minutes

SPI

TECHNICAL COMMITTEE MEETING

Sheraton Hopkins Hotel
Cleveland, Ohio

Tuesday, October 18, 1988
9:00 AM to 4:00 PM

Attendees:

F. Borelli	-Georgia Gulf Corporation
C. Bush	-BFGoodrich Company
L. Fishbein	-Borden Chemical
D. Goodman	-Occidental Chemical corporation
R. Gottesman	-Vinyl Institute
R. Hinderer	-BFGoodrich Company
M. Hirschler	-BFGoodrich Company
O. Kauder	-Witco Chemical Company
B. Kazmer	-BFGoodrich Company
J. Krokosky	-Dow Chemical Company
D. Neale	-BFGoodrich Company
L. Pollner	-Witco Chemical Company
A. Reventas	-Shintech

GENERAL

The new Committee chairman, Chuck Bush, was introduced to the Committee and other attendees introduced themselves. The Committee decided to invite a representative from the Vinyl Council of Canada to attend future VI Technical Committee meetings. Gottesman to handle invitation with Ms. S. Coulson of the Vinyl Council of Canada.

The continuing role of the Technical Committee was discussed. The consensus was that the main roles of the committee will be to address the technical aspects of industry issues by providing information and/or funding technical research where necessary and to serve as the technical arm of the various VI task forces.

PROJECT REVIEWS:

Solid Waste Management

1. Recycling

Plastics Recycling Foundation (PRF). The PRF is moving ahead on its program on collection methods, separation of materials, resin reclamation, and market development for recycled products. Its "ET-1" machine is now running, can produce lineal products, and can use PVC as a part of its feed stream. The ET-1 processing technology seems to be in hand with the major issue now being market identification and development for the products of this technology. The Rutgers research program has had a management change and is now more aggressive.

Action: Carroll to continue VI involvement in the PRF program as Chairman of the PRF comingled plastics technical committee and Gottesman to continue with position on Board of PRF. The VI role is to continue support of selected research programs and to support work on comingled plastics recycling.

The Vinyl Institute, A Division of The Society of the Plastics Industry, Inc.
Wayne Interchange Plaza II, 155 Route 46 West, Wayne, New Jersey 07470, (201) 890-9299

Plastics Recycling Applied Research Institute (PRARI). Gretchen Brewer has recently resigned her position with the Commonwealth of Massachusetts and her continued involvement at PRARI is questionable. The ET-1 machine owned by PRARI partner New England CRInc. has produced a product from a recycle stream which looks like "synthetic wood." A number of concerns have arisen about this product - flammability, toxicity, leachability, etc., plus the product has an unpleasant smell. Also, a question was raised about whether the VI or the Council on Solid Waste Solutions of SPI should be funding PRARI.

Actions: Fishbein and Gottesman to determine whether this effort is duplicating efforts elsewhere and to ask Prof. Chen of Univ. of Lowell to coordinate with the PRF as much as possible. Further, the VI needs to reassess the program at PRARI and determine how well it fits with VI interests and to decide whether to continue in FY 89-90 with the $50,000/year financial support we provide (Fishbein, Gottesman/Bush).

Gottesman and Fishbein will attend the November PRARI Board meeting and then determine whether future funding should come from VI or the SPI Council.

The latest status report from Dr. Chen to L. Fishbein and a history of PRARI are attached to the meeting minutes.

Plant Collection Program (Delaware Valley). The collection of bottles did not turn out to be as easy as we expected. The major reason is that PVC bottles do not have the turnover that PET soda bottles have and therefore not as much consumer awareness as the soda bottles. We collected only 500 lbs. of bottles and had to fill our need by buying 3000 lbs of material consisting of shredded used French water bottles. The bottles were put through the Rutgers pilot process to clean them up and the product is now being processed in Florida into pipe and fittings.

Actions: N. Jacobs to monitor the reprocessing to develop a PR package. Krokosky and Borelli to follow up on possible identification and separation techniques via UPC bar codes (IBM proposal) and IR scanning (Italian technique).

Vermont Republic Industries. This is a federal and state-funded non-profit organization which recycles PVC used to package computer chips. The VI has given VRI a $25,000 grant to identify sources of PVC solid waste and to characterize these products for potential recycling applications. About one quarter of the one year study has passed. So far VRI has been unsuccessful in identifying any substantive sources of waste PVC.

Action: Goodman and Gottesman to track the progress of this program and to define the potential future direction of this program.

ASTM Task Group on Voluntary Consensus Standard on Plastics Recycling. The current activities of this group are focused on

definition of the scope of this activity within ASTM. The VI has submitted proposals and G. Koch of Georgia Gulf had been representing the VI in this group prior to his recent retirement. F. Borelli will now follow up on the status of this effort.

2. Incineration/Ash Disposal.

The EPA commented negatively that the NYSERDA incineration study was flawed. Our consultant, Dr. R. McGee has prepared a white paper to refute the EPA assertion and the VI has also responded to the EPA comments. Gottesman pointed that the focus of concerns about incineration is shifting to disposal of ash from incinerators, especially with regard to heavy metal content of ash. Lead and cadmium are the initial targets and their use in plastics is getting attention.

The lead and cadmium PVC stabilizer issue was discussed at some length. Otto Kauder commented that Witco has been involved in cadmium alternatives for over 15 years and that commercial success has been virtually non-existent for replacement of cadmium. The reason is that the alternatives are not cost competitive with cadmium. Barium/zinc stabilizers are widely used in Japan where the use of cadmium is heavily regulated. Replacement of lead stabilizers have the additional problem that in wire and cable compounds the lead stabilizer is critical to achieving the proper balance of electrical and physical properties in the compounds. Replacement of lead stabilizers would be technically very difficult, if not impossible.

Action: Bud Hall of Vista will head up a sub-committee to address these issues and develop a position for the VI. Kauder volunteered someone from Witco-Argus to help as needed.

Pipe Issues

1. California EIR Status - Worker Health Study

The worker health monitoring study is nearing completion. The dimethylformamide content of solvent cements remains an issue and it appears that NSF has not acted in this area as we had expected. Finally, a financial shortfall of $225-250,000 exists for completion of the EIR. This issue will be addressed at the next meeting of the Pipe Task Force and the next Executive Board meeting.

Actions: Gottesman to discuss reinstating the NSF initiative on solvent cements with NSF on October 19. The VI Technical Committee (Hinderer) will continue to track and push the EIR, and the Technical Committee will support future work deemed necessary by the Pipe Task Force.

2. Code Matters.

Al Reventas was named to serve as Technical Committee liaison with the Pipe Task Force. He will meet with Alan Olson in the near future to take over Alan's activities in the pipe code area.

Bud Hall was named to bring back technical issues and needs from the Electrical Materials Task Force for action by Steve Hookanson of Vista, who is serving as the Technical member of this new Task Force.

3. NSF Standard 61 Joint Committee.

Ultimately NSF will be a 3rd party certifier for all types of water carrying pipe. Gottesman was able to obtain a non-voting seat on this committee for a VI representative. Goodman will represent the VI. BFGoodrich will continue with its voting seat which was previously occupied by Alan Olson.

Fire and Combustion Toxicity

1. Marcelo Hirschler reported on a number of current initiatives. Key events and issues are summarized as follows:

a. The Alarie/UPitt combustion toxicity method has died in ASTM.

b. The NIBS combustion toxicity method development is continuing at SwRI. The VI is to contribute $10,000 to NIBS to expedite the development at SwRI. The current timetable calls for presentation of the test method to ASTM by 12/89. We need to push for presentation by 6/89 because of implications in Massachusetts.

c. The Union Carbide PE vs PVC wire & cable and conduit technical paper was discussed. Analysis of the paper shows that the technical content is generally good with a few flaws. The general consensus is that the Union Carbide product is not going anywhere and that the VI should do nothing in response at this time.

d. The ASTM task group on smoke corrosivity is going ahead with a test based on the cone calorimeter. The current plan is to push ahead with this approach and nothing more.

e. The FAST fire model at NBS can now handle HCl decay.

Marcelo agreed to provide 1-paragraph synopses of key areas to Technical Committee members in advance of future committee meetings.

2. Medical/Health Effects.

The SwRI baboon experimental work has been completed, but SwRI has run out of money to complete and publish the work. Management of the Fire Group at SwRI has changed, and the principal investigator, H. Kaplan, has early retired. The VI has been asked for additional funding to complete the project. The Technical Committee recommended that this funding be provided. Gottesman will communicate to SwRI agreement to extend the contract pending approval by the VI Board in December. Hinderer will follow SwRI's progress on this project

3. New York State Toxicity Data Bank.

On December 16, 1988 pipe products will be covered by this regulation. The PPFA is submitting data.

D. Technical Information Papers

1. VCM Generation in Landfills.

Goodman completed a preliminary screening literature study on this subject. The study shows that the primary source of VCM in landfills is the degradation of cleaning and degreasing solvents which find their way into landfills. Residual VCM in PVC produced after the mid-1970's is not a source. Goodman's report is attached to the meeting minutes.

Krokosky agreed to carry out a more thorough study with support from Goodman, Hirschler, and Borelli where needed. The key issues are (a) what happens in landfills and (b) what happens to ground water. The goal of this study will be a Technical Bulletin and a publication in a technical journal.

2. Indoor Pollution from PVC.

Borelli reported that a paper has been prepared in draft form. Borelli and Gottesman will work with Nora Jacobs of the Edward Howard Company to get the paper into a form that is understandable by laymen.

NEW BUSINESS

Proposals for Reclamation of PVC from Wire and Cable Scrap. Two proposals have been received. Bush to follow up for further details.

Paper for the Fourth International Conference on Solid Waste Management. Goodman agreed to write this paper.

Fire Properties of Vinyl Wall Coverings. A vinyl wall covering made by Compo was alleged to have spread the Cathedral Hill fire. Fishbein agreed to follow up on this allegation.

NEXT MEETING

The next meeting of the Technical Committee will be in Houston on Tuesday, December 13, starting at 1PM. Gottesman to provide further details shortly.

C. N. Bush

10/18/88
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University of Lowell
College of Engineering

Department of Plastics Engineering

October 3, 1988

Dr. Leon Fishbein
Borden Chemical Company
511 Lancaster Street
Leominster, MA 01453

Dear Lee:

Enclosed is a copy of the status report. I hope you will find it useful.

Sincerely,

S J Chen

S.J. Chen
Professor
Plastics Engineering

SJC/rd

Enclosure

xc: Mr. Dick Kattar
President
New England Crinc
74 Salem Road
No. Billerica, MA 01862

Evaluation, Optimization, and Implementation of Polymer Recycling Technologies in the Commonwealth of Massachusetts

Mid-year Report

S J Chen
Robert A. Malloy

University of Lowell

and

Stephen Katz

New England Crinc

August 1988

SPI-11094

Introduction

As Massachusetts and many other states facing solid waste disposal crisis adopt recycling strategies to reduce the waste stream, waste plastics are often singled out for scrutiny because they do not biodegrade in landfill and they pose environmental risks when incinerated. They are highly visible as litter and are perceived as non-recyclable. At least a dozen states, including Massachusetts, are considering legistrative measures against certain plastic types or products, in the view that the plastic industry has failed to voluntarily take responsibility for the disposal problem.

In the U. S. , research and development efforts in plastic recycling have focused mainly on the reuse of clean, homogeneous in-plant scraps. Little attention has been paid to the post-consumer household waste plastics.

The main objective of this project is to implement a small industrial plant to recycle post-consumer mixed plastic waste to produce lumber-like products. Optimization of the process will be studied to determine the optimum processing conditions. Properties of the products will be measured and compared to those of wood lumber. Modifications of the process and equipment will be made to improve the efficiency of the process.

From February to July we have accomplished the following:

1. Procurement of all of the equipment
2. Installation , startup , and debugging of the equipment

3. Production of products

4. Literature survey on separation technologies

The Recycling Process and the Equipment

The post-consumer mixed plastic waste is granulated or densified before it is fed into an extruder. The granulated mixed plastic chips are melted in the extruder before the melt is extruded into various molds which are cooled in a water tank. The finished lumber-like products are removed from the molds by compressed air. Figure 1 is the schematic of the process. The granulator is used to granulate the waste plastic products, such as bottles into chips or flakes. The densifier is to densify thin plastic film and to chop it into chips or pellets. The extruder is used to melt the chips and to pump the melt into the molds. The extruder has a short length to diameter ratio of 13 to 1 as compared to 24 to 1 or larger for conventional plastic extruders. The extrudate solidifies in the molds which are cooled in the water tank. The lumber-like products are pushed out of the molds by compressed air. Further cooling of the products is needed and is accomplished on a rack. Each mold is 10 feet in length.

The granulator, densifier, and their auxilliary equipment were to be supplied by Nelmor Company originally as an in-kind contribution to the project. However, Nelmor could not fullfill their commitment. In order to move ahead with the project New England Crinc decided to purchase them in addition to their commitment to purchase the extruder, the molds, and other auxilliary equipment. All of the equipment was procured in February. Installation, start-up, and debugging of the process were successfully completed by March 15. Many samples have been produced for tests and for market testing. As of May 20 over seven thousand pounds of the post-

consumer mixed plastic waste were processed to produce over two hundred boards of various sizes.

Determination of the Optimum Melt Temperature

The melt temperature used in the processing of mixed plastic waste is a very important factor in determining the physical properties of the finished products . It is also important to make sure that the melt temperature is below the degradation temperature of the individual plastic in the waste stream so that a minimum amount of degradation occurs and no undesirable fumes are generated. At the University of Lowell, the granulated mixed waste plastic is molded in an ASTM test mold at various melt temperatures to obtain test samples. Physical properties , such as flexural, tensile, and impact strength are measured. Figure 2 shows a typical curve of tensile strengh as a function of the melt temperature for a particular recipe. In this case, a maximum tensile strength was obtained at a melt temperature of 340 - 380 F. Once the optimum melt temperature range is determined, the extruder screw speed and the flow rate are adjusted to produce all the products for that particular recipe.

Separation Technologies

The post-consumer mixed plastic waste varies in composition depending on the source. To produce products of consistent physical properties it may be necessary to use known quantities of separated raw materials. The pre-sorted plastics will allow us to obtain a specific blend to achieve specific properties. In addition, pre-sorted plastics can be reused after cleaning depending on the market demand for the particular resin. We believe that a cost-effective method for separating individual plastics is an important part of the whole recycle process.

No separation technologies of mixed plastic waste have been reported in the literature. Proprietary techniques have been used by Trasplastek of Canada and Sorema of Italy. Both companies use a similar method of sink/float separation. The method involves chopping or granulating of the mixed plastic waste followed by washing, sink/float separation, and pelletizing the separated plastics. In granulation the plastics are chopped into small pieces which are then passed through an air cyclone to remove the fines, such as paper labels, and dust. In the washing phase, dirt and other contaminants are separated from the process stream. The plastics chips are sorted by a proprietary sink/float separation and drying system before being fed into an extruder for pelletizing to produce the final plastic pellets.

Future Work

During the next six months we plan to do the following:

1. Modification of the process and/or the molds to decrease the cooling time
2. Continuation of the development of recipes
3. Measurement of the physical properties of the products for each recipe

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PRELIMINARY FINDINGS

LITERATURE SEARCH ON VINYL CHLORIDE GENESIS IN LANDFILLS

I. PREDOMINANT SOURCE

The literature screened, to date, has demonstrated that the predominant origin of vinyl chloride is from common cleaning and degreasing solvents that have found their way into the landfills. These solvents are transformed into simpler molecules, including vinyl chloride, by one of the following two mechanisms. Some of the pertinent persuasive literature is referenced on page 3.

(A) BIOTRANSFORMATION

Anaerobic microbial degradation of halogenated hydrocarbons, such as 1,1,1-trichloroethane (TCA), trichloroethylene (TCE), and perchloroethylene (PERC).

(B) CHEMICAL TRANSFORMATION

Involving chemical reactions of halogenated hydrocarbons, such as dehydrohalogenation or dehydrochlorination, dechlorination, hydrolysis, etc.

II. POSSIBLE (PRE 1974) SOURCES

Prior to the OSHA regulation of 1974, vinyl chloride was used as a spray can propellant as well as an anesthetic. Aerosol cans and anesthesia containers may still exist in old landfills. If they do, they would be few in number, so that the potential contribution of VC from aerosol cans would be trivial.

Also prior to 1974, PVC was made with high residual vinyl chloride (approximately 300 parts per million). Diffusion of VC from these products was a possible contribution in old landfills, however, these products should exist in limited amounts and most of the VC has diffused after 14 years, so that the potential contribution for VC migration from old PVC is trivial.

III. NONEXISTENT (ALLEGED) SOURCES

Since 1974, PVC has been made with less than one-hundredth of the residual VC content of PVC made before 1974. With current manufacturing techniques, most PVC resin today contains less than one part per million (< 1 ppm). After the PVC has been fabricated and used over the product lifetime, there is usually no detectable level of VC remaining in the product, so that the landfill contribution is nonexistent.

When PVC is polymerized it is like the albumen in an egg which irreversibly changes into a higher molecular weight form and cannot revert back. Depolymerization of PVC is virtually nonexistent, and classical degradation of PVC (dehyrohalogenation and molecular weight loss) does not occur within typical landfill conditions.

DG 10/4/88

VINYL CHLORIDE GENESIS FROM LANDFILLS (CONT.)

ESTIMATED CONTRIBUTIONS

SOURCE	QUALITATIVE CONTRIBUTION
BIOTRANSFORMATION	MAJOR
CHEMICAL TRANSFORMATION	SOME
AEROSOL CANS (PRE 1974)	TRIVIAL
MIGRATION FROM PVC (PRE 1974)	TRIVIAL
MIGRATION FROM PVC (POST 1974)	NONE
FROM PVC (DEPOLYMERIZATION)	NONE
OTHER (TO BE DEFINED)	SMALL

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VINYL CHLORIDE GENESIS FROM LANDFILLS (CONT.)

SELECTED BIBLIOGRAPHY

1.) Wolf, K., Holland, R., and Rajaratnam, A., Vinyl Chloride Contamination: The Hidden Threat, J. Hazardous Materials, 15, 163-184 (1987).

2.) Suflita, J. M., Gibson, S. A., and Beeman, R. E., Anaerobic Biotransformations of Pollutant Chemicals in Aquifers, J. Industrial Microbiology, 3, 179-194 (1988).

3.) Summary of Available Information Related to the Occurrence of Vinyl Chloride and Ground Water as a Transformation Product of Other Volatile Organic Chemicals, EPA Contract No. 68-01-7166, Work Assignment 5, SAIC Project No. 2-813-07-545-05, October 9, 1985.

4.) Parsons, F., Wood, P. R., and DeMarco, J., Transformations of Tetrachloroethene and Trichloroethene in Microcosms and Groundwater, J. AWWA, Research and Technology, 56-59, February 1984.

5.) Molton, P. M., Hallen, R.T., and Pyne, J. W., Study of Vinyl Chloride Formation at Landfill Sites in California, Battelle Pacific Northwest Labs., prepared for California State Air Resources Board, January 1987.

DG 10/4/88

10/18/88
Lee Fishbein
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HISTORY OF PRARI

In early 1987, a group of concerned citizens from industry, government and academia began meeting informally to discuss ways that these three sectors could work cooperatively to foster plastics recycling as a means to conserve resources, help alleviate the nation's solid waste disposal crisis, and protect the environment and wild life from such hazards as plastic litter and ocean pollution. This "ad hoc" group set as its goal the formation of a specialized organization, later named the Plastics Recycling Applied Research Institute (PRARI), with the following mission:

(1) To support and/or carry out research projects to develop practical approaches for collecting waste plastics, motivating citizen participation in plastics recovery, converting reclaimed plastics into usable new products or raw materials, and demonstrating the potential of plastics recycling to reduce wastes and conserve resources and the environment.

(2) To educate industry and government decision-makers and the public at large on the problems of plastic pollution on land and at sea; the depletion of finite resources (petroleum and natural gas) caused by the proliferation of disposable plastic products; and the need for citizens, industry, government and academia to work in concert to address these problems by developing and participating in plastics recycling.

(3) To create a structure whereby New England state governments, other government units, industry, academia, and concerned individuals could combine funding resources (grants, contributions, in-kind services, etc.) in a unified plastics recycling research effort.

Subsequently, in December, 1987, the Plastics Recycling Applied Research Institute was incorporated under the laws of the Commonwealth of Massachusetts. Three members of the founding "ad hoc" group became officers of the corporation and three other members became directors. PRARI's board includes a polymer chemist from the University of Lowell, the president of a recycling firm, representatives from the governments of Rhode Island and Massachusetts, a representative from the plastics industry, and a CPA from a local accounting firm.

On a volunteer basis this board commenced efforts to raise start-up funds from the plastics industry, its trade associations, other companies, and several New England state governments. Pledges of interest were received from Massachusetts, Rhode Island, and Connecticut environmental agencies. Negotiations to secure funds from these and other sources will be part of future activities.

PRARI Present Activities

PRARI's present activities consist chiefly of organizational steps common to a newly formed corporation (setting up books, applying for not-for-profit tax-exempt status, structuring the board) and on-going fund-raising efforts to gain financial support for planned research and education programs. In July, 1987, PRARI received a first grant of $50,000 as general research support from the Vinyl Institute, the trade association of companies that manufacture polyvinyl chloride plastics. At its regular monthly meetings, the board is presently deciding on research objectives and programs to utilize this funding. Top priority efforts are a small waste plastics collection pilot to obtain raw materials, and research, development and testing of molded plastic products made from mixed waste stream plastics.

Future Activities

Planned future activities will focus mainly on development of a fund-raising strategy, solicitation materials, grant proposals, to the private sector, and continued negotiations with New England State governments. PRARI hopes to obtain funding to pursue an integrated research and public education agenda, including:

1. identifying ways to cost-effectively collect plastics discarded by households, institutions, business and industry;
2. evaluate, develop and/or improve technologies for recycling waste plastics into new products or raw materials;
3. test and optimize the performance characteristics (strength, durability, molding properties, etc.) of recycled plastic items;
4. conduct public education activities to stimulate citizen participation in recycling as a means to conserve resources and the environment;

5. hold training activities such as tours and seminars for the plastic industry, government, college students (future plastics engineers), and the public at large on the importance of recycling as one solution to the solid waste disposal crisis.

It is anticipated that the balance of 1988 and calendar year 1989 will largely be devoted to organizational and fund-raising efforts. At the same time, the Vinyl Institute grant will be employed for one or two small research projects as described above in present activities. Also the board will be expanded and formal affiliations with one or more universities will be cultivated. As funding is secured and research projects are undertaken, PRARI will endeavor to share its findings, via publications, seminars, and a public information clearinghouse, with industries, governments and citizens concerned with resource-conserving solutions to the growing problem of plastics waste disposal. It is expected that 2 to 3 years will be needed to bring all planned programs on line.