection also can be cut.

Chief Edwards estimates there were 1,000 multi-family dwellings sprinklered during the summer of 1984, "with two times that number on the drawing board." He anticipates that new code changes will require all commercial buildings to be sprinklered, along with all dwellings other than one- and two-family homes. Scottsdale codes now require all commercial buildings 7,500 square feet and larger to be sprinklered.

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

Address correspondence, including requests for additional copies, to Shell Chemical Company, Room 1220, One Shell Plaza, Houston, Texas 77002.

Printed in U.S.A. 1984,
Shell Chemical Company.

Where to buy fire sprinkler pipe and fittings

Shell Chemical does not manufacture pipe or fittings. The following independent companies supply polybutylene pipe and fittings for fire sprinkler installations.

Bow Plastics
104 Sharron Avenue
Plattsburgh, NY 12901
(518) 561-0190
Attn: Mr. Paul Stanfield

General Fire Protection
3095 Harris Street
Kennesaw, GA 30144
(404) 422-8600
Attn: Mr. Dick Gust

Trojan Plastics, Inc.
2211 N. 38th Street
Tampa, FL 33605
(813) 242-4211
Attn: Mr. John Hehn

Vanguard Plastics, Inc.
P.O. Box 346
McPherson, KS 67460-0346
(316) 241-6369
Attn: Mr. Keith Swinehart

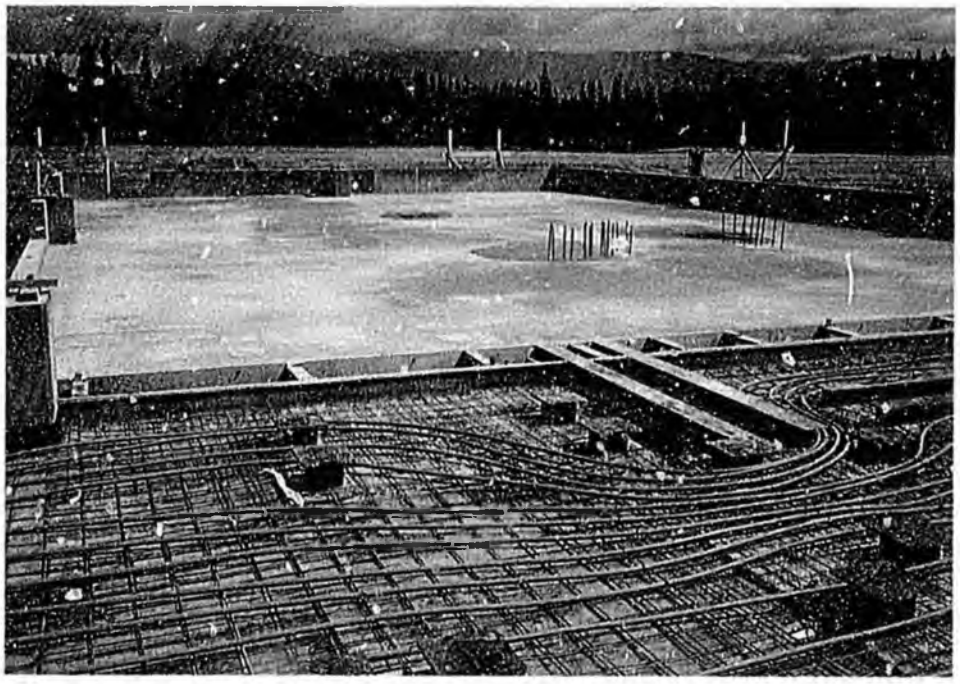
Wesflex Manufacturing Co.
1880 Garden Tract Road
Richmond, CA 94801
(415) 233-6670
Attn: Mr. Roger Reichart

DURAFLEX™ POLYBUTYLENE

PIPER

Published by Shell Chemical Company Volume V, Number 1, 1984

Effectiveness of mill's heating system depends on polybutylene pipe



The high temperature capabilities of polybutylene pipe enable a radiant slab heating system to provide a comfortable working environment in a Canadian planing mill even when the temperatures are 40 below zero.

A hot 50-50 mixture of ethylene glycol and water pumped through the pipe embedded in the slab radiates an even heat level throughout the 27,000 square feet in a MacKenzie, British Columbia mill.

The popularity of polybutylene pipe in the westernmost province of Canada for radiant heating of saw mills and similar plants has led to increased installations in small commercial buildings and homes, according to Larry Smith, manager, Westburn Industrial Enterprises, in Prince George.

Smith said that in his experience, other flexible plastic piping materials tended to become brittle with the high temperatures often required of the anti-freeze/water solution in cold weather. "Polybutylene pipe is by far the choice for radiant slab heating applications here," he added.

Since the system was installed at MacKenzie in 1980 Smith said that about three times as many installers "are capable of putting in this kind of system in this area" as three years ago. "More homeowners also are wanting to put in radiant slab heating systems. They feel they are more comfortable with this type of heating system."

Smith and Vic Swaykoski,

(continued on page 2)

Comfortable, cost efficient, underfloor heating systems based on circulating hot water through polybutylene pipe embedded in a floor are described in this new full color, 8 page brochure.

The brochure describes in detail the advantages of underfloor heating systems and their use in applications ranging from heating homes, offices and manufacturing buildings to melting snow and heating greenhouse seed beds. Installation techniques are illustrated and design information is also included.

To obtain a copy of this brochure, please write: Shell Chemical Company, Advertising Manager, P. O. Box 2463, Houston, Texas 77001.

(continued from cover)

mechanical contractor and owner of Doug's Heating (Northern) Ltd. of Prince George, played instrumental roles in the planing mill installation for Finlay Forest Industries. The large mill is producing about one-half million board feet a day.

The system uses an indoor/outdoor thermostat to control the temperature of the 1,320 gall... of liquid that is circulated at a rate of up to 250 gpm by a 7½-hp pump. The thermostat offers a one-t... ne ratio so that when the outside temperature is at freezing, the circulating fluid is at 100°F. Each time the ambient temperature drops one degree, the temperature of the liquid is automatically increased by one degree. A waste recovery unit burning wood shavings has replaced the gas-fired boiler initially used to heat the water/glycol mixture.

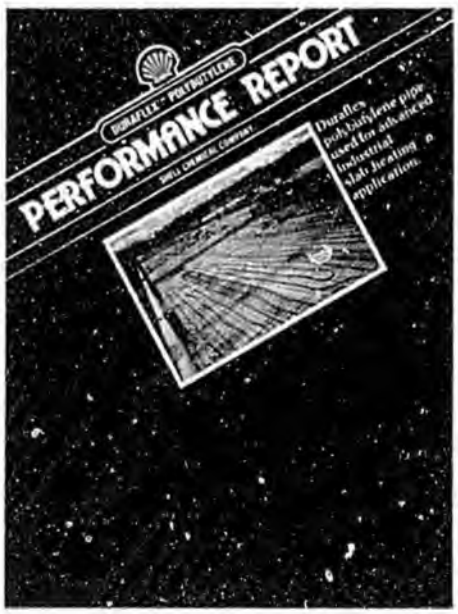
The radiant system also was selected because a conventional forced air system would have aggravated the problem of swirling sawdust in the mill. Consulting engineer, George Nixon, of North Vancouver, pointed out that the wood dust not only collects on and clogs filters, coils and fan-driven heaters, but also increases the risk of fire due to dust settling on a hot line.

Swaykoski, whose crews had installed eight other similar systems in mills before the MacKenzie job, said that "slab heating and circulating warm-air systems might cost about the same to start with but six months down the road you'll be having to pay a premium for maintenance, to say nothing of the nuisance and hazards of circulating fine sawdust if you install a forced air system."

"Pipe made of polybutylene is the tube we use. It's the only plastic tube that will stand the hot water temperatures necessary to bring the floor heat up to at least 50 degrees," he said, adding that temperatures occasionally plunge to minus 60 degrees in the area.

Ease of installation was cited by him as another advantage for polybutylene pipe in such systems. He said the lightweight, flexible pipe can be curved to a bending radius as tight as 10 times the outside diameter without kinking, thus eliminating the need for elbows and connections in the slab as required with copper or other rigid plastic materials. Swaykoski added that polybutylene pipe is corrosion resistant and resists scale and sediment buildup inside the pipe, which could arrest the fluid flow.

Additional information on this system is presented in the Product Performance Report shown below. For a copy, write: Shell Chemical Company, Advertising Manager, P. O. Box 2463, Houston, Texas 77001.



Above ground radiant slab system cuts home heating costs 25%

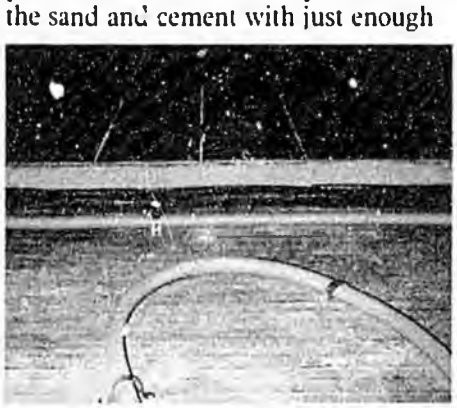
The concept of radiant slab heating is not new. Both homeowners and industry have benefitted from this energy-efficient heating method for years.

While most radiant slab heating systems are based on heating pipes embedded in a structural slab poured on the ground, a system installed in Colts Neck, New Jersey utilizes slabs poured above ground on wood joists. Wayne Pomanowski, owner and builder of the home, estimates that the system saved him 25% in energy costs over forced air heating during its first year of operation.

"The system provides the most even and comfortable heat available," he added.

This unique system consists of lightweight concrete poured over polybutylene pipe to form slabs on plywood surfaces. Pomanowski said the "above-ground slabs function only as heat sinks and don't serve as part of the structural strength of the house."

Installers used a dry mix concrete for the slab. The concrete was much less dense than the aggregate-type concrete used for structural strength and could be mixed with less water — about one part portland cement to two parts sand. "The whole key was to mix the sand and cement with just enough water to be damp and formable, but not wet," he said.



Close up shows a portion of the first floor before the concrete was poured and another area where glazed Italian tile covers the slab.

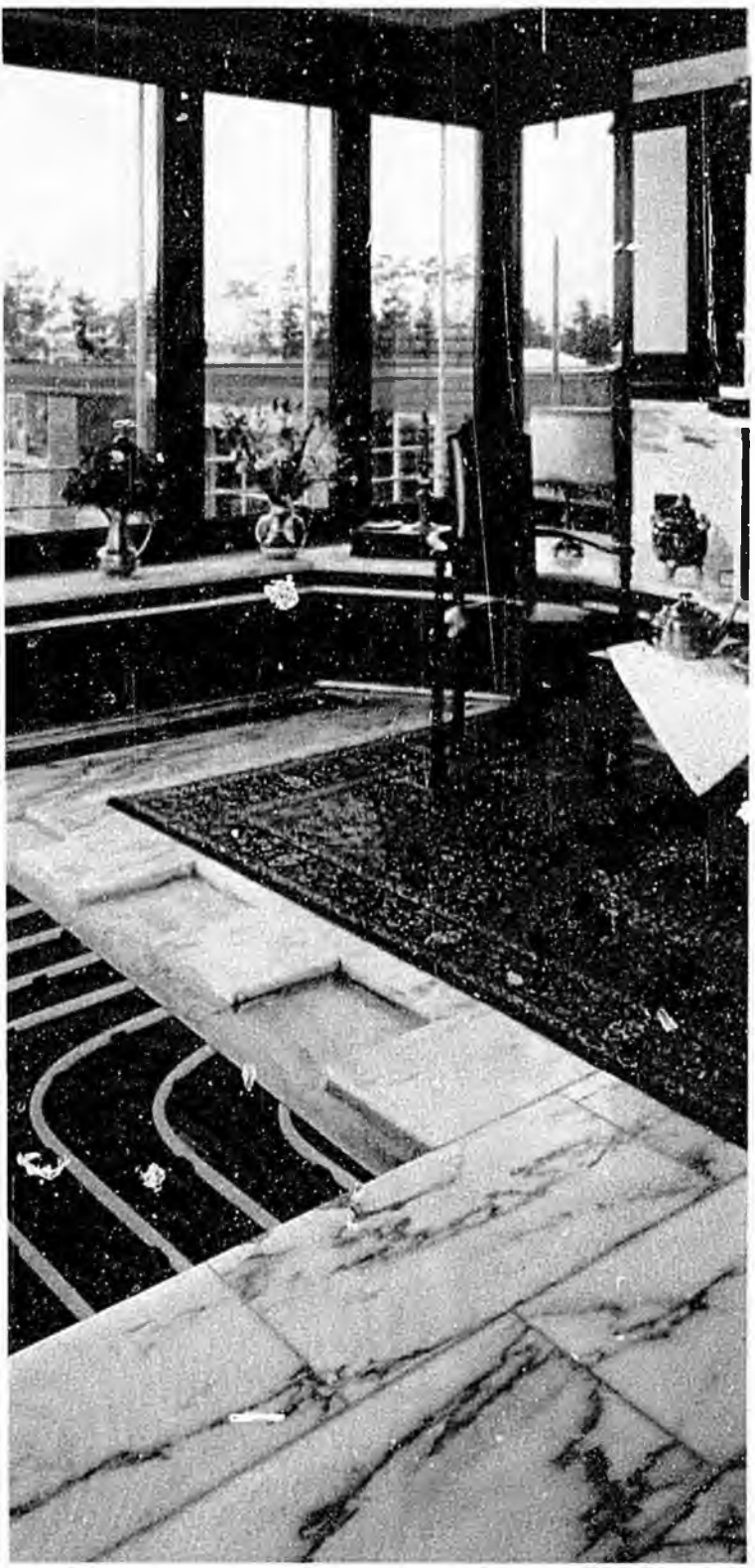
In order to accommodate the system, Pomanowski had to make some modifications in the home, which is a concrete block, standard construction two-story building with a basement. Floor joists were supported by a 10-inch steel "I" beam to provide adequate support for the plywood and joist sub-flooring under each lightweight slab. The joists are spaced 16 inches on center. According to Pomanowski, a builder and developer himself, these are simple modifications that can be incorporated into most home designs if they aren't already specified.

Pomanowski selected polybutylene pipe "because of its proven advantages in other successful radiant slab heating installations." Over the past decade, more than 400 million feet of polybutylene tubing have been used in radiant heating systems worldwide.

300-foot coils of 1-inch diameter

(continued on page 4)

et for radiant heating ns bolstered ropean technology



Spurred by the tremendous success which they have enjoyed in Europe, several European companies with extensive experience in underfloor heating systems are establishing operations in North America to promote installations of their radiant slab heating systems.

The two companies that are already established are headquartered in Germany. They are H. Kampmann GmbH, of Lingen, and Thermolutz GmbH & Co. of Reutlingen. A third company, Osterreichische Salen-Kunststoffwerke GmbH of Vienna is looking for representation.

Kampmann, which has been installing systems in Germany since 1973, opened a subsidiary in 1981 in Markham, Ontario, near Toronto. Thermolutz, which has over 10 years of experience established E. Wagner, P. O. Box 1585, Salt Lake City, Utah 84110 as an affiliate in 1982.

"There is a tremendous market in Europe for polybutylene pipe in underfloor heating systems. It is going extremely well right now in England, particularly with large municipal projects," pointed out General Manager Keith Moffatt, Kampmann Heaters (Canada) Incorporated.

Moffatt said installations in eastern Canada have been mostly commercial and industrial, including greenhouses and seed beds, while residential applications represent the major demand in the west.

"People want to feel safe with underfloor heating. That's why we have a 10-year, 10-million-dollar warranty," he said, adding that "for heating in North America, there's no way to go but up."

Both Thermolutz and Kampmann have produced literature dealing with product descriptions and applications, calculations of heating requirements, schematic layouts, installation instructions and other related data.

For copies of Kampmann's literature, write: Kampmann Heaters (Canada) Inc., 110 Ferrier Street, Markham, Ontario, L3Rz5. For product literature from Thermolutz, write: E. Wagner, P. O. Box 1585, Salt Lake City, Utah 84110. Literature from Salen can be obtained by writing Osterreichische Salen Kunststoffwerke GmbH, P. O. Box 100, Vienna, Austria.

("Above ground" continued from page 2)

and 400-foot coils of ¾-inch diameter polybutylene pipe were used in the Colts Neck installation. The 1-inch pipe was embedded in the first floor slab, which also radiates heat down into the basement.

Because heat rises from the first floor slab, less heating capacity was needed on the second floor. Therefore, ¾-inch pipe was selected for the second floor slab.

"Installing the pipe was easy and quick. We laid it out and fastened it to the floor over a mason lath and wire mesh. The floor had plastic sheeting over it to serve as a vapor barrier. After the connections were made, the concrete slab was poured over the pipe and wire mesh. The finished slab is 2½ inches thick," Pomanowski said.

Slabs in radiant heating systems can be overlaid with a number of different floor coverings. The first floor slab was covered with glazed Italian tile. The second floor was carpeted wall-to-wall. He offered this description of the layout:

"Each floor is about 1200 square feet. There are four zones, each with a separate thermostat that operates a corresponding circulation pump connected to the boiler header. Each zone contains about a 600-foot run of polybutylene pipe. The boiler is a conventional oil-fired model. A solar collection unit could also be easily adapted, using the boiler as a back-up. The whole system is simple and works on a principle similar to radiators.

"But there are no radiators or registers for the heat in the rooms. Other than the boiler and the thermostats, everything is in the floor. The polybutylene pipe releases heat from the circulating hot water to the slab, evenly and steadily, minimizing any hot spots. The heat transferred to the room from the slab is constant and comfortable.

In contrast to baseboard systems, furniture can be placed anywhere in the room without affecting the room's warmth.

"This system is an architect's dream, because there is nothing visible. The heat is ideal — very even and comfortable. And it is 25% less expensive to operate than forced air heating," he said.

Three-hundred-foot coils of 1-inch pipe were embedded in the first floor slab. Pomanowski said the system also served to effectively radiate heat into the basement.

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Printed in U.S.A. 1984,
Shell Chemical Company

Where to buy polybutylene pipe

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Bow Corporation
104 Sharron Avenue
Plattsburgh, New York 12901
518/561-0190
Attn: Mr. Gus Ayers

Briggs Manufacturing Company
1500 Dale Mabry Highway
Tampa, Florida 33607
813/871-4304
Attn: Mr. Sterling Brown

Delta Faucet Co.
55 East 111th 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 10th Street
Plano, Texas 75074
214/423-3576
Attn: Mr. Bill Smith

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

Wesflex Manufacturing Co.
1880 Garden Tract Road
Richmond, California 94802
415/233-6670
Attn: Mr. Roger Reichart

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

DURAFLEX™ POLYBUTYLENE

PIPER

Published by Shell Chemical Company Volume IV, Number 3, 1983

Master plumber calls polybutylene pipe "Best Technology Available"

A Houston plumber who began using polybutylene pipe five years ago for plumbing repair and replacement of aging metal water systems said he has now made more than 500 installations and has not had a call-back or complaint.

"Soil in this area contains a high level of lime which encourages buried metal feeder line pipe to rust," says Laurence Klein of Klein Plumbing Inc. "Also, Houston water in general is high in mineral content. This encourages deposits and clogging.

Flexible, lightweight polybutylene pipe helps enable Klein to retrofit an entire plumbing system in half the time required to repair with metal pipe.

"Even so, most plumbing failures in this area, and particularly those inside the house, center on the mating of different metals," he continues. "For instance, hanging copper pipe on a steel or galvanized hanger with no insulation between the metal surfaces sets up an electrolytic action which can result in a perfect hole in the pipe."

When Klein came to Houston a few years ago, he discovered that there were thousands of homes 15-20 years old and older that were plumbed with galvanized steel pipe or combinations

(continued on page 3)

Improved piping simplifies earth-coupled heat pump installation

An innovative new pipe produced from Duraflex* polybutylene resin has reduced costs and greatly simplified the installation of horizontal closed-loop, earth-coupled heat pump systems.

Earth-coupled heat pump systems extract heat from the ground for heating or discharge heat into the ground for cooling. Exchanging heat with this milder and more stable natural heat source rather than with outside air enables the heat pump to provide more efficient heating and cooling than is possible with conventional heating systems or air-to-air heat pumps.

Dramatic drops in power consumption have been documented for homes which have converted to earth-coupled heat pump systems. Whereas electric resistance heat has a typical coefficient of performance (COP) of only 1 and air-to-air heat pumps have a more efficient rating of 1.7, the earth-coupled systems have a COP of 3 or more. As a result of their performance, thousands of these systems have been installed in residential and commercial applications ranging in size from one ton to 60 tons.

There are two types of closed-loop systems. The horizontal type uses pipe buried 4 to 6 feet below ground in a trench. A low-wattage pump circulates water from the heat pump through the earth coil to exchange heat with the earth and then back to the heat pump.

The second method is to use pipe in a well as a vertical heat exchanger. Water is pumped from the heat pump through the pipe to the bottom of the well and back to the heat pump, exchanging heat with the earth.

Both types require virtually no water because they recirculate the initial charge of water. In contrast, the more widely used water source heat pump systems are open systems using thousands of gallons of fresh well water daily.

Standard pipe made from Duraflex polybutylene resin has long been recommended by Geosystems, Inc., Stillwater, Okla., the company that pioneered closed-loop, earth-coupled

(continued on page 2)

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

("Improved piping" continued from cover)
heat pump installations. Reasons: cost effectiveness, ease of installation and long life.

The availability of polybutylene pipe in 500-foot coils has been particularly advantageous for installers of the longer horizontal type systems because it minimizes the number of joints, thereby saving time.

Now, a recent development in the forming process for polybutylene pipe provides a new lighter, "square" configuration pipe which further simplifies installation.

"The new shape is much easier to install. It's lighter so it's easier to handle and it rolls out evenly in the ditch," pointed out Carl Ledbetter, Geosystems co-partner.

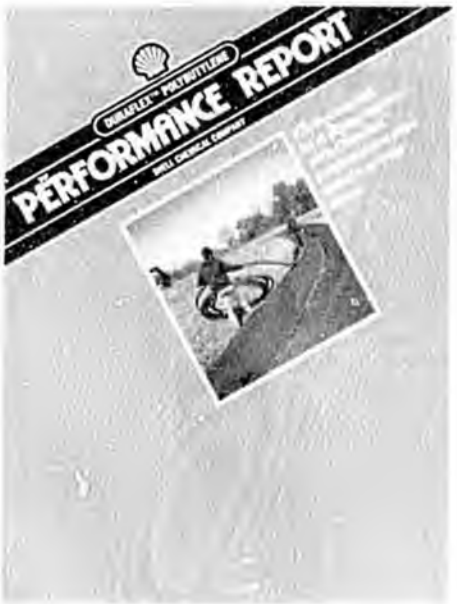
The unique chemical structure of the polybutylene resin makes it possible to perform pipe into a square configuration. This shape not only makes it easier for the installer to lay the pipe in the trench but it also reduces any tendency of the pipe to recoil.

"Shell came up with the idea of a square pipe with its decreased wall thickness which is the first pipe I know of that was specifically developed with the earth-coupled heat pump installer in mind," Ledbetter said.

The square pipe was used first in the heat pump system of a home of nearly 5,000 square feet. Two men easily uncoiled pipe from the bed of a truck into the trench despite 15-20 mph winds and temperatures in the low 40s.

"You can install polybutylene pipe in an earth-coupled system in about as cold a weather as a man can work in," Ledbetter stated. Based on the success obtained under these adverse conditions, Geosystems has now switched almost all of its horizontal systems to square polybutylene pipe.

Additional information on these systems is presented in a new Product Performance Report shown below. For a copy, write: Shell Chemical Company, Advertising Manager, P.O. Box 2463, Houston, Texas 77001.



Polybutylene proves ideal interconnecting pipe for solar heating systems in Carolinas

Six south-facing, medium-temperature collectors provide as much as a quarter of a million BTUs a day for domestic hot water, space heating and pool heating.

Nearly 60 miles of insulated gray polybutylene pipe were used last year by a North Carolina distributor to link medium-temperature drainback solar collectors with Aqua II Water Stove heating systems in homes and businesses.

After more than three years experience with pipe manufactured from Duraflex™ polybutylene resin, Distributor Tom Puckett of Clemmons, N.C. described the pipe as "a plumber's dream come true."

"It's easy to put in. It's lightweight to carry on a roof and the pipe has the high temperature capability that is required for solar systems.

"When we started," he continued, "we wanted a product that would be quick to install at a cost that wasn't outrageous. Solar space heating systems in general were expensive in the past and it was very advantageous for us to find a product like polybutylene to keep our installation costs down."

Puckett's system consists of a bank of Morning Star glazed solar collectors connected with polybutylene pipe to the Aqua II Water Stove, a storage tank that contains a non-pressurized open-vented fire box. The solar collectors feature high absorptivity electroplated black chrome surfaces that are capable of generating 934 BTUs per square foot of area every day in sunny weather. The wood burning Water Stove is used to supplement the solar system on cold, cloudy days.

(continued on page 3)

A small 1/12th h.p. pump (Taco) is all that is needed to push the water from the tank through the polybutylene supply line to the top of the collectors. The flow rate is 1¼ gallons per minute per panel. When not needed for heating, water is drained back to the tank in a return line to prevent stagnation and to avoid water freezing during the winter.

The solar collectors are equipped with 180°F cut off sensors. However, Puckett observed that, even when the Water Stove generated boiling water at 212°F there was never any problem with polybutylene pipe.

The solar collector/Water Stove system sold by Puckett is applicable to installations ranging from residences and swimming pools to businesses with a high demand for hot water such as laundromats and car washes.

Tom Puckett pulls back the insulation to reveal one of the 3/4" gray Duraflex polybutylene lines linking solar collectors with a 500-gallon Aqua Stove water tank.

When used for domestic hot water only, the system can save up to 90% of the heating costs and, when also used in a space heating system the heating bill can be cut approximately in half. This operating efficiency has already generated interest from 1500 miles away.

"There's a huge market out there for these systems and it doesn't matter whether you're rich or have a low income. These systems are getting the attention of both, as well as everyone in between," Puckett said.

A close-up view of a Water Stove's tank shows the small pump, hot air duct, insulated polybutylene supply and return lines, and, at the top, the domestic hot water line.

Solar energy systems also carry a tax credit incentive from the federal government and from many states.

"Write-offs amounting to 40% by the federal government and 25% by North Carolina have been extremely helpful to us in our business," Puckett said.

North Carolina's Energy Conservation Act grants homeowners and businesses a tax credit of 25% of the first $4,000 for installing solar equipment in a new or existing home. (For example, a $4,000 overall system would actually cost the homeowner only $1,400.)

As a result of these benefits, the sales of the solar/Water Stove system doubled from 1981 to 1982 with another doubling under way in 1983.

The installation advantages and performance properties of pipe made from Duraflex polybutylene resin in solar heating systems are presented in a full color, 12-page brochure. Cost saving features, benefits available to the solar installer, and installation guidelines for using the pipe in various types of collector systems are included.

To obtain a copy, write Shell Chemical Company, Advertising Manager, P.O. Box 2463, Houston, Texas 77001.

("Master plumber" continued from cover)

of galvanized and copper tubing.

"With relatively hard water and the soil conditions in the Houston area, I knew that many of these systems had to be failing daily and consequently there was a good market for a plumber who could fix them efficiently and economically," he said.

Klein rejected the traditional option of either replacing damaged pipe sections or installing metal pipe throughout the system. "I felt there had to be an efficient, quick repair method which would be reliable and long-lasting," he said.

"I started out patching, repairing and retrofitting in the conventional way with metal pipe and fittings, but it was frustrating," he said. "Retrofitting and repairing with metal is usually very time consuming and therefore expensive. A high percentage of people living in old homes where repairs are needed are not in high income brackets. Frequently, they can't afford to pay for extensive repairs and replacement without undue hardship. So they tend to have a plumber do only what is absolutely necessary to stop a leak or keep the water flowing."

This situation is very frustrating to Klein, who takes a great deal of pride in his work. If he does piece-meal patching on metal systems, a plumber can't guarantee his work.

"You can do a superb job of repairing a section and another part of the system may fail the next day or a week later," he says. "The customer who just paid you to fix his plumbing can't understand why it didn't stay fixed and doesn't want to pay for more work."

Klein experimented with polybutylene pipe and discovered that he could retrofit entire water systems with it in less than half the time required to repair or retrofit with metal pipe.

"With this system, I can completely replace a metal water system for a reasonable price and still make an attractive profit," Klein says. "I carefully test each installation before leaving the job to make sure it is right. Knowing I won't be wasting my time on problems and call-backs reassures me that the profit will be mine to keep. Customers are pleased with the lack of noise and the reliability of these systems, and my business has grown

(continued on page 4)

("Master plumber" continued from page 3)
rapidly because of people recommending me to their friends.

"And this way, I can guarantee my work."

Klein Plumbing also handles repair and maintenance plumbing for several large apartment and condominium companies in addition to its regular call-in business.

About three years ago he landed a contract to handle plumbing repairs for one of Houston's largest apartment operators.

"At the time their repair costs were running about $12,000 a month, including water leaks, pump failures and sewer failures," he recalls. Klein set up individual maintenance programs tailored to each apartment complex. He trained maintenance and repair employees to make minor repairs and perform preventive maintenance on equipment like pumps. The company's costs for outside plumbing repairs have dropped to only about $1,200 per month.

The corroded galvanized pipe (bottom) is typical of the problems Laurence Klein encounters in older water systems in Houston.

How does a master plumber feel about using polybutylene pipe in his craft?

"It's the best technology available," he says. "It extends my ability to perform and compete and lowers the overall cost while improving the quality of every job I do.

"Polybutylene pipe even lowers my insurance costs because I don't have to do torch work while soldering or brazing at the job site," he says. "However you look at it, it is the very best system available for the repair plumber and the consumer."

Code bodies grant approvals for polybutylene pipe

Recent code approvals for use of polybutylene pipe in hot and cold water plumbing, cold water service and other applications include:

Plumbing
State of Idaho
State of Massachusetts
City of Tucson, Arizona
Navajo County, Arizona
Baltimore County, Maryland
Douglas County, Nevada
Onodaga County, New York

Fire Sprinklers
City of St. Petersburg, Florida
City of University Park, Texas
City of Vancouver, Washington

Cold Water Service
City and County of Denver, Colorado

Heat Fusion Fittings
State of Utah

Where to buy polybutylene pipe

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

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 Swinehart

Wesflex Manufacturing Co.
1880 Garden Tract Road
Richmond, California 94801
415/233-6670
Attn: Mr. Roger Reichart

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

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PIPER

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Large South Florida Subdivision being Plumbed with Polybutylene

100-foot coils of polybutylene pipe are quickly rolled out in 8-inch trenches before being covered with dirt, a plastic vapor barrier, wire mesh and concrete. Before the slab is poured the plumbing system is tested at 165 psi for four hours.

With quality and cost the key determinants for the plumbing to be used in South Florida, the builder and plumber at Holiday at Lantana chose a system based on polybutylene pipe and acetal insert fittings.

The system will be used for hot and cold water plumbing in 514 single-family homes being built by Hovsons, Inc. at Holiday at Lantana, a new community southwest of Palm Beach and about seven miles from the Atlantic Ocean. By January, 1984, 138 homes had already been either sold or were under construction.

The subdivision is the most recent of the approximate 6,000 homes plumbed with polybutylene pipe by Fort Lauderdale's Zicaro's Plumbing since 1979.

"My first look at polybutylene pipe convinced me that it had brought a new standard of quality that would improve the plumbing industry," said Nick Zicaro, general manager of the 15-year-old company which now has branch offices in Orlando and Clearwater.

Hovsons' goal at Holiday at Lantana is to build affordable housing with quality. To help reach that objective, President Hirair Hovnanian assigned Robert Mardigian, Vice President — Marketing & Sales, to research and evaluate the newest and most efficient building techniques. In the course of his study he learned about plumbing with systems built around polybutylene pipe and approached Nick Zicaro for a bid.

"We requested bids for both copper and polybutylene systems and found that our cost savings with polybutylene would be very good," Mardigian said.

Because there is no need for open flames to solder joints as with copper tubing, Mardigian estimates that he eventually will also be able to reduce his insurance costs at the subdivision.

Zicaro stated that "electrolysis and corrosion are constant problems here with metal and copper pipe. Hard water in south Florida can cause a raceway to put a pinhole in a copper system and you're always having leaks from joints when you put in copper. Polybutylene is inert, so it can resist

(continued on page 2)

Recommended methods for installing polybutylene tubing with insert fitting/crimp joints are described in a 16-page booklet recently published by the Plastic Pipe and Fittings Association (PPFA).

The booklet addresses such topics as materials identification, proper tool use, how to make good connections, good installation practices, and precautions which should be taken.

To obtain a copy of this booklet, please write to one of the system suppliers listed on the back page of this newsletter, or to: The Plastic Pipe and Fittings Association, 999 N. Main Street, Glen Ellyn, Illinois 60137.

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

("Florida Subdivision" continued from cover)
the corrosive elements in water and is unaffected by acid soil conditions or electrolysis."

"Galvanized pipe and copper can clog from scale buildup from hard water, but there's no scale buildup with polybutylene," he added.

Using polybutylene pipe provides several other benefits as well. "Besides giving a builder a top quality system, one of my men can plumb a typical single floor, two-bedroom house in about five hours compared to eight for copper," Zicaro said. His company is now putting plumbing systems based on polybutylene pipe in about 2,000 homes annually.

While stressing the beneficial properties of the pipe, Zicaro also points out that it is simple to install, requires no soldering to connect joints and is available in long coils so no fittings are needed under the slab.

He estimates about 80% of his total potable water plumbing installations utilize polybutylene pipe and almost 100% of the retrofit jobs.

Zicaro's projects range from affordable homes to larger, more expensive custom homes, including one $600,000 home in south Florida which he recently plumbed with a system based on polybutylene pipe.

At Holiday at Lantana, coils of tubing are unrolled in trenches eight

Protective polyethylene sleeves are slipped over the polybutylene pipe and they are secured to a metal stake to prevent movement during the pouring of the slab or damage to the pipe during final stages of slab construction.

inches deep and staked in position. A protective plastic sleeve is placed over the tubing at slab penetrations to protect it from damage during framing operations. The tubing is then covered with dirt and a plastic vapor barrier and wire mesh are placed on the ground before pouring a 4-inch concrete foundation. A typical house requires about 80 feet of ¾-inch tubing and 120 feet of ½-inch tubing. Slabs are poured for four to five houses a day.

The system is hydrostatically tested at 165 psi for four hours after installation in order to detect any flaws in the installation. Zicaro cited another advantage for polybutylene: crews can be quickly and easily trained to install polybutylene pipe and insert fittings.

Holiday at Lantana offers prospects four models, all with two baths and two with three bedrooms. Living areas range from about 1100 square feet to more than 1400 square feet. Prices begin at $56,000 and go up to $62,000 with 5% down.

The homes include central air conditioning, wall-to-wall carpets, vinyl floors in baths and kitchen, cathedral ceilings, dishwashers, ovens, disposals and smoke detectors. The subdivision is expected to be completed in the spring of 1986.

Hovsons has built two other south Florida communities and has more than 4,500 homes under construction in south Florida and New Jersey. Some 11,000 homes already had been built by Hovsons in Toms River, New Jersey. Holiday at Lantana, however, is the first subdivision in which polybutylene pipe was used.

"We've been very well satisfied with the product," Mardigian said. "It cuts down on man-hours and cost of installation. You can bend it around easily and it doesn't corrode or crack. I think it's a great material to work with. It's really simplified the building process and the home buyers seem to be very receptive to it."

Polybutylene Plumbing Pipe Systems Survive Year-End Cold Wave

Polybutylene plumbing pipe saved thousands of home and apartment owners the cost and inconvenience of broken water pipes during the extremely severe cold spell over the 1983 Christmas holidays.

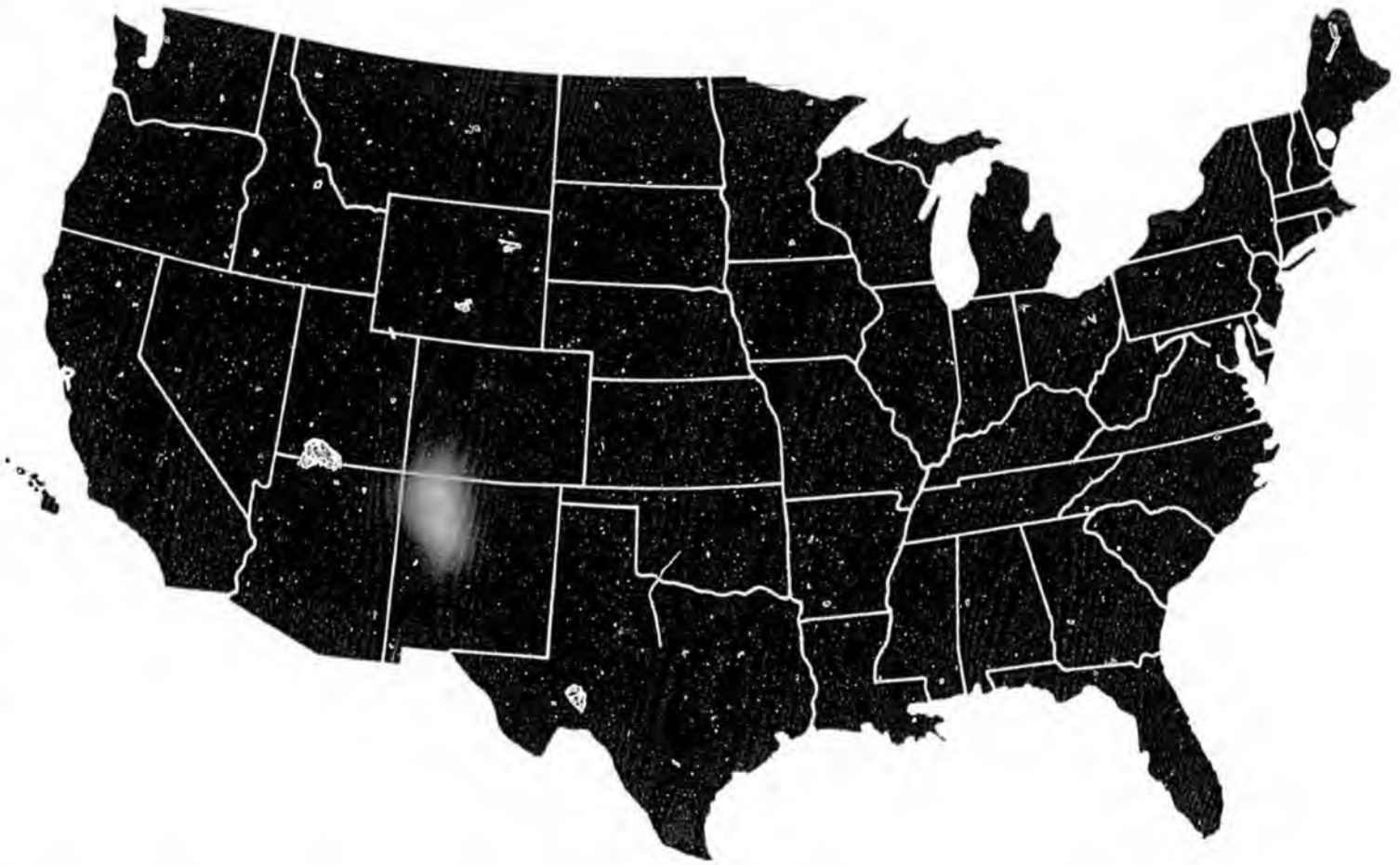
"It was a major disaster in this area," says Jack Smith of Sundance, Inc., a plumbing contractor in Marietta, Ga., where temperatures dropped to near zero and high winds pushed the chill factor to −50°F. "We had 500 to 700 service calls. They came in waves. But only one involved a system piped with polybutylene pipe. All the others involved breaks in copper and galvanized pipe. And we've installed hundreds of polybutylene piped water systems in this area."

The experience with polybutylene pipe during the freeze in Cobb County, Ga., has fire and building code inspectors smiling. Cobb County, which is part of the rapidly growing Atlanta metropolitan area, has been a leader in changing building codes to allow the use of polybutylene pipe in hot and cold water plumbing and to authorize cost-saving building code modifications to encourage the installation of residential fire sprinkler systems.

"There were leaking pipes all over town — and one in an unheated area of a new school may have caused a

(continued on page 4)

This new Marietta, Ga. home was unoccupied and unheated when temperatures dropped to near 0°F. The plumbing system froze but when the thaw came there were no breaks or leaks in the polybutylene pipe.



Polybutylene approved for plumbing applications in most major cities

Plumbing systems incorporating polybutylene pipe for hot and cold water distribution have received code approvals in all of the national and regional plumbing codes in the United States and in over 75% of the nation's major metropolitan areas.*

Some 77 major metropolitan areas in 32 states are identified in the map above and listings below. An indication of the growing popularity of systems based on polybutylene pipe is reflected in the fact that a majority of these approvals have been granted in the past three years. During the last year alone, enough polybutylene pipe has been consumed in the United States to completely encircle the earth.

*The approvals shown above are based on Shell's best understanding as of May, 1984. Because codes continue to be changed and because the approvals may not cover all communities within the major metropolitan areas, a potential user should always check with his local authority before proceeding with an installation.

ALABAMA
- Huntsville

ARIZONA
- Phoenix
- Tucson

ARKANSAS
- Little Rock

CALIFORNIA
- San Diego
- San Jose

COLORADO
- Colorado Springs
- Denver

CONNECTICUT
- Hartford

DELAWARE
- Wilmington

DISTRICT OF COLUMBIA
- Washington, DC

FLORIDA
- Fort Lauderdale
- Fort Meyers
- Fort Walton Beach
- Jacksonville
- Lakeland
- Melbourne
- Miami
- Ocala
- Orlando
- Pensacola
- Sarasota
- Tallahassee
- Tampa
- West Palm Beach

GEORGIA
- Atlanta
- Augusta
- Savannah

HAWAII
- Honolulu

INDIANA
- Indianapolis

KANSAS
- Wichita

KENTUCKY
- Louisville

LOUISIANA
- Baton Rouge
- Lafayette
- New Orleans
- Shreveport

MASSACHUSETTS
- Boston

MICHIGAN
- Detroit

MISSOURI
- Kansas City

NEVADA
- Las Vegas

NEW JERSEY
- Asbury Park
- New Brunswick
- Newark

NEW MEXICO
- Albuquerque

NORTH CAROLINA
- Charlotte
- Greensboro
- Raleigh

OHIO
- Cincinnati
- Columbus
- Toledo

OKLAHOMA
- Oklahoma City
- Tulsa

OREGON
- Portland

PENNSYLVANIA
- Pittsburgh

RHODE ISLAND
- Providence

SOUTH CAROLINA
- Charleston
- Columbia
- Greenville

TENNESSEE
- Knoxville
- Memphis
- Nashville

TEXAS
- Abilene
- Austin
- Brownsville
- Bryan, College Station
- Corpus Christi
- Dallas, Fort Worth
- Galveston
- Houston
- McAllen
- Midland
- Odessa

VIRGINIA
- Newport News
- Norfolk
- Richmond

WASHINGTON
- Seattle
- Tacoma

("Cold Wave" continued from page 2)
quarter of a million dollars or more in damages by itself — but virtually no problems with the residential systems based on polybutylene pipe," says Lt. Jerry W. Grier of the Cobb County Fire Department. "We've got about 9,000 water systems and sprinklers based on polybutylene pipe in the county." Because of the dramatic difference in performance, the Cobb County Fire Department is now considering mandating polybutylene pipe for all sprinkler systems installed in the attic.

"We're very pleased with the performance of polybutylene," says Jim Bechtel, Senior Vice President of Post Properties, Inc., which is one of the largest builders and operators of multifamily dwellings in the Atlanta area. "We have 250 domestic water systems and 148 fire sprinkler systems based on polybutylene pipe in operation. There was only one break involving a system based on polybutylene pipe during the freeze."

"This freeze changed a lot of people's minds about plastic pipe," says Danny R. Gosdin, a field supervisor for Carroll & Boyd, Inc., of Jonesboro, Ga., a mechanical contractor for Pulte Homes. "We've installed hundreds of water systems based on polybutylene pipe, and during the freeze we had only one fitting push off from freezing, but virtually no water damage resulted. Yet, the first day after the hard freeze, we had 250 calls, all involving water systems made with copper or galvanized pipe. That makes you think this polybutylene pipe is pretty good stuff."

"Knowing what I know now, I'd pay more to have a water system piped with polybutylene than I would for a system made with metal pipe," says W. T. Anderson, who is director of inspections for Cobb County. In actual practice, polybutylene plumbing systems can be installed less expensively than copper systems, even at today's depressed copper prices.

In Houston, the same cold front dropped temperatures to a record low of 11 degrees on Christmas morning and held the area below freezing for more than 100 hours. According to preliminary estimates, freeze damages were expected to match or exceed damages caused by the wind and flooding from Hurricane Alicia last August. Some 5-10 percent of homes and apartments in the area experienced frozen and broken pipes.

"One apartment complex I repaired had over 180 breaks," says Laurence Klein, a master plumber who specializes in repair and replacement plumbing for large apartment and condominium operators. For several years, Klein has used polybutylene pipe to replace copper and galvanized pipe in water systems and during that time has replaced hundreds of metal water systems in the Houston area with polybutylene pipe.

"I did a good month's work in the week following the freeze, but didn't get a single call involving polybutylene pipe," he said. "The freeze really separated the good from the bad plumbing. Polybutylene isn't giving me very much repair business."

Wood Bros. Homes, Inc., one of the larger home builders in the Houston area which switched to polybutylene pipe for its plumbing a little over a year ago, also reported no complaints of breakage or water damage from occupants of some 250 to 300 homes constructed with the high performance plastic pipe.

"Our sales department, because of problems in the past with other plastic pipe, has been uncomfortable about our changing to polybutylene, and felt they were having to sell over it," says Trudy Starkey, who is purchasing agent for Wood Bros. "Since the freeze, that has changed and they now feel that it is a sales point in favor of Wood Bros. Homes."

Where to buy polybutylene pipe

Shell Chemical Company does not manufacture pipe or fittings. The following independent manufacturers supply plumbing fittings as well as pipe produced from Duraflex™ polybutylene resin:

Bow Corporation
104 Sharron Avenue
Plattsburgh, New York 12901
518/561-0190
Attn: Mr. Gus Ayers

Briggs Manufacturing Company
1500 Dale Mabry Highway
Tampa, Florida 33607
813/871-4304
Attn: Mr. Sterling Brown

Delta Faucet Co.
55 East 111th 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 10th Street
Plano, Texas 75074
214/423-3576
Attn: Mr. Bill Smith

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

Wesflex Manufacturing Co.
1880 Garden Tract Road
Richmond, California 94802
415/233-6670
Attn: Mr. Roger Reichart

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

Address correspondence, including requests for additional copies, to Shell Chemical Company, Room 1220, One Shell Plaza, Houston, Texas 77002.

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Shell Chemical Company.

SUMMARY SHEET

PLASTIC PIPE WATER SERVICE FAILURES

Breakdown of Costs:

LOCATION	COSTS
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:	97.5 - 97.65 million

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 sheer 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, 1982. 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 - 97.6 million dollars

1/11/83.

SUMMARY

CALIFORNIA DEPARTMENT OF CONSUMER AFFAIRS, FRIENDS OF THE EARTH, CONSUMER FEDERATION OF CALIFORNIA, STATE BUILDING AND CONSTRUCTION TRADES COUNCIL OF CALIFORNIA, AFL-CIO, and AILEEN ADAMS, (PLAINTIFFS)

vs.

INTERNATIONAL ASSOCIATION OF PLUMBING AND MECHANICAL OFFICIALS (IAPMO). (DEFENDANTS)

Exhibit "A"

I. BACKGROUND ON THE PROBLEM OF PLASTIC PIPES

Recent tests in California have duplicated field and laboratory experiences of water utility districts and environmental health experts that polyvinylchloride (PVC), polyethylene (PE), and polybutylene (PB) water service lines can be and are permeated (infiltrated) by gasoline, petroleum distillates and industrial solvents.

The public health impact can be serious enough to require the removal of an entire underground network of plastic water service lines and may cause serious health consequences for its consumers. Because of the pervasive occurence of toxic chemical spills and soil contamination with residues of pesticides and herbicides, California will need to embark on a comprehensive analysis of the problem. The problem is amplified by the specter of frequently used garden and household products that may permeate these plastic pipe.

Permeation of plastic pipe by toxic chemicals is all the more serious because of the existing threat to water quality by the pipes themselves and the quality of our current water supply. The California Department of Health found that the pipes themselves leach large amounts of chloroform, carbon tetrachloride, DEHP and a host of solvents used to degrease and glue the pipes. If these toxic chemicals are added to the already high level of contamination of many water supplies, then a truly dangerous prospect

for the quality of our potable water systems emerges.

Since 1977, the State of California has reviewed industry requests for unlimited usage of plastic pipe for water distribution. Industry assertions of economic feasibility and product safety were thoroughly and comprehensively reviewed by California Departments of Health, Consumer Affairs, Housing and Community Development, Cal/OSHA, and the State Fire Marshal. The Department of Housing and Community Development(HCD) concluded, after extensive hearings and in consultation with these other state agencies, that there was substantial evidence that unlimited use of plastic pipe may have a significant effect on the environment.

These conclusions were reached because of the threat to workers who breathe the fumes of the glues, and the presence of toxic chemicals (dimethylformamide, tetrahydrofuran, DEHP, carbon tetrachloride, chloroform and many others) in drinking water passed through the pipe, and an equally dramatic conclusion of the State Fire Marshal that plastic pipe is high rise construction may pose an unreasonable fire risk.

Since plastic pipe was found to have a potentially adverse effect on the environment because of its threat to water quality, worker safety, and fire safety, state agencies in California will not allow its expanded use until all scientific and public health questions have been answered. The State Architect has also warned all the design professions and school districts throughout California

of the potential hazards of plastic pipe.

Because the International Association of Plumbing and Mechanical Officials (IAPMO) proceeded with the expanded use of plastic pipe in its 1982 Uniform Plumbing Code, a coalition of state public and private consumer groups, environmental and labor organizations sued IAPMO and forced a notice disclaimer at each location in the Code where plastic pipe is mentioned. The lawsuit is still in progress over complaints that IAPMO misrepresents its product evaluation to the general public.

Outlined below are some of the key issues being pursued in that lawsuit.

II. ISSUES IN LAWSUIT AGAINST IAPMO

Under current law, IAPMO has the authority to prepare a model code know as the Uniform Plumbing Code (UPC). The code is prepared every three years and is forwarded to Housing and Community Development (HCD) for action. HCD may make minor modifications. In the event HCD takes no action, the Model Code lapses into law in one year. The Code is then forwarded to the Building Standards Commission for final approval and publication.

IAPMO's voting membership consists of governmental jurisdictions and building officials of member jurisdictions. The UPC is approved at the IAPMO annual convention after recommendations from IAPMO's code change committee are presented to the members who come to the convention.

IAPMO's other major function is preparation of a Research Directory which lists products by the manufacturer's name. (Such "listings" are used by jurisdictions for substitutions of plumbing materials.) In order for a product to be approved, the manufacturer must submit a sizeable application fee, along with durability and strength tests and show compliance with certain standards, depending on the product.

In the case of plastic pipe products and solvents, the appropriate standard is the National Sanitation Foundation (NSF) Standard 14. One of the main problems with the standard is that it does not test for the leaching of organic chemicals (dimethylformamide, tetrahydrofuran, DEHP, carbon tetrachloride, chloroform, and more) from the plastic pipe products, nor does it test the permeability of the pipe. NSF 14 also does not test for fire safety performance with respect to either the increased fire-spread risks or the toxicity of the smoke.

Finally, NSF 14 is inadequate because plastic pipe does not have a 100% content requirement standard. Thus, each manufacturer varies the formula; only generic varieties of pipe (i.e. CPVC, PVC, ABS) are tested under Standard 14.

After one review of the manufacturer's application by the IAPMO Research Committee, the plastic pipe product is given the IAPMO seal or logo which declares that the product has been tested and meets minimum health and safety requirements.

The product is then listed in the Research Directory. Both the Research Directory and the UPC are heavily relied upon by contractors, builders, inspectors and others in the building and construction trades.

In 1981, IAPMO voted for nearly unlimited use of plastic pipe products for transportation of hot and cold potable water for its 1982 Code. By this time, HCD required, in accordance with the California Environmental Quality Act (CEQA), preparation of an EIR for such expanded use of plastic pipe.

Nevertheless, IAPMO proceeded to distribute its 1982 UPC with apparent approval of plastic piping products for transportation of potable water.

The Department of Consumer Affairs and a host of environmental and consumer groups filed a complaint alleging unfair business practices and negligent misrepresentation (Business and Professional Code sections 17200 and 17500).

The theory of the case is that IAPMO's representations in both the UPC and Research Directory that plastic pipe products are safe are, in fact, gross misrepresentations. IAPMO has no testing facilities or qualified chemists, toxicologists, or epidemiologists on staff. Voting on product approval for the Research Directory and the UPC is limited to voting members of IAPMO. Furthermore, IAPMO has totally ignored the substantial evidence amassed by HCD that substantial adverse impacts are a possibility

and that an EIR would be required before use of such plastic pipe can receive HCD approval.

The Department of Consumer Affairs immediately requested an injuction from the Los Angeles Superior Court to prohibit IAPMO from distributing the 1982 UPC without a warning of potential hazards. The Superior Court denied the motion, as did the Appellate Court. However, the Supreme Court granted an alternative wri forcing IAPMO to affix a warning to the UPC. That warning reads:

> NOTICE: An Environmental Impact Report is now being prepared in California to determine whether the use of CPVC, PVC, or PB plastic pipe for transporting potable water poses a danger to public health or the environment. At the time of this printing of the 1982 Edition of the Uniform Plumbing Code, the State of California does not permit any expansion in the use of such pipe beyond those applications permitted in the 1979 Edition of the Uniform Plumbing Code.
>
> For information on California restrictions, contact the State Housing Law Section of the California Housing and Community Development Department.

The trial on the underlying merits is now set for December 12, 1983 in Los Angeles Superior Court before the Honorable Judge Jack Crickard. The objectives of the plaintiffs are

best understood in light of the relief requested. Plaintiffs seek to require either IAPMO, or the product manufacturer through a contract with an independent laboratory approved or designated by IAPMO, to test each individual product for health and safety effects. Such health and safety effects should include:

1. toxicological testing of chemicals found in products or to have leached from products;

2. water chemistry testing of appropriate uses of such products;

3. permeation of organic and inorganic substances into potable water from either airborne or groundladen substances;

4. fire safety testing;

5. worker/installer safety assessment;

6. determination of durability to assure adequate service life.

Moreover, all Research Committee meetings should be opened to the public at large. Decisions by the Research Committee should be based on substantial evidence in the record. Findings should be prepared by IAPMO which show that the Research Committee has determined that the product does not create negative health and safety effects. Members of the Research Committee must not be limited to IAPMO members only, but rather must include public members, including but not limited to, those representing environmental and consumer interests. These public members shall

have voting privileges on the Research Committee.

IAPMO plays a critical legislative role and enjoys the economic and legal benefits of such a role. The time has come for them to assume the related burden of public responsibility.

ASSEMBLY

CALIFORNIA LEGISLATURE

ART AGNOS

ASSEMBLYMAN SIXTEENTH DISTRICT

DEMOCRATIC CAUCUS SECRETARY

CHAIRMAN
WAYS and MEANS SUBCOMMITTEE on HEALTH
and WELFARE

AGENDA

SUBCOMMITTEE #1 on HEALTH and WELFARE
OVERSIGHT HEARING on PLASTIC PIPE
WEDNESDAY OCTOBER 19, 1983
1:00 - 3:00 P.M.

Background

In July the Governor blue pencilled $200,000 for a study to assess the public impact of the permeation and infiltration of plastic pipe and pipe water mains by toxic chemicals. The study called for a comprehensive and independent literature search on permeation; the development of new test protocols to assess permeation: and risk assessment based on the likelihood and dose of human exposure to chemicals which could enter drinking water supplies.

The study designed by the Assembly was to be carried out by an independent contractor under the supervision of the Assembly Office of Research. It was to be completed by March 1, 1984, and it was funded entirely by the Hazardous Waste Control Account.

The Governor's veto message stated that the item was vetoed because it was more appropriate for the study to be funded by the pipe industry.

Major Issues

This hearing will address five critical issues relating to the plastic pipe issue.

1. How much do we know about the phenomena of permeation? Do existing studies and available information suggest that this is a serious health issue?

2. What type of studies are currently being done by industry? Are they comparable to the study proposed by the Legislature?

3. Is it prudent public policy to rely on the industries which manufacture plastic pipe and have direct financial interest in its use, to perform an important public health study?

4. Is there a legitimate need for an independent study of plastic pipe permeability? How should such a study be funded?

5. Are existing regulations being adequately enforced? Are there immediate steps that should be taken to limit or restrict the use of plastic pipe?

Witnesses

Mr. Richard Spohn, Attorney
Consumer Federation of America

Mr. Michael Paparian
Sierra Club

Mr. Marc Lappe
Coalition of Consumer Labor and Environment Groups

Resident
McColl Dump Site

Mr. Alan J. Olson
B. F. Goodrich Corp., representing the Vinyl Institute

Mr. Jim Blumencrantz
R & G Sloane, representing the Plastic Pipe & Fitting Association

Mr. Robert Harris, PhD, Co-Director
Hazardous Waste Research Program, Princeton University

Mr. Robert Fugina, Chief Deputy Director
State Department of Health Services

Mr. Harvey Collins, Chief
Environment Health Division - State Department of Health Services

SACRAMENTO ADDRESS
STATE CAPITOL
SACRAMENTO 95814
(916) 445-8253

DISTRICT OFFICE
1084 STATE BUILDING
350 MCALLISTER
SAN FRANCISCO CA 94102
(415) 557-2253

COMMITTEES
AGING
ELECTIONS AND REAPPORTIONMENT
RULES
WAYS AND MEANS

Assembly
California Legislature

ART AGNOS
ASSEMBLYMAN, SIXTEENTH DISTRICT

DEMOCRATIC CAUCUS SECRETARY
CHAIRMAN
WAYS AND MEANS SUBCOMMITTEE ON HEALTH AND WELFARE

PLASTIC PIPE AND PERMEATION; DOHS OVERSIGHT HEARING
OCTOBER 19, 1983

BACKGROUND PAPER FOR
ASSEMBLY WAYS AND MEANS SUBCOMMITTEE NO. 1
ON HEALTH AND WELFARE

Summary

This briefing document provides background information on the phenomena of plastic pipe permeation and discusses what the state has done to restrict the use of plastic pipe. The document is organized as follows:

I. Overview of the Issue

Permeation refers to the phenomenon by which chemical substances travel through the walls of plastic pipe from surrounding soils and contaminate fluids transported within the pipe. Permeation is of concern whenever drinking water is transported by plastic pipe through soils that are contaminated with hazardous substances. The evidence demonstrates that permeation does occur, although the data necessary to determine the extent and severity of the problem is not conclusive. Uncertainty rests both with the potential frequency of the problem and with the often unknown health effects resulting from chronic (long-term) exposure to low levels of toxic substances.

A. Types of Pipe:

There are three major types of plastic pipe commonly in use for water service. The types of pipe are refered to by their prime constituents: polybutylene (PB), polyethylene (PE) and polyvinylchloride (PVC). Pipe used for water mains is generally from two to twelve inches in diameter. Pipe used to service individual customers is two inches or less in diameter. Evidence indicates that the higher the density of the molecules of the plastics used in the pipe, the lower the permeability of the walls and the lower the rate of permeation.

B. Reports of Permeation:

Permeation has been reported in California and in the Netherlands and EPA data indicates that other states have also experienced permeation problems. Alleged incidents of permeation have been connected to contaminated soils in the vacinity of both the McColl and Stringfellow dumpsites. Permeation could also be a problem if plastic pipe is installed to carry drinking water near any of the hundreds of other identified California sites with known soil contamination.

The experience of one major California water utility demonstrates that the installation of plastic pipe in localized areas subject to soil contamination from the spillage of gasoline can lead to permeation. Other situations of concern include: a) cases in which pipe is installed in new housing developments located on old

agricultural lands that have been sprayed with persistant pesticides; and b) application of common pesticides in a residential setting. In summary, the preconditions for permeation may be a common feature of residential and urban settings.

C. Related Public Health Issues:

Permeation is only one of several public health issues related to the use of plastic pipe. One major concern is the contamination of tap water from the leaching of plasticizing agents which are used in the manufacture of plastic pipe, and of solvents and glues used in connecting pieces of pipe. There are also concerns about toxic fumes that are generated during structural fires. Leaching and plastic fumes are major issues in an EIR being developed by SRI International for the State Department of Housing and Community Development (HCD). By contrast there is no scientific study of permeation being carried out in California.

D. Jurisdictional Issues:

Jurisdiction over the use of plastic pipe in California involves a split at the property line of the individual homeowner. The laying of water mains and the delivery of water up to, and away from the property line is regulated by the Sanitary Engineering Branch of the Department of Health Services (DOHS). The use of plastic pipe inside of the property line and within buildings is regulated by HCD. The failure to properly evaluate the threat of permeation in the five years that DOHS has known of the concern, and the failure to take appropriate preventive action, is partially due to this split in jurisdiction. In larger part, DOHS's failure on permeation is a function of:

- o very poor follow through once regulations are developed;
- o a tendency to downplay the potential severity of public health threats and;
- o understaffing.

E. Economic Interests:

The debate on permeation is often clouded by the large economic interests involved in the issue. Plumbers unions have generally been opposed to the use of plastic pipe on several grounds including:

- o occupational health issues involved in using glues that contain synthetic organic compounds to join pieces of pipe and;

- o public health issues of fire safety, leaching and permeation.

In addition, plastic pipe is generally less expensive than metal pipe and is more easily installed, particularly by homeowners and other nonprofessional plumbers that can use glue and avoid the soldering necessary with metal pipe. Plumbers have not been vocal in raising potential health concerns with nonplastic pipe. Yet there are also occupational and public health issues related to the use of asbestos in pipe, and the lead and cadmium used to solder metal pipe.

II. What is Known About Permeation?

The following is a summary of incidences of contamination and studies related to permeation. Events are presented chronologically where possible.

A. East Bay MUD:

In the late 1970's the East Bay Municipal Utility District (EBMUD) began to receive complaints about drinking water tasting and smelling of petroleum. After investigating several complaints EBMUD concluded that gasoline and other petroleum distillates must have been present in soils into which plastic water mains and service pipes were installed, and that these chemicals permeated through the walls of the pipe and into the tap water.

EBMUD conducted laboratory studies demonstrating that permeation occurs when PE and PB plastic pipe is allowed to soak in a solution of gasoline diluted with water. Results of an identical test of permeation through PVC pipe were negative. Several of the first incidents of petroleum distillate permeation were linked to: (1) the uncontrolled drainage of materials used to clean motorcycles and the corrosion of asphalt, and (2) the contamination of soil caused by the spillage of gasoline from the tanks of automobiles parked on a steep hill.

A third reported incident of permeation in the EBMUD service area involved the presence of butyl mercaptan in tap water. Mercaptans are added to natural gas to produce an odor for safety reasons. The mercaptans apparently permeated from a natural gas service pipe made of PE and through a PE water pipe with which the gas pipe was in direct contact. EBMUD conducted a simple laboratory test of permeation using butyl mercaptan and PE pipe. Strong mercaptan odors were detected in several of the samples.

Several aspects of the EBMUD experience deserve note:

- Although one of the reported cases of permeation occurred on the premises of an operating chemical manufacturing plant, EBMUD did no test for substances other than gasoline and butyl mercaptan.

- o The EBMUD lab tests demonstrate that permeation occurs. There was no attempt, however, to quantitatively correlate concentrations of specific substances with the rate of permeation for each type of pipe.

- o EBMUD conclusions that permeation is not a common phenomenon because of the relatively low number of reported cases may be erroneous. As the utility notes, permeation will not likely be reported unless the taste or odor of the tap water is adversely affected. Thus there may be unreported incidents of permeation that involve substances at concentrations too low to be detected by end users.

- o A number of the EBMUD incidents involved contaminated soils on the property of the building involved. There is serious concern that the application of pesticides near a residence, particularly fumigation with lindane and chlordane for termite or ant control, may increase the likelihood of the permeation of service pipe running through soils within the property line. One consultant notes that it is common practice when fumigating for termites to deliberately spray both the soil and any pipes entering the house.

- o The EBMUD permeation experiences resulted in the 1979 promulgation of DOHS regulations prohibiting the use of plastic pipe in soils contaminated with petroleum distillates.

B. Lekkerkerk:

Lekkerkerk is a town in the Netherlands that experienced what appears to be the most serious reported incident of permeation. PE pipe was installed in Lekkerkerk in soils that were heavily contaminated with a variety of substances including known carcinogens. Many of the buildings were located on top of an old chemical waste dump. Trichloroethylene (TCE), for instance, was found in concentrations of from 140 to 160 parts per million (ppm). In 1980, 800 inhabitants were evacuated from 270 houses which were then put up on piles while the contaminated soil, totalling 150,000 tons, could be removed.

Dutch scientists subsequently did several studies of

permeation. One was a 1981 study of the permeation of gaseous methyl bromide through PE, PB and PVC pipe. An incident of suspected permeation involved this soil disinfectant which is commonly used in both the Netherlands and the U.S. PVC pipe was found to be the most resistant and of the three was the only one that did not permeate. These results are of concern in California because of the chemical similarity of methyl bromide to ethylene dibromide (EDB). Although EDB is now being banned for use by the EPA, the substance is very persistant and has been used for many years on California soils.

C. Housing and Community Development EIR:

The Department of Housing and Community Development is currently preparing an EIR on the impacts of expanding the legal uses for plastic pipe in residential buildings. Legal use is currently restricted to effluent and prohibits the use of plastic pipe to deliver potable water. Development of the EIR began in 1978 with the formation of a task force chaired by HCD and including representatives of DOHS, Consumer Affairs, Cal-OSHA, the Fire Marshall, the Pipe Trades Council (plumbers), the California Building Trades Council, a plumbers union and several manufacturers of plastic pipe. The study is being conducted by SRI International and funded by the Society of the Plastic Industry.

Although SRI identified permeation as an important public health concern, HCD does not want to include the issue in the EIR because:

- o the concern was brought up too late in the process;
- o too much basic scientific research is required before permeation can validly be evaluated in an EIR and;
- o the issue is outside of HCD's jurisdiction. Despite ongoing efforts of the Pipe Trades Council and a coalition of environmental and consumer organizations, it is not clear that the EIR is the proper forum for a study of permeation. The EIR focusses on the use of pipe in buildings and permeation occurs outside of residences.

D. McColl Dumpsite/Coyote Hills:

In 1981 residents of the Coyote Hills housing development near the McColl dumpsite began to complain of petroleum odors and tastes in their drinking water. Little was done at either the local or the state level to respond to these concerns. Two years later, during the summer of 1983, DOHS finally conducted water sampling and laboratory analyses of Coyote Hills tap water. Although DOHS concluded that permeation probably is not a problem in this Fullerton community, the report has been criticized by local residents and the Pipe Trades Council. Specific objections to the study include:

- o Water was only allowed to accumulate in the plastic service lines for two hours. Such a short period may not adequately reflect actual residential use, tending to understate any permeation.
- o No soil testing was done in the vacinity of the plastic pipe from which water entered the houses.
- o Instead of testing a random number of houses, essential for statistical validity, DOHS allegedly tested the first twelve houses they came across.
- o The Department never took the measurements of water flowrate necessary to assure that the sampled water came from the service pipe, where it was supposed to be static for two hours.

The Department found extremely low levels of one or more of three toxic organic compounds (toluene, styrene and tetrahydrofuran) in the water of three houses. The Department concluded that although the source of the substances is unknown, none of the substances is related to the oilfield wastes that contaminate the soils of the area, and that permeation is not demonstrated to be occuring. McColl residents will vociferously dispute the results of the DOHS study. The Department intends to do further water sampling at the Coyote Hills subdivision. The nature of this testing has not been announced.

E. Stringfellow Dumpsite:

Permeation has also become a concern at the Stringfellow dumpsite. In 1978 the regional water board released part of the liquid contents of one of the Stringfellow ponds during a heavy rainstorm in order to avoid a breaching of the pond walls. The effluent ran down the canyon and across a portion of the playground at the Glen Avon school. Synthetic organic compounds have recently been found in water from the school drinking fountains. It is possible that some of the Stringfellow wastes may have percolated into the school's soils and permeated plastic water service pipe.

F. Department of Consumer Affairs:

The Department of Consumer Affairs has been involved in the issue of permeation in several different contexts:

- In mid-1982 Dr. Marc Lappe, a consultant for Consumer Affairs during the Brown Administration, learned of the Lekkerkerk incident and obtained a copy of the EBMUD studies that had been part of the hearing record for the DOHS regulations. Lappe designed a protocol, working with Consumer Affairs and funding from the state Building Trades Council, to duplicate the EBMUD tests on petroleum distillates and to test a broader range of organic compounds including solvents and pesticides. As with the EBMUD studies, the aim was to qualitatively rather than quantitatively, demonstrate the threat of permeation. The work was conducted by AnLab, a independent laboratory in Sacramento, and the results were relesed by Consumer Affairs in December 1982.

The results included:

- o In testing permeation of pipe with soil saturated by gasoline, AnLab found that benzene (a potent carcinogen) accumulated in pipe at levels of up to 100 ppm in one week. The federal regulatory action level for benzene in drinking water is approximately ten thousand times lower.

- o In testing a range of pesticides, AnLab obtained negative results for chlordane, but positive results for lindane. This result raises serious questions regarding common methods of ant and

termite control that include spraying pesticides on water pipes.

- In the spring of 1983, Gus Koehler, then a research analyst with Consumer Affairs, learned of the experiences of McColl area residents. Koehler researched and wrote a paper entitled, "Plastic Water Pipe in Coyote Hills: A Case Study of Regulatory Failure", that became available in draft form in August 1983. The Koehler study is as an indictment of a state regulatory structure that is intended to protect the public health. The report demonstrates the ineffectiveness of the existing DOHS permeation regulations, due largely to lack of enforcement, and the finger pointing concerning the lack of soil testing prior to the installation of plastic pipe between the developer, the water agency and county health officials. Koehler has since been removed from his post at Consumer Affairs and shuffled to a desk with no phone in a different department.

G. Shell Study:

In July 1983 the Governor vetoed budget item 4260-001-014 which would have allocated $200,000 from DOHS' Hazardous Waste Control Account for an independent study of permeation. Department representatives testified in budget hearings that such a study would be useful.

DOHS is now working with Shell scientific staff at the firm's corporate headquaters in Houston to develop a protocol for a study to be both funded and conducted by Shell. Department spokepersons have indicated that Shell and DOHS are a long way from agreement about the initial protocol submitted by Shell. For example, Shell does not want to test soils contaminated above 1 part per million. In practice, soil is often contaminated at levels far in excess of this.

A number of questions are unanswered:

- o What was the impetus for the veto of the budgeted study and the Shell study? Did Shell offer to do the study or was the firm approached by the Administration?

- o How will the Shell study address the fundemental issue of permeation if it involves only one type of pipe, PB, of which Shell is the major manufacturer? Does the Department have any plans for more exhaustive study of permeation?

- To what degree will DOHS be able to exercise control over a study that is funded by Shell and is conducted in Texas? Will this study just be another example of suspect results from private testing by an affected industry?

The Shell study is already controversial. The Department contends that no actual work has been done by Shell and that only the protocol is now under discussion. The Pipe Trades Council asserts, however, that Shell has already conducted testing and is unhappy with the results. This controversy highlights the dangers of relying on a study such as Shell's as the basis for major public health decisions.

B. New Studies:

The results of several new studies are now becoming available including:

- Recent laboratory studies by a New Jersey utility, the American Water Works Company, strengthens the case on permeation. American Water Works conducted tests using substances present in low concentrations in the gaseous phase, rather than soil saturated with liquids. One major result is that PE, PB and PVC all were permeated by a gaseous solvent in periods ranging from one day to one week.

- AnLab, with funding from the Pipe Trades Council, has replicated its 1982 experiments using tighter controls to avoid any possible entry of substances through the joints between the pieces of pipe, rather than through the walls. The results, to be released at the hearing, include:

  - The degree and rate of permeation appears to be a function of identifiable chemical characteristics of a permeant. Constituents of gasoline, such as benzene, and chlorinated solvents permeate readily while pesticides permeate more slowly.

  - In order of the threat of permeation, PE pipe poses the greatest danger, PB pipe is of intermediate danger, and PVC appears to pose the least threat.

- o California Analytical Labs, also under contract to the Pipe Trades Council, is conducting tests on a carbon water filter from one of the McColl area houses sampled by DOHS. The results, also to be released at the hearing, indicate the presence of over thirty organic chemicals, including a number of benzene-related molecules. Some of the chemicals are known or suspected carcinogens. A number of the chemicals are related to crude petroleum and could probably be linked to the McColl wastes.

I. Miscellaneous Notes:

Ray Leonardini's group, the Pipe Trades Council and a coalition of organizations including Friends of the Earth, Citizens for a Better Environment and the Consumer Federation of California, is suing the International Association of Plumbing and Mechanical Officials (IAPMO). IAPMO is developing rules governing the installation and use of plastic pipe. Although the rules do not have the weight of law, it is common for IAPMO rules to be incorporated into state building codes. The suit is now in the discovery phase and is expected to go to trial in Los Angeles in December.

IAPMO contends that sufficient data exists to certify plastic pipes as safe. The plaintiffs assert that there is insufficient data and that the development of the rules is premature.

III. Does California Need an Independent Study of Permeation? What are the Issues?

There are significant drawbacks to relying on an industry organization to both fund and conduct a study of permeation. The Shell study will examine only PB pipe, of which the company is the major manufacturer. In addition, representatives of DOHS indicate that Shell and the Department are far from agreement on the protocol initially submitted by the firm. The State has little if any leverage over research funded and conducted by a private firm. Is the public good served by a prolonged study that addresses only part of the issue? The results of the Shell study will be inconclusive for all parties except Shell.

IV. Are Existing Regulations Being Adequately Enforced? Are there Immediate Steps that Should be Taken to Restrict the Use of Plastic Pipe?

A. Existing Regulations:

In 1979 the Sanitary Engineering Branch promulgated two new regulations relating to the permeation of plastic pipe. These regulations were the direct result of studies by East Bay MUD, and were added to Title 22, Article 5, Water Mains and Appurtances.

- Section 64624 (f) states that:

  "Plastic pipe shall not be used in areas subject to contamination by petroleum distillates."

- Section 64630 (g) states that:

  "Installation of water mains near the following sources of potential contamination shall be subject to written approval by the Department on a case-by-case basis:

  (1) Storage ponds or land disposal sites for waste water or industrial process water containing toxic materials or pathogenic organisms.

  (2) Solid waste disposal sites.

  (3) Facilities such as storage tanks and pipelines where malfunction of the facility would subject the water in the main to toxic or pathogenic contamination."

B. The Need for Emergency Regulations:

The scope of existing regulations appears to be inadequate to protect public health from toxic contaminants. Existing regulations apply only to petroleum distillates and exclude many solvents, pesticides and other toxic substances that can permeate plastic pipe.

Section 64624 should be expanded beyond petroleum

distillates to include all hazardous substances, including wastes. In addition the regulations could require:

- o certification that soil has been tested prior to installation of plastic pipe
- o that end users of water receive notice from the entity installing the pipe that plastic pipe has been used and that in the event of contamination of adjacent soils delivered water could become contaminated through permeation.

C. The Need for an Information Program:

The Department has no procedures to inform affected parties of the permeation regulations. A Department survey of water utilities found very poor knowledge of the regulations. It is unlikely that housing developers have any knowledge of the regulations. In the case of the alleged permeation in the vacinity of McColl, there were three forms of regulatory failure.

- o The contractor was unaware of Section 64624 which prohibits the use of plastic pipe in areas subject to soil contamination.
- o The water purveyor relied on the contactor to inform him of any soil contamination.
- o Despite the proximity of the McColl dumpsite the water purveyor did not request the Department's permission to install plastic pipe, in violation of Section 64630.

DOHS should develop procedures to:

- o Inform water utilities and contractors of their responsibilities under the permeation regulations.
- o Utilize data from a variety of sources within the Department, and from the regional water boards and the State Waste Management Board, to aid local governments in locating sites of known or potential contamination. This data base should include information on abandoned sites, underground storage facilities, solid and industrial waste disposal facilities and liquid waste surface impoundments.

PRESS INFORMATION

for

WAYS & MEANS SUBCOMMITTEE NUMBER 1
ART AGNOS, CHAIRPERSON

HEARING ON PLASTIC PIPE PERMEATION

1 p.m. Room 437

October 19, 1983

Presented by:

The Consumer Federation of California, Friends of the Earth, Citizens for a Better Environment, The Natural Resources Defense Council, and the California Pipe Trades Council

Coordinator:
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INDEX

ENCLOSURES

(1)

A STATEMENT OF CONCERN FOR A NEW PUBLIC HEALTH RISK POSED BY TOXIC SUBSTANCES THAT PENETRATE PLASTIC DRINKING WATER PIPES

Presented to

The Assembly Ways and Means Subcommittee Number 1
Art Agnos, Chairperson

by

The Consumer Federation of California, Friends of the Earth, Citizens for a Better Environment, The Natural Resources Defense Council, and the California Pipe Trades Council

October 19, 1983

We wish to alert the Committee to a new and previously underestimated source of environmental contamination. We are gravely concerned that California consumers may be unknowingly exposed to hazardous chemicals which may enter drinking water supplies from contaminated soils by migrating through the walls of permeable plastic water pipes.

The degree of our concern is heightened by two facts:

1) the increasing occurrences of soil contamination following accidental spills, leaks from underground storage tanks and, chemical migration from landfills [from the records of the Environmental Protection Agency we know of 58 episodes of major spills of gasoline or diesel oil in one month in California alone (January, 1983)]; and,

2) the increasing reliance of many municipalities on plastic pipes as the conduits for potable water.

In the past, such episodes of soil contamination had been thought to be rare and small in magnitude. From the EPA records we know that spills in the million-gallon range may occur monthly. In early May, 1983, the Regional Water Quality Control Board in Santa Clara reported a total of 57 major underground leaks from storage tanks containing industrial solvents and stripping solutions.

Municipalities either have been unaware of these problems or have underestimated its seriousness. San Francisco uses plastic piping in over 50 percent of its water service connections. The East Bay Municipal Utility District (EBMUD), in spite of having uncovered over a dozen such episodes since 1978, relies almost exclusively on polybutylene plastic pipe for its mains and recommends such use for service laterals.

Research done at the Anlab Laboratory in Sacramento under the supervision of Prof. Marc Lappe' of the UC Berkeley School of Public Health has shown that several major groups of hazardous chemicals can permeate different types of plastic pipe. Some of these pipes, such as polybutylene and polyethylene, are strikingly permeable to chlorinated solvents including some which are carcinogenic in animals.

At the Fairchild plant in San Jose, for instance, soils have been contaminated with chlorinated solvents like 1,1,1 trichloroethane and 1,1 dichloroethylene. Homes in the immediate

vicinity of the plume of contamination are plumbed with subsoil polyethylene (PE) and polyvinychloride pipe (PVC). PE has proven to be extremely permeable to these solvents, PVC less so.

Homes sold throughout California are commonly sprayed with lindane, a carcinogenic and teratogenic pest control agent which the EPA has just recertified for use as a structural pest control agent. The labels on several such formulations carry the instruction to spray directly on exposed pipes. Anlab studies show that prolonged contact (1-7 weeks) between PVC pipe and a concentrated lindane solution results in substantial contamination of water inside the intact pipe with this highly persistant pesticide.

Although it contains less toxic ingredients than lindane, the chemical of greatest concern remains gasoline because of its ubiquitous presence in the environment. In spite of studies done in 1978-79 by EBMUD which showed that gasoline will readily penetrate PE and PB (polybutylene) pipe, the level of concern of health officials for this now commonly recognized permeation event remains inexplicably low. A survey of water utility districts in California performed in the summer of 1983 by the Sanitary Engineering Branch of the State Department of Health Services showed that 62 percent of the representatives of districts which regularly recommend the use of plastic pipe for water lines knew nothing about State regulations which proscribed their use in the presence of petroleum distillates.

In spite of their familiarity with permeation problems with plastic pipe, the Department of Health Services failed to specify permeability when asked to indicate what public health concerns were properly within the scope of an Environmental Impact Report on expanded use of plastic pipe being conducted by the Department of Housing and Community Development. This omission is all the more questionable in the face of the fact that Robert Stephens, then the Department's head of hazardous substances, had just returned from an oversight mission in Holland where he had observed the most serious environmental episode involving plastic pipe permeation then known (Lekkerkerk).

Perhaps of greater concern, is the fact that the attorney for the Society for Plastics, Inc., failed to divulge any data about plastic pipe permeation when asked to do so by the Department of Health Services in March of 1981 following the first public reports of the Lekkerkerk event. It is clear from material submitted for the public record that such industry data were available.

Part of the lack of the Department's concern may have stemmed from the mistaken belief that problems of the magnitude of the Lekkerkerk episode (often called Europe's Love Canal) could not happen in the United States. But we know now of several episodes reported to American water districts and the EPA which have involved potential human exposure to extremely hazardous substances such as benzene as the result of permeation of plastic pipe.

Another explanation for Department passivity is the belief that the taste or odor of the water will alert consumers to the existence of a problem. Published data on odor thresholds for the chemicals of concern for permeation establish that consumers cannot be expected to detect them before they are already above the level of health concern.

A case in point is benzene, a human leukemia-causing agent. Data from the Anlab studies showed that this constituent of gasoline will readily go through PB and PE pipe walls and reach extremely high concentrations (100 ppm) after just one week of exposure. This observation could have predicted a permeation contamination episode in Columbus, Ohio, where seven people were exposed to levels of benzene well above those considered the threshold for regulatory action. For benzene in particular, the odor detection threshold is known to be substantially above this threshold, set by the EPA at 0.66 parts per billion (ppb). At 100 parts per million, the levels found by the Anlab work--albeit with pure gasoline--are over 100,000 times the action level.

The lack of response on the part of the plastics industry to the Department's request for data on permeation (March, 1981) is even less understandable, since several industry studies on the resistance of various plastics to attack by chemicals, show that they have known about the vulnerability of various plastics since the early 1960's. That they permitted water pipes to be constructed of these same materials without public disclosure of this vulnerability to appropriate public agencies is cause for concern.

Because of the gravity of the potential health hazards posed by these and other carcinogenic chemicals, and the uncertainties surrounding where and when health-threatening episodes may occur throughout the state, we believe that the following moratoria requirements and authorizations should be adopted immediately:

1) A specific moratorium on use of underground plastic

pipes for carrying potable water in and around high-risk sites in the state. These sites, to be specified by the Department of Health Services, Department of Food and Agriculture, and CalTrans, would include, but not be limited to, areas of proximity to present and abandoned hazardous waste disposal sites; land in proximity to underground chemical storage tanks; agricultural land where residual contamination with pesticides or soil sterilants may occur; and, rights-of-way at high risk for accidents or spills that contaminate soils with potentially permeating chemicals.

2) A requirement that soils at all major construction sites and rights-of-way [illegible] which contractors intend to use plastic pipe be monitored prior to use to determine the presence of significant levels of permeating chemicals.

3) A directive to the Department of Health Services to rigorously enforce relevant statutes and regulations dealing with the siting of water mains and service laterals.

4) A notification requirement that householders whose service lines have been plumbed with plastic be warned of the health risks associated with permeation of toxic chemicals from contaminated soil.

5) A requirement that CalTrans and other emergency agencies notify local water utilities known to use plastic pipe of any spill or leakage of hazardous chemicals which can permeate plastic piping (A model notification request for PCB permeation of PB pipe was recently developed by the North Marin County Water District).

6) A requirement that the Department of Food and Agriculture monitor agricultural soils for residual contaminants which can permeate underground plastic irrigation pipes and thereby recontaminate crops or workers (examples include DBCP and dichloropropanes). And

7) An authorization for the Department of Health Services to modify its existing regulations proscribing the use of plastic pipe where petroleum distillates are present to encompass all classes of chemicals known

to permeate plastic pipe.

We believe that the health and welfare of California citizens will be substantially served by taking the steps outlined above to offset the real and potentially damaging health threat posed by the permeation of plastic water pipes by toxic organic chemicals.

INCIDENTS OF PERMEATION OF PLASTIC WATER SUPPLY LINES

SITE	NUMBER OF EPISODES
East Bay Municipal Utility Districts, Oakland, California: Reports of at least twelve specific incidents of potable water being contaminated by gasoline distillates via permeation of plastic pipe. Specific types of plastic pipes permeated are unknown at this time.	12
Marin Municipal Water District, Corte Madera, California: Episodes of gasoline permeation of PB pipe at two residences.	2
North Marin County Water District, Novato, California: Permeation of PB pipe by gasoline (accident near meter) at a residence.	1
State of Delaware: Department of Health and Social Services Division of Public Health reported an episode of permeation at a shopping center of PE pipe by Tetrachloroethylene (PCE).	1
Columous, Ohio: Shopping center, 2492 Morse Road, Columbus, reports of permeation of PE by gasoline distillates. Adverse health effects reported.	2

INCIDENTS OF PERMEATION OF PLASTIC WATER SUPPLY LINES
(Continued)

SITE	NUMBER OF EPISODES
Chattanooga, Tennessee:	
Permeation of a residential plastic service line by gasoline.	1
Lekkerkerk, Nederlands:	
See attached description. 800 Inhabitants evacuated; 270 homes contaminated.	270

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FOR IMMEDIATE RELEASE
October 19, 1983

(3)

A new danger associated with the use of plastic pipe was revealed today in Sacramento at an Assembly committee hearing. Laboratory tests have shown that lindane, a carcinogenic chemical commonly sprayed on or near pipes for the control of termites and other structural pests, will penetrate the walls of some plastic pipe and contaminate drinking water according to Dr. Marc Lappe of the U.C. Berkely School of Public Health.

Testifying before an Assembly Ways & Means Subcommittee chaired by Assemblyman Art Agnos (D-San Francisco), Lappe urged the state to adopt an emergency regulation to prevent the application of lindane on or near plastic pipe.

Under California law, all structures must be treated for termites before sale or resale. The average home in California is resold every four years, according to Lappe, and lindane is the second most common chemical used for the required treatment. Lappe speculated that, by the year 1990, most Californians will have drunk water from lindane contaminated pipes.

Lappe warned the committee that "the state departments which are responsible for health and environmental protection need to conduct comprehensive examinations of plastic pipe permeation and do a better job of coordinating information amongst themselves." The testing for lindane permeation was recently completed under Lappe's supervision by an independent laboratory in Sacramento. Previous research had indicated that gasoline and other toxic chemicals commonly spilled, dumped, or sprayed in or on soil will permeate plastic pipe.

"Despite the reports of gasoline permeation episodes by three different California utility districts and independent confirmation of my findings by the American Water Works Service Co in New Jersey, the state has attempted to ignore this serious health hazard," Lappe charged.

Agnos had called the hearing in response to an unreleased report by the Department of Consumer Affairs that the Department of Health Services and other agencies had failed to properly protect drinking water quality in a housing tract developed near the McColl hazardous waste site in Fullerton. The hearing also questioned the Governor's veto of a Budget Bill appropriation which would have commissioned a study of pipe permeation.

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LINDANE

Common Name: Lindane

Synonyms: Hexachlorocyclohexane; gamma benzene hexachloride; BHC

Uses: Fumigant in homes and gardens* (See attachments); control of body lice

*Approximately 29,000 pounds of Lindane were used for structural pest control in California in 1981. Pesticide Use Report, Dept of Food and Agriculture, State of California, 1981.

Type of Chemical: Organochlorine (chlorinated hydrocarbon)

Chemical and Physical Properties: Colorless; persists in environmeant for approximately 10 years**

** An Assessment of the Health Risks of Seven Pesticides Used for Termite Control. Committee on Toxicology, Board on Toxicology and Environmental Health Hazards, Commission on Life Sciences. National Academy Press, Washington, D.C. August, 1982.p.3.

LD_{50}: Acute oral: 88 mg/kg. in male rats*

*Thomson, W.T. Agricultural Chemicals, Thomson Publications, California. 1977.

Antidote: No antidote available

Acute Health Effects: As an organochlorine, lindane may disrupt the function of the nervous system, principally that of the brain. Acute symptoms may include headache, disorientation, apprehension, weakness, muscle twitching and convulsions. Chlorinated hydrocarbons are fat soluble and may be stored in human body fat.

Morgan, D.P., 1977. Recog. & Mgmt. of Pesticide Poisonings, U.S. EPA, Washington, D.C.

A 2-year-old boy developed aplastic anemia after playing with a dog treated with lindane solution for mange.

Vodopick, H. "Cherchez la Chienne: Erythropoietic Hypoplasia After Exposure to -Benzene Hexachloride." JAMA, 234(8), 850-851, 1975.

Lindane can be absorbed through the skin.

Chronic Health Effects: Lindane has been shown to cause cancer in rats and mice.

Reuber, M.D., 1979. "Carcinogenicity of Lindane." Environ. Res. 19(2): 460-481.
Reuber, M.D., 1979. "Carcinomas and Other Lesions of the Liver in Mice Ingesting Organochlorine Pesticides." Toxicol. Annu. 3:231-256.

Lindane has been found to be mutagenic in human cell cultures and plant root tips.

Vachkova-Petrova, R.(Inst. Hyg. & Occup. Dis., Med. Acad., Sofia, Bulgaria), 1978. Mutagenna aktivnost na pestitsidite. (Mutagenic activity of pesticides). Khig. Zdraveopaz. 21(5):496-605. (Bulgarian).
Kolmark, F.G. "The Induction of Cytogenetic Changes and Atypical Growth by Hexachlorocyclohexane." Science, 109, 467-468.

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CAUTION

May be fatal if swallowed. Harmful if inhaled or absorbed through the skin or eyes. Do not swallow or inhale vapor or spray mist or allow contact with skin, eyes or clothing.

Avoid contact with food or feeds.

If swallowed, induce vomiting by giving the victim 1 Tablespoon of table salt in a glass of water. If on skin, remove contaminated clothing and wash with soap and water; if in eyes, flush with running water. Call a physician in all cases of suspected poisoning. Do not use in dairy barns or milkhouses.

Do not use in edible products areas of food processing plants, restaurants or other areas where food is commercially prepared or processed. Do not use in serving areas while food is exposed.

This product is toxic to fish, birds, and other wildlife. Keep out of lakes, streams, or ponds. Do not contaminate water by cleaning of equipment, or disposal of wastes.

Apply this product only as specified on this label.

NOTICE — Recommendations for the use of this product are based upon information believed to be reliable at the time of printing. The storage and use of this product being beyond the control of Los Angeles Chemical Company, no guarantees expressed or implied are made as to the effects of such, or the results to be obtained, if not used in strict accordance with the recommendations and established safe and sound practice. The buyer assumes all responsibility including any injuries and/or damages resulting from its misuse as such, or in combination with other products. No recommendations are made under abnormal storage or use conditions, or under conditions not reasonably foreseeable to the seller.

EPA REG. NO. 962-366 AA

EPA EST. NO. 962-CA-1

LACCO

HI-LIN

CONTAINS 1 LB. LINDANE PER GAL.

FOR SPOT APPLICATION ONLY

ACTIVE INGREDIENTS:	
Lindane (Gamma Isomer of Benzene Hexachloride)	12.9%
Xylene	78.4%
INERT INGREDIENTS	8.7%

CAUTION

KEEP OUT OF REACH OF CHILDREN

KEEP CONTAINER CLOSED. DO NOT LEAVE IN SUNSHINE.

Do not reuse empty drum. Return to drum reconditioner or destroy by perforating or crushing and burying in a safe place away from water supplies.

WARNING — FLAMMABLE!

KEEP AWAY FROM HEAT OR OPEN FLAME

See other precautions on the back/side panel

LOT NUMBER

NET CONTENTS

1 GALLON

DIRECTIONS

MANUFACTURED BY

LOS ANGELES CHEMICAL COMPANY

DIRECTIONS

LACCO HI-LIN is prepared for use against certain household and structural pests as listed below. Dosages are given in terms of fluid quarts of this product.

HOUSEHOLD: 1 quart in 25 gallons as a coarse, wet spray or with a paint brush as directed for the control of the following pests. Repeat as needed to maintain effective control. May cause staining in some cases.

ANTS: Apply to ant trails, door sills, window frames, openings around water pipes, heat ducts, electrical outlets, baseboards and other areas where ants may enter rooms.

ROACHES, WATERBUGS: Apply to infested cracks, hiding places and adjacent exposed surfaces where pests may crawl when not in hiding.

MOSQUITOES: Apply to doors, door sills, screens, window frames, and other areas where the pests frequently alight.

SILVERFISH: Apply to baseboards and areas behind shelving, bookcases and storage spaces.

FLEAS: Apply to infested areas around baseboards, windows and door frames, wall cracks, sleeping quarters of household pets and localized areas of floors and floor coverings; place fresh bedding in animal quarters after treatment and do not apply directly to pets.

DIRECTIONS (Continued)

FLIES: 1 quart in 8 gallons of water. Apply to doors, door sills, screens, window frames, and other areas where pests frequently alight.

STRUCTURAL: 1 quart in 25 gallons of water, pre-construction. Apply as a coarse, wet spray, or with a paint brush. Inspect treated areas annually for signs of infestation.

SUBTERRANEAN TERMITES: Slab construction, use a solution of 1 quart to 3½ gallons of water. For treatment before gravel or cinder fill has been added, apply 1 gallon of solution per 10 square feet of soil surface. Where fill has already been added, apply 1½ gallons per 10 square feet. Conventional construction, use a solution of 1 quart to 3½ gallons of water. Apply to trench 6 inches wide and up to 30 inches deep for buildings with deep foundations along both sides of exterior and interior foundations, around piers and under utility entrances; placing about 1/3 of the solution in the bottom of the trench with the remaining 2/3 mixed into the soil as the trench is backfilled. Use 2 gallons of solution per 5 linear feet for trenches not over 15 inches deep and 4 gallons per 5 linear feet for trenches exceeding 15 to 18 inches in depth. On voids of unit masonry walls, apply to 125 linear feet, from the surface of the soil to the footing.

CAUTION

Do not use in dairy barns or milk houses.
Keep container closed.
May be absorbed through skin.
Avoid inhalation and skin contact.
In case of contact, wash immediately with soap and water.
Avoid contamination of feed and foodstuffs.
Do not use on household pets or humans.
Harmful if swallowed.

DO NOT LEAVE IN SUNSHINE. DO NOT USE, POUR, SPILL OR STORE NEAR HEAT OR OPEN FLAME.

DESTROY OR RETURN THIS CONTAINER WHEN EMPTY.

Do not reuse empty drum. Return to drum reconditioner or destroy by perforating or crushing and burying in a safe place away from water supplies.

DIRECTIONS

LACCO LIN-O-FLY is prepared for use against certain household pests, listed below. Use as a spot treatment inside dwellings. Do not use as a general space spray or broadcast vapor. Use a coarse type spray.

ANTS: Spray around doorways, windows and cracks or openings of any kind in floor, walls or ceiling where ants might enter the room. Pay particular attention to space behind baseboards, under sinks, in cupboards and behind built-in drawers. Repeat as needed for complete control.

FLIES, MOSQUITOES: Spray to heavy dampness on and around doors, around windows, on screens and any surface on which flies or other insects congregate. Repeat often as necessary to maintain maximum killing value.

SPIDERS, CENTIPEDES: Spray infested baseboards, corners, behind pipes, storage or dark areas. Pay particular attention to basements or areas under houses, garages and storage sheds. Repeat often as needed to maintain killing efficiency of treatment.

EPA REG. NO. 962-375 AA

EPA EST. [illegible]-CA-1

LACCO

LIN-O-FLY

KILLS FLIES WITH LINDANE

ACTIVE INGREDIENTS:	
Lindane (Gamma Isomer of Benzene Hexachloride)	.50%
Deodorized Kerosene	95.10%
Toluene	4.25%
INERT INGREDIENTS:	.15%

CAUTION!

KEEP OUT OF REACH OF CHILDREN

SEE CAUTION STATEMENT TO LEFT.

LOT NUMBER 3351 CTTD214

NET CONTENTS 1 GALLONS

MANUFACTURED BY

LOS ANGELES CHEMICAL COMPANY

DIRECTIONS (Con't.)

CRICKETS: Spray baseboards, floors of closets and storage places. Spray thoroughly around doorways and openings of any kind through which crickets might enter. Repeat each 2 to 4 weeks during heavy cricket infestations.

ROACHES, WATERBUGS: Spray around doors, windows, and into any cracks or spaces (such as around drain pipes) through which insects might enter. Pay particular attention to areas behind built-in drawers and cupboards. Repeat as needed to maintain control.

CARPET BEETLES: Spray infested areas of carpets and surrounding floor. Spray dark corners and into cracks where insects might hide. Repeat as needed.

CLOTHES MOTHS: Clothing, blankets and other woolens to be protected should be cleaned and thoroughly sprayed so as to dampen all surfaces. Pay particular attention to seams, cuffs and pockets. Dry thoroughly and place in good tight storage. Treated items should be dry cleaned before being used as clothing or bedding.

FLEAS: Spray infested areas carefully. Direct spray into cracks, crevices and other hiding places in out houses, yards and kennels, so that all infested areas are dampened. Repeat at monthly intervals. Do not use in human habitations. Do not spray animals. Dry treated areas carefully before allowing pets to re-enter.

SILVERFISH: Spray baseboards, behind drawers or shelving, book cases and storage areas. Repeat as needed to maintain efficient control—usually about each 2 to 3 months.

NOTICE: Recommendations for the use of this product are based upon information believed to be reliable at time of printing. The use of this product being beyond the control of LOS ANGELES CHEMICAL COMPANY, no guarantee, expressed or implied is made as to the effects of such or the results to be obtained if not used in accordance with directions or established safe and sound practice. The BUYER must assume all responsibility including injury and/or damage resulting from its misuse as such or in combination with other products.

Environment Di. :torate

ENV/WMP/80.Sem.15

To: [illegible]
Seminar on Hazardous Waste
"Problem" Sites

English only

(4)

EXPERT SEMINAR

ON HAZARDOUS WASTE 'PROBLEM' SITES

Case of Lekkerkerk

(Contribution by Mr. Strybis)

The attached paper is submitted for consideration at the expert seminar on hazardous waste "problem" sites, OECD, Paris, November 5-7, 1980.

It has been specially prepared by Mr. Stybis, Netherlands.

Lekkerkerk

One of the most serious cases of soil pollution in the Netherlands is the case of Lekkerkerk.

Lekkerkerk is a village north east of Rotterdam on the river Lek in a reclaimed coastal swamp area. Around 1970 for the expansion of this village the ditches in the expansion area west of the village were not filled up with crushed peat, straw and saw dust, as usually is done for building purp in marshy polders, but for financial reasons with the building and demolition wastes. Among these, chemical wastes and waste oil were dumped illegally, partly in drums (of which more than a thousand have been found until now) and probably partly unpacked. Soon after the houses on this "ground" were built and inhabited complaints arose about bad smells in the houses, while at a number of places gas and water tubes in the ground were so badly affected by polluted grondwater that they broke.

After the fainting of two workmen in a pit dug for inspection of gas pipes an investigation was started in 1978. From this resulted that soil and grou water in this new part of the village were badly polluted by aromatic hydrocarbons, mainly xylene, toluene and ethylbenzene (solvents widely used in the paintindustry) that, as later appeared, floated as a film on a layer of oily waste material on the groundwater.

Because of the low permeability of the peat soil and because of the fact that Lekkerkerk lies in an area behind the dike of the river Lek where the groundwater wells up, the pollution had not spread laterally nor vertically to the subsoil. But when in april 1980 further investigations showed that not only the atmosphere inside the houses contained relatively high concentrations of aromatic hydrocarbons by evaporation from the soil, but that these polluting compounds also penetrated through the network of PVC and PCE tubes in the ground for the distribution of drinkir water as a result of which the quality of this water could not be guarante any longer, in the interest of public health it was decided that at the shortest possible notice all pollutions should be removed. This cleaning operation is now in progress and reached the world press for because of t some 800 inhabitants had to be evacuated from their 270 homes for abou six to nine months.

The operation is complicated by the fact that for social and financial reasons the aim is to save the 270 houses that are built on piles, some of concrete, others of wood.

The following works have been carried out or are still to be carried out.

1. All pavements, trees and other vegetation, street lights, garages, tubes and cables in the ground have been removed and if polluted have been destroyed. Only the houses were left standing.

2. The canal around the concerning part of the village was dammed off from the surrounding surface waters to prevent possible spreading of pollutions during the operation. By steel barrages the subsoil of the quarter was divided into five compartments to reduce spreading of pollutions from uncleaned territory into cleaned territory and to reduce the quantities of groundwater that have to be pumped away during the operation.

3. The groundwater level in the compartments was lowered by pumping for the time of the operation to a level just under the pollutions so that work can be done under dry conditions, which makes grading and concentrating easier. Well from the river Lek is opposed by a number of deep well pumping stations.

4. All polluted materials deposited on the original surface and in the ditches are removed and transported to a combustion installation for domestic and chemical wastes at Rotterdam to be burned. All polluted water thas is pumped out of the compartments is led to a temporary purification installation on the spot, where it is purified and finally led through active carbon filters before it is drained into the river Lek. Saturated active carbon sludges and chemicals separated from the water are burnt at the combustion installation in Rotterdam.

5. Underneath the houses the removal of soil and polluting substances is done by special drilling and dragging machines that can work horizontally. To prevent leaning to one side of the houses work is done two opposite sides at the same time. Houses on wooden piles are kept up straight by temporary steel constructions for additional support while work underneath them is going on.

6. After removal of all wastes and polluted soil (estimated on 75.000 tons of which 2.000 drums) the depressions are filled with clean sand, for which was chosen "flugsand" to prevent differential setting of the ground afterwards. Flugsand is a light vulcanic sand from the Eifel area

in Germany, which has about the same volumeweight under water saturated conditions as peat. Next clean topsoil is brought up. After that the infrastructure of the quarter can be reestablished and the groundwater is raised to its original level again.

It is expected that the inhabitants can return to their homes on a new clean subsoil between november 1980 and february 1981. The costs of the whole operation are estimated to be more than 140 million guilders.

(5)

Anlab
ANALYTICAL LABORATORY
A DIVISION OF DEWANTE & STOWELL

1914 S STREET, SACRAMENTO, CALIFORNIA 95814 • 916-447-2946

PERMEATION OF ORGANIC COMPOUNDS IN PLASTIC PIPE

Anlab
ANALYTICAL LABORATORY
A DIVISION OF DEWANTE & STOWELL

1914 S STREET SACRAMENTO CALIFORNIA 95814 • 916 447-2946

September 15, 1983

Mr. Ray Leonardini
555 Capitol Mall, Suite 435
Sacramento, CA 95814

The results of the pipe study are in the report enclosed.

The findings indicate that certain organic chemicals can permeate through plastic pipe under the conditions of the study.

Sincerely,

Tom Ikesaki

Tom Ikesaki

TI:et
Encls.

ABSTRACT

Four potable water service pipes were tested for permeability to specific organic compounds. These organic compounds were used in concentrated form in these tests and may not be representative of normal applications. Three series of test designs were used. Successive tests were designed to reduce the possible effect of pipe joints to the inward migration of chemicals through the pipe material.

Three groups of chemicals were tested; chlorinated solvents, pesticides and gasoline in Polybutylene (PB), Polyethylene (PE), Polyvinylchloride (PVC) and Copper (CU) pipes.

Permeation by small molecular weight chlorinated solvents was pronounced for polyolefin pipes (PB & PE), less for PVC. Trace contamination of joined pipe systems (PVC and Copper) was also found. Controls with no joints in pipes showed that PVC but not Copper was permeable to specific molecular weight chemicals.

For systems showing permeation, the rank order of chemicals was related to molecular weight and polarity, with constituents of chlorinated solvents, gasoline (benzene and substituted benzenes) showing the greatest permeation effect in polyolefin and chlorinated pipes, respectively. The rank of pipes according to decreasing permeability is: Polyethylene, Polybutylene, Polyvinylchloride and Copper.

Results indicate the presence of organic chemicals from other sources such as pipe joining and sealing compounds, and a group of chemicals that appear to have been extracted as specific plastic pipes were permeated.

(6)

SOME FREQUENTLY ASKED QUESTIONS CONCERNING PIPE PERMEATION

ANSWERS PREPARED BY THE CALIFORNIA PIPE TRADES COUNCIL

Q. WHAT IS PIPE PERMEATION?

A. Pipe permeation is the phenomena whereby toxic substances seep through pipe material causing the contamination of the drinking water which is carried by those pipes. This occurs most commonly with pipe which is buried in soil.

Q. WHEN WAS PIPE PERMEATION FIRST DISCOVERED?

A. That is hard to answer. Pipe permeation was not widely reported until the Department of Consumer Affairs released test results in December, 1982, which showed that plastic pipe can be permeated by a number of carcinogens. The test was sponsored by the California Pipe Trades Council and was conducted by Anlab, an independent testing laboratory in Sacramento. The investigation leading to that test, however, revealed that the East Bay Municipal Utility District had recognized permeation as early as 1978 and had reported its findings to the Department of Health Services. Further, the president of the Society of the Plastics Industry (a major trade association of plastic resin and plastic product producers) stated, in response to DCA's permeation announcement, that the findings "are not new, since they have been identified long ago . . . ."

Q. IS ONLY PLASTIC PIPE PERMEABLE?

A. As far as we know, the only testing for permeation has been conducted with plastic pipe and the only reported instances of pipe permeation have involved plastic pipe (although metal pipes have been used as test control, but were not permeated). We believe, however, that all pipe materials should be tested to make absolutely certain that public health is protected. The Budget Bill item (#4260-001-014) which would have appropriated funds for a permeation study called for the testing of all pipe materials. It was vetoed by the Governor.

Q. WHICH CHEMICALS CAN PERMEATE PLASTIC PIPE?

A. No one knows for sure how many different chemicals can permeate plastic pipe, nor under which conditions the permeation is most likely to occur. Among the toxics discovered to permeate, however, are some known carcinogens and some which are known to cause liver and kidney damage, mobility impairment, birth defects, lung congestion, nausea, and anemia. Until a comprehensive test is conducted, we simply won't know which chemicals permeate at hazardous levels. The Anlab test found the following will

permeate:

1, 2 dichloropropane
1, 1, 1 trichloroethane
trichloroethylene
1, 1 dichloroethane
1, 1 dichloroethylene
Ethyloxirane
Benzene
Methylpyrole
Butane
Toluene
Xylenes
Trimethylbenzenes
Tetramethylbenzenes
Ethylbenzene
Chloroform
Lindane

(An attachment to this series of questions & answers, excerpted from "The Merck Index" shows some of the common uses of these toxic chemicals.)

Q. WHY DID THE GOVERNOR VETO THE PIPE PERMEATION STUDY?

A. In his veto message, the Governor stated, "I am eliminating the $200,000 legislative augmentation for the study of the permeation and infiltration of toxic chemicals into pipe and pipe water mains. I believe it is more appropriate for this study to be funded by the pipe industry."

Q. WHY SHOULDN'T THE INDUSTRY BE REQUIRED TO FUND THE STUDY?

A. We're talking about a potentially serious health hazard which could affect millions of Californians. It requires a thorough and objective examination. Just as statistics can be manipulated, so can test protocols and results. Although the plastics industry acknowledges that they have known of the permeation phenomena for some time, the industry has not been at the forefront of any effort to restrict the use of plastic pipe to safe applications. Further, the president of the Society of the Plastics Industry, while referring to the permeation tests financed by the California Pipe Trades Council, stated, "There should be serious questions about the validity of a report funded by a source opposed to the product it is testing." We concur that privately funded tests may have a credibility problem and we also assert the same logic used by the S.P.I. president should discourage reliance on tests funded by advocates of products. The potential health hazard related to permeation is simply too serious to have its examination and evaluation financed, designed, or conducted by any organization other than one that is thoroughly and unquestionably objective.

Q. WAS THE TEST FUNDED BY THE PLUMBERS UNIONS (CALIFORNIA PIPE TRADES COUNCIL) A RELIABLE TEST?

A. The objective of the test was to determine whether or not certain chemicals could permeate plastic pipe. The test did not replicate "real-life" circumstances. It used highly saturated sandy soil in a controlled environment in order to accelerate the results. The test did prove that, under those conditions, plastic pipe is permeable. We know that a much more expensive and sophisticated test, such as the one which the Governor vetoed, is necessary to accurately determine which chemicals will permeate and under which soil conditions the permeation will occur. The plumbers' test was not designed to be the "last word"; its purpose was to provide sufficient evidence of the problem in order to prompt responsible parties (such as the State) to conduct a comprehensive and objective test.

Q. WHO BESIDES THE PLUMBERS UNIONS HAVE HAD EXPERIENCE WITH PERMEATION TESTING?

A. Apparently the East Bay Municipal Utility District conducted some limited testing after their initial discovery of permeation. We have recently learned, also, that testing has been conducted by the American Water Works Service Co. in New Jersey and that the company's results have shown findings similar to our own. None of this testing, however, has been nearly as comprehensive as the one which would have been conducted pursuant to the Budget Bill provisions. Strangely, although the Department of Health Services has jurisdiction over the regulation of public drinking water distribution systems and although the department has been aware of the permeation phenomena at least since 1978, DHS has never shown any interest in permeation testing until now.

Q. HASN'T A PERMEATION TEST BEEN CONDUCTED BY THE CITIZENS FOR SAFE DRINKING WATER?

A. No. The Citizens for Safe Drinking Water did widely report its discovery of lead leaching in copper pipe. The test was conducted at a few locations in Sacramento. The City of Sacramento subsequently tested the same water taps and found no evidence of leaching. The only known member of the Citizens for Safe Drinking Water, by the way, is a public relations representative for the Plastic Pipe & Fitting Association, a trade association which has worked closely with the Society of the Plastics Industry. This front organization has never announced the conduct or the results of any permeation studies.

Q. ASIDE FROM LABORATORY TESTING, WHERE HAS PERMEATION OCCURRED?

A. It may have occurred at the Coyote Hills tract near the McColl hazardous waste site in Fullerton. Further testing needs to be

conducted there to know for certain. The most dramatic permeation episode occurred at Lekkerkerk, a town in the Netherlands. There, 800 inhabitants were evacuated when 270 homes were contaminated by toxics in the soil which permeated plastic pipes and conduit. All other known instances have been in the U.S. The East Bay Municipal Utility District has reported 12 episodes of gasoline permeating PB pipe, two episodes of gasoline permeation of PB pipe have been reported by the Marin Municipal Water District in Corte Madera, one identical episode has been reported by the North Marin County Water District in Novato, Tetrachloroethylene (PCE) has permeated PE pipe in Delaware, gasoline distillates permeated PE pipe in Columbus, Ohio, and gasoline permeated plastic water service lines in Chattanooga. Undoubtedly, there have been a number of other permeation episodes that have gone unrecognized or unreported.

Q. AREN'T THE PLUMBERS SIMPLY OPPOSING PLASTIC PIPE BECAUSE THE INSTALLATION OF PLASTIC PIPE REDUCES LABOR COSTS?

A. The advocates of plastic pipe want you to think that is the reason. Actually, there are minimal economic considerations related to the plastic pipe issue. As you know, SRI International (formerly Stanford Research Institute) is currently producing an environmental impact report (E.I.R.) for the Department of Housing & Community Development which relates to the expanded uses of plastic plumbing pipe. The initial review draft produced by SRI (the final report will not be completed until next year) reports on page IV.F-1 that the proposed expanded use of plastics in home construction would amount to a labor savings of only about $50 per single family residence. The E.I.R. does not include a review of the permeation phenomena, so no accurate costs are available on the labor cost differential between the installation of underground plastic pipe and the installation of alternative materials. However, since plumbing the interior of a house is much more complicated than simply laying pipe in a trench, we can assume that the impact on labor costs -- if subsurface plastic water lines were to be restricted -- would be negligible.

Q. WHY THEN, ARE THE PLUMBERS SO CONCERNED ABOUT PERMEATION?

A. Members of the plumbing trades drink water too. Historically, our membership has been very active in the promotion of technologies to deliver pure water and to provide adequate sanitation. Our initial examination into the plastic pipe issue had been prompted by a fear that the health of plumbers had been severely endangered by the use of adhesives required for the bonding of plastic pipe, just as, 30 years ago, our fear that working with asbestos was causing cancer amongst our membership led to our investigation into the dangers of that material. Our continuing examination of plastic has uncovered the other dangers of the material, i.e., permeation, leaching, and fire toxicity.

Q. HOW COME THE E.I.R. DOES NOT INCLUDE AN EXAMINATION OF THE PERMEATION ISSUE?

A. We think it should. Unfortunately the proponents of the E.I.R. were unaware of the permeation issue when the scope of the study was being determined by the E.I.R. Task Force membership (although at least two of the participants, the Department of Health Services representative and the Society of the Plastics Industry spokesperson, were apparently well aware of the issue but chose not to reveal it) and it was therefore never included in the E.I.R.'s original work plan. When permeation eventually became a public issue, various environmental and labor organizations, some legislators, and even the Department of Health Services requested that an evaluation of pipe permeation be included in the E.I.R. Despite the strong evidence that this problem needs a careful analysis, the Department of Housing & Community Development acceded to the demands of the plastic industry and refused to permit the inclusion of a permeation study.

Q. WHAT REASONS DID THE DEPARTMENT OF HOUSING & COMMUNITY DEVELOPMENT GIVE FOR REFUSING TO INCLUDE PERMEATION TESTING AS AN ELEMENT OF THE E.I.R?

A. The department contended that underground pipes are outside of their jurisdiction. That contention is not true. While water mains are the responsibility of the Department of Health Services, the subsurface pipes which carry water from the meter (usually at the property line) to the structure are within the jurisdiction of DHCD. Clearly, if a plastic water main can be permeated, so can a plastic service line carrying water under a residential yard. DHCD has frequently sided with the plastic industry representatives during E.I.R. Task Force disputes, so the department's refusal was not surprising.

Q. WHAT IS THE MAGNITUDE OF THE PROBLEM?

A. No one can know for sure, but we believe it can be a problem with enormous consequences. Until a comprehensive test is completed, we can not know with absolute certainty which chemicals will permeate plastic pipe, which soil conditions contribute to it, nor how long it takes for permeation to reach truly hazardous levels. The vetoed study could have given us those answers. Its possible, however, to speculate with some assurance about the magnitude of the problem:

The E.I.R. draft prepared by SRI estimates that over 25% of all Californians will live in homes plumbed by plastic pipe within the next 25 years if the proposed new uses of plastic are approved. It is safe to estimate that at least that many, and probably many more, will also be served by underground pipe systems which include at least some plastic. (The manager of the San Juan Suburban Water District in Sacramento County has estimated that 98% of the new homes in his district have plastic water lines from the house to the main.) Consider also that

there are thousands of recorded toxic spills each year in California (every one of them could eventually trigger some permeation activity), that there are now tens of thousands of California homes near hazardous waste sites (such as the Coyote Hills tract near McColl), and that many new communities are projected for development on land which had formerly been contaminated by pesticides. The potential for extreme danger is high; its time for clear answers.

Q. IS ANYONE BESIDES THE CALIFORNIA PIPE TRADES COUNCIL ACTIVELY SUPPORTING PERMEATION TESTING?

A. There is, of course, considerable support within the Legislature. Additionally, the California Pipe Trades Council is part of a coalition of organizations which have been actively pushing for permeation testing. Other members of the coalition include the Citizens for a Better Environment, the Consumer Federation of California, the Friends of the Earth, and the Natural Resources Defense Council. Additionally, the Sierra Club has taken strong supportive positions.

The Merck Index. 9th Edition, Merck and Company, Inc., New Jersey, 1976.

1,2-Dichloropropane-Uses: solvent, dry clearing fluids, degreaser, insecticidal fumigant mixtures

1,1,1-Trichloroethane-Uses: metal cleaning

Trichloroethylene(TCE)-Uses: solvent, paints, degreaser, dry cleaning

Benzene-Uses: solvent, varnishes, petroleum products

Butane-Uses: petroleum products; synthetic rubber

Toluene-Uses: solvent, insecticidal fumigant mixtures, petroleum products

Xylene-Uses: solvent, insecticidal fumigant mixtures, petroleum products

Chloroform-Uses: solvent, cleaning agent

Trimethylbenzene: found in petroleum products

Tetramethylbenzenes: found in petroleum products

Ethylbenzene: found in petroleum products

Investigation of
Plastic Pipe Permeation
by Organic Chemicals

November 1984

TABLE OF CONTENTS

LIST OF FIGURES

EXECUTIVE SUMMARY

In the past several years, with the increased use of advance analytical techniques, there have been numerous reported instances of drinking water contamination from the permeation of plastic service lines by organic chemicals, principally gasoline. At least two such cases have occurred within the American System. Because a variety of plastic pipe materials are in use for both water company and customer service lines, the Materials Management Committee requested that an investigation be conducted to determine the extent to which these contaminants will permeate pipe materials.

A study was carried out during 1983 and 1984 at the Belleville Laboratory which tested five different pipe materials: iron, copper, polyethylene (PE), polybutylene (PB), and chlorinated poly(vinyl chloride) (CPVC) against permeation from three different organic chemicals (trichloroethylene (TCE), chlordane and gasoline. In order to simulate worst case environmental conditions the study was carried out using two concurrent pipe exposures; one exposing the pipe to a vapor environment and a second exposing separate pipes to a soil containing the organic chemical. The studies were carried out in three phases, one for each organic chemical, for a minimum exposure of 10 weeks.

The results of the investigation show that all plastic pipe materials were permeated by trichloroethylene and gasoline, but not by chlordane. The CPVC pipe was somewhat more resistant to

permeation than the PE or PB pipe. No permeation occurred in either the iron or the copper pipe.

This report is hereby submitted to the Materials Management Committee for their consideration of a policy addressing the use of plastic pipe materials within the American System.

INTRODUCTION

In the past several years there has been an increasing awareness of the potential for plastic pipe to be permeated by organic chemicals. Numerous incidents have been reported in the literature and at industry meetings. This awareness has no doubt resulted from improved analytical capability and availability. Several years ago the response to taste and odor complaints may have been limited to more traditional tests for bacteria and inorganic chemicals. Today, a complaint which might suggest the presence of an organic chemical will probably be tested for volatile organic chemicals or other more sophisticated analysis. The introduction of organic contamination through pipeline permeation can not only cause complaints, but could also make the water unsafe for consumption.

A. Case Histories

The East Bay Municipal Utilities District in Oakland, California reported in 1979 that at least four instances of apparent petroleum distillate penetration of PB water service lines had been encountered by their field personnel (1). Later laboratory testing confirmed this supposition to their satisfaction. Another case was recently reported from Washington State in which PB service line to a commercial establishment was permeated by gasoline (2). In this case, the soil surrounding the pipe installation was contaminated with gasoline. A case in Maryland was reported in which concentrations up to 5,500 ug/L of

toluene were found in a water sample collect from service line consisting of both PE and PB (3). The soil surrounding the service line was contaminated with gasoline as a result of a leaking underground storage tank that had been abandoned.

Similar incidents were reported by the Alabama Department of Environmental Management (4). One incident, typical of most reported cases, started with a complaint of an unusual odor which resulted in the collection of a sample for organics analysis. The organics detected could not be traced to the water source so service pipe permeation was suspected. During replacement of the PB service pipe the soil excavation released a strong fuel odor. Further investigation revealed that this site was the fuel storage yard during construction of the subdivision and the soil was still saturated with diesel fuel. A second incident reported in Alabama occurred as a gasoline truck accident spilled fuel which then saturated the soil and permeated PB service pipe. In this instance the spilled gasoline travelled under the road bed to permeate another service line 60 feet away.

In the past 2 years there have been two occasions within the American System where permeation of potable water system service line materials by petroleum products has been suspected. Both occasions were similar in that the water company became alerted by a customer complaint of odor in the drinking water. The first instance occurred at a private residence in Chattanooga, Tennessee where the customer service line was 3/4 inch PE. The investigation was initially confounded because the problem was temporarily

corrected by flushing the customer's plumbing. The customer's service line was replaced with copper after it became known that gasoline had leaked from the customer's car in the vicinity of the line. Traces of gasoline could be observed in the ditch during the line replacement. A section of the PE line was taken to the water company laboratory where it was filled with plant tap water. After two weeks exposure, the water was found to contain toluene (3100 ug/L), benzene (520 ug/L) and ethylbenzene (440 ug/L), all of which were absent in the plant tap water, but are constituents of gasoline.

A similar instance occurred in Darien, Connecticut where a customer complaint of gasoline odor resulted in sample analysis which showed benzene (>100 ug/L) and toluene (>50 ug/L) in the tap water. As in the other case, the odors were absent after flushing and when the homeowners' plumbing was in daily use. Samples collected after the system had not been in use for 2 days contained approximately 16 ug/L benzene and a gasoline odor. The customers' 1 1/4 inch PE service line was replaced with copper after it was determined that an abandoned underground gasoline storage tank on the customers' property had developed a leak and saturated the ground surrounding the line.

B. Laboratory Investigations

In order to confirm the supposition that plastic pipe can be permeated by certain organics, a number of laboratory studies have been carried out by various groups. As a follow up to one case history described earlier the East Bay Municipal Utilities District carried out tests in 1978 which found that PB and PE were

permeated by gasoline in one week when exposed to gasoline soaked vermiculite (1). In the same study Poly(Vinyl Chloride) (PVC) was not permeable to gasoline during a six week exposure.

As a follow up to drinking water contamination in the Netherlands, the industry research group, Keuringsinstituent Voor Waterleidingartikelen (KIWA), investigated the influence of methyl bromide on plastic pipe (5). Methyl bromide is widely used as a soil disinfectant in horticultural areas. Their study was set up with PE, PVC and metal pipe connections submersed in a 100 ppm solution of methyl bromide. No permeation was found through the metal pipe connections or the PVC pipe after 8 weeks. The methyl bromide did permeate the PE pipe within one week.

Tests have also been conducted by a private laboratory in California as part of an effort to limit the use of plastic pipe in the State (6). These tests showed permeation by various solvents (1,1,-Dichloroethylene, 1,2-Dichloroethane, and Trichloroethylene) in both PE and PB pipe. PVC pipe was also tested but there was joint (solvent weld) failure presumably due to the solvent exposure. No plastic pipe (PE, PB or PVC) was permeated by various herbicides and pesticides (2,4-D, Banvel-D, Dinoseb and Chlordane)after 3 weeks exposure to a 100% solution.

Currently, testing is being carried out at the Battelle research laboratory for The Vinyl Institute (7). The Phase I study concluded that jointed pipe of all type tested (iron, asbestos and PVC) is subject to solvent (toluene, hexane, and 1,1,1-trichloroethane) permeation through joint gasket materials. However, it should be noted that the gaskets used in this study