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Vice President
Research and Development

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September 1, 1983
MMO/217/83

RECEIVED

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MEDICAL DIV.

TO: Vinyl Institute Technical Committee

FROM: M. M. O'Mara

Enclosed is our third progress report against objectives. This report is a result of a one-day meeting at the Seven Continents Restaurant in Chicago's O'Hare airport.

Our next meeting will be a teleconference on Tuesday, September 20, 1983 at 9:00 a.m. (EDT).

The next quarterly meeting will be at the Seven Continents Restaurant on Tuesday, November 1, 1983 from 9:30 a.m. and ending around 4:00 p.m.

Please be sure to distribute this report to interested parties in your organization.

Sincerely,

MMO/mat
enc.

cc: R.T.Gottesman
B.A.DiLiddo

Committee:
B.Hall
W.Carroll
L.Fishbein
D.Goodman
R.Flammer

VMD 723321

Progress Against Objectives

OBJECTIVE & RESPONSIBILITY*

PROGRESS/ACTIONS

1 - Combustion Paper
(O'Mara)

This objective is completed. A BFG Task Force delivered its product to the Communications Committee which is in the progress of preparing public oriented documents. Future progress on this project will now be the responsibility of Snider and his committee.

2 - Computer Database
(Fishbein)

The Battelle contract has been signed and abstract readers are finally being hired. Due to delays caused by a contract disagreement between Battelle and the VI, there is some slippage on timing. However, thanks to Gottesman's help, we are now on track with the following timetable (all 1983):

Abstracts to Battelle	9/5
Prototype Database Built	9/19
Database Changes Made	10/1
Database Loaded	11/28

*See Mission/Objective document for full description.

Other SPI Fire Programs
(O'Mara)

In early August, the Hazards Analysis Committee and the Research Committee of SPI met and restructured their programs. More emphasis will be placed on mathematical modelling and less on defensive programs aimed at answering the ridiculous technical claims of Wallace, Vickery, etc. Key projects are:

- i) Pitt/NBS Protocol Study
- ii) Fire Modelling Program
- iii) Fire Gas Condensation Study
- iv) CO in Non-fire Victims Analysis
- v) Support Marriott Fire Experiments
- vi) Smoke Hazard vs. Toxic Gas Hazard Study

While these programs have been designed for the entire plastic industry, projects i, iii, and iv are particularly helpful to the PVC industry.

OBJECTIVE & RESPONSIBILITY*

4 - Medical Subcommittee
 (Hall)

PROGRESS/ACTIONS

This new subcommittee of the Technical Committee is headed by Dr. Johnson (BFG) with management oversight responsibility from Bud Hall. The entire subcommittee consists of:

Hall - Management Oversight
 Johnson - Technical Head
 Williams - Toxicologist (DuPont)
 Brodele - Toxicologist (Conoco)
 "X" - Dow

(As of this date, we are continuing our efforts to obtain someone from Dow.) The Medical Subcommittee has outlined 3 action steps to meet our objective of providing new information to rebut the Dryer-Esch article of 1976. These action steps are:

- i) It has been decided not to support the Boyd project on abstracting toxicological articles. It is felt that little can be learned from doing this. Boyd will be informed of our decision.
- ii) S. Williams will undertake an internal rebuttal of the Esch-Dryer article by reviewing pertinent literature references.
- iii) New Research. In order to effectively rebut the wild claims of Esch, Wallace, Birky and Alarie, we must have some new data targeted specifically at their claims. The subcommittee has reviewed these claims and has proposed the following research:
 - a. Deposition of HCl in the throat/lungs of rodents vs. primates.
 - b. Sensitivity of HCl/CO to primates vs. rodents.

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OBJECTIVE & RESPONSIBILITY*

PROGRESS/ACTIONS

- c. Cornmeal effects of HCl vs. other irritants.
- d. RD50 as a tool for predicting incapacitation.
- e. Secondary, systemic effects of HCl on biological systems.
- f. Comprehensive review of CO toxicity.
- g. Epidemiology of CO related deaths.
- h. Epidemiology of firemen mortality - cancer concern.

The Technical Committee reviewed these projects in depth and discussed the relative merit of each. Based on this discussion, the following decisions have been made concerning the above:

*Combine A, B, C and E into one project, obtain bid from SWRI by 9/7/83.

*Do not bother with D because it is now recognized that Alarie's method is not useful (even Alarie doesn't advocate it any longer).

*Visit FAA and discuss piggyback onto their primate project at SWRI - O'Mara/Johnson, mid-September.

*F, G now out for bids and to be funded by other SPI committees.

*H should be approached through OSHA. Gottesman, Freeman (SPI) will recommend how we approach OSHA on obtaining information on Project H.

OBJECTIVE & RESPONSIBILITY*

5 - HCl Transport
(Carroll)

6 - Pipe Permeation
(Goodman)

PROGRESS/ACTIONS

The first technical report of the Technical Committee has been issued - "The Generation, Transport and Decay of HCl as a Combustion Product of PVC - An Investigation of Electrical Overload of Power Wires in a Plenum Space". Briefly (hopefully more brief than the title), this study shows that under extreme electrical overload conditions, PVC insulation decomposes and releases HCl. This HCl condenses in the plenum and on the surface of the false ceiling thereby eliminating any hazard from HCl in the room below (for the wire loading, plenum size and room size chosen which were typical).

The VI has invited the NBS to participate in the planning of future experiments. NBS is doing similar experiments and by joining forces, we hope to be more cost effective and further drive the entire project toward a hazard analysis exercise. Dr. Richard Gann has been named by NBS to advise the VI in these experiments.

The next set of experiments is now being planned by Carroll and his subcommittee.

An overview of this project indicates that we have completed Phase I (pure solvent exposures), and Battelle is in the process of preparing a document. Questions relating to certain technical problems (cross contamination, gasket composition, analytical procedure, and pressure loss during exposure) have been raised and are currently being addressed by Goodman and his subcommittee. At this time, we can say that jointed PVC, jointed ductile iron, and jointed asbestos cement pipe are penetrated rapidly (within days) by pure toluene and 1,1,1 trichlorethane. The attack appears to be through the rubber gasket and is roughly independent of the composition of the pipe. The situation with hexane solvent is penetrated and is under further study. Phase II (solvent in water) of this project is just beginning.

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OBJECTIVE & RESPONSIBILITY*

PROGRESS/ACTIONS

So far, the project supports our claim that when heavy concentrations of organic pollutants (toluene and 1,1,1, TCE, so far) come in contact with piping system, it serves no purpose to argue about the relative merits of plastic vs. other piping systems. All systems are compounded rapidly by these solvents.

Action Item - Mr. Goodman and his sub-committee will evaluate the Battelle work and address the technical issues already mentioned with the Battelle staff.

7 - Other Critical Issues
 (O'Mara)

O'Mara, some members of the Technical and Communications Committees, Dr. Paula Dunnigan and Dr. Gottesman, participated in a brainstorming session to identify other issues that could potentially impact the PVC industry. The output of this session was 11 potential issues. O'Mara will summarize these issues for Gottesman who in turn, will obtain comments from other interested individuals in the vinyl industry. He will then advise the Technical/Communication Committee's on the relative importance of these issues.

Action Item - Document to Gottesman by
 9/7/83/

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 9/2/83

VMD 723326

Evaluation of the Pulmonary Toxicity of Plasticized Polyvinyl Chloride Thermal Decomposition Products in Guinea Pigs by Repeated CO₂ Challenges

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Evaluation of the Pulmonary Toxicity of Plasticized Polyvinyl Chloride Thermal Decomposition Products in Guinea Pigs by Repeated CO₂ Challenges. WONG, K. L., STOCK, M. F., AND ALARIE, Y. C. (1983). *Toxicol. Appl. Pharmacol.* 70, 236-248. Male guinea pigs were exposed to thermal decomposition products of plasticized polyvinyl chloride (PVC-A) at different concentrations up to levels inducing acute lethality. Several groups exposed at sublethal levels were then evaluated for pulmonary performance for a period of 57 days following exposure. Pulmonary performance was evaluated by challenging each animal with a mixture containing 10% CO₂, 20% O₂, and 70% N₂. In control animals, this mixture induced an increase in both tidal volume and respiratory frequency. This hyperventilatory response was greatly depressed during the first 3 days following exposure and gradually returned to normal during the following weeks with the exception of the highest exposure group which still showed a diminished response 57 days after exposure. The pulmonary toxicity induced by thermal decomposition products of PVC-A is probably related to the very large amount of HCl released during thermal decomposition. The CO₂ response test, a noninvasive and noninvasive method to evaluate pulmonary performance in guinea pigs, is easily performed and appears to be a very promising type of pulmonary function test for toxicological evaluations.

In the last three decades there has been widespread use of plastics for building construction as well as for furnishings. The hazards of thermal decomposition products of plastics in fire were recognized since the fifties and sixties (Coleman and Thomas, 1954; Zapp, 1957, 1962; MacFarland and Leong, 1962) and also extensively discussed recently (Bowes, 1974; Einhorn, 1975; Dyer and Esch, 1976; Alarie and Anderson, 1981). The toxicological studies performed so far have been mainly oriented toward the acute lethal effects of the smoke from synthetic polymers. An extensive report has been prepared giving a summary of the methods used by different investigators in many countries (Kaplan *et al.*, 1983).

Among the plastics, polyvinyl chloride (PVC) is the most commonly used for a wide variety of applications (Cullis and Hirschler, 1981). Toxicological evaluations of PVC thermal decomposition products were undertaken many years ago (Zapp, 1957, 1962; Cornish and Abar, 1969). Recent evidence points to the importance of HCl, which is generated in major quantities, from thermal degradation of PVC (Tsuchiya and Sumi, 1967; Boettner *et al.*, 1969; Paciorek *et al.*, 1974; Smith, 1974). HCl released from thermal decomposition of PVC was shown to be primarily responsible for producing extensive damage to the upper respiratory tract (Lucia *et al.*, 1977), severe sensory irritation (Barrow *et al.*, 1976), pulmonary infarcts and edema, and massive pulmonary hemorrhage (Boudene *et*

al., 1977). More recent studies have shown that mechanical effects were exposed to thermal decomposition products of PVC (Jaeger *et al.*, 1977). Acute adverse effects of thermal decomposition products were reported in guinea pigs after an exposure to products of PVC. The pulmonary performance and ventilatory response were adapted for guinea pigs (1982). The rationale for the response test is that in order to produce hyperventilation in guinea pigs but not in pigs or obstructive lung disease, a relatively large increase in tidal volume is required (1954; Eldridge and 1965).

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Animals

English, smooth-haired guinea pigs weighing between 375 g from Hilltop Lab were used. Except during the Guinea Pig Chow and tar

Chemicals

The polyvinyl chloride was furnished by the National Bureau of Standards, by weight, was 32.0% phthalate plasticizer, lead stabilizer, and 0.5% test. animals were challenged with CO₂, 20% O₂, and 70% N₂ Division, Searle Medical

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