Air Products and Chemicals INC.

ESCAMBIA PLANT

INTEROFFICE MEMORANDUM

To: A. R. Donaghy

Date: June 2, 1971

From: J. H. Williamson

Copies: A. R. Adams
P. R. Browne
J. M. Davidson
V. J. Grande
D. J. Mann
R. R. Spiegelhalter
R. W. Whitaker

Re: Monthly Sales Samples
Summary for May, 1971
Less than 50# Samples

PVC N/C SHIPMENTS

Customer	Date	Type	Lot	Lbs.	Shipped Per
B. F. Goodrich Chemical Co.	5-4-71	6180	7338	Skid 1-21	P. R. Browne
" " "	"	"	7340	Skid 1-19	" "
Wikit Incorporation	5-5-71	9010	6616	5	J. L. Harvey
" "	"	6180	7303	5	" "
B. F. Goodrich Chemical Co.	5-5-71	6180	7415	Skid 1-15	P. R. Browne
" " "	"	"	7421	Skid 1-21	" "
Vitek Research Corp.	5-10-71	2160	6070	5	P. R. Browne
" " "	"	2185	5990	5	" "
" " "	"	3185	4821	5	" "
Sobin Chemicals	5-11-71	1200	5953	5	V. J. Grande
" "	"	1225	5881	5	" "
Ashland Oil & Refining	5-18-71	2200	7269	5	W. C. Kueance
B. F. Goodrich Chemical Co.	5-19-71	6180	7521	Skids 1-18	P. R. Browne
" " "	"	"	7494	1-8	" "
" " "	"	"	7495	1-10	" "
" " "	"	"	7492	1-11	" "
" " "	"	"	7518	1-21	" "
" " "	"	"	7515	1-18	" "
" " "	"	"	7517	1-18	" "
" " "	5-21-71	6180	7520	1-20	" "

Customer	Date	Type	Lot	Lbs.	Shipped Per
John Barr, APCI	5-20-71	6180	7314	2	P. R. Browne
" " "	"	"	7322	2	" "
" " "	"	"	7324	2	" "
" " "	"	"	7326	2	" "
" " "	"	"	7330	2	" "
" " "	"	"	7332	2	" "
" " "	"	"	7288	2	" "
" " "	"	"	7290	2	" "
" " "	"	8225	7287	2	" "
Jerry Lavender, APCI	5-24-71	1225	B/T 310	5	P. R. Browne
Scott Graphics	5-24-71	6145	6700	5	Bob Campenella
B. F. Goodrich	5-26-71	6180	6496	Skid 1-8	P. R. Browne
" "	"	"	6499	Skid 1-20	" "
Jerry Lavender, APCI	5-27-71	1225	B/T 1328	5	P. R. Browne

J. H. Williamson

JHW:es

T. S. Ai Products and Chemicals

PUT IT IN WRITING

DATE: June 2, 1971

TO: A. Ross Adams

FROM: G. J. Mantell

SUBJECT: Highlights of Plastics Division R&D May 1971

APPLICATION RESEARCH AND DEVELOPMENT

I. Bottle Compounds

Room temperature organoleptic tests at Seagrams continue to look promising. Their more meaningful high temperature accelerated tests on a number of promising compounds are underway. These tests may continue for as long as three months for a final decision. Work at Brown-Forman is somewhat less promising. None of the compounds which look promising at Seagrams passed Brown-Forman's initial testing. I believe that their test procedures are suspect and that we are no worse than a B. F. Goodrich compound they now use. We will continue to work with Brown-Forman on their testing procedures. We have not given up here.

II. Film and Sheeting

A new compound (C-500) was developed to overcome the printing ink blocking problem which Orchard Corporation found with our experimental compound C-482. A Calvert City run and a trial at Orchard Corporation are scheduled for early June. Products B-175 and C-351 were run at Calvert City with help and assistance from Middlesex personnel. Both products were successfully made and ran well at Apache. There is a need for equipment modification at Apache if C-351 is to be operated successfully. We are working closely with the customer in this regard. Another lot of C-480, for extrusion of crease-whitening resistant clear sheet, was successfully made at the Calvert City plant. A trial at Hallmark will be run in June.

III. Injection Molding

Four research candidate compounds for the Bell Telephone handset were delivered to Bell and evaluated for stability and processability in their Brabender. Initial reports were quite promising. They have injection molded samples for more complete physical property study and data should be available from them during the first week of June.

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The compound development work for Oster has not succeeded in developing a green that can be successfully molded in the Oster blender base mold. We are unable to eliminate a fine black streak with their equipment and as well, at equipment in our own plant at Morristown. B-617 a modification of 2003-A in the same color also shows the streaking problem. We are somewhat at a loss on how to solve this problem. It is of interest that the same compounds in white do not show the black streak, but a line does appear as a "scratch" in the same part of the molded item.

A program was initiated in cooperation with General Electric and Rohm & Haas to develop a PVC compound suitable for injection molding a room air-conditioner housing now employing the more expensive Lexan polycarbonate. A number of experimental compounds were sent to GE for evaluation of flow properties only. GE's input on this is critical to further development work on this project.

IV. Floor Tile

We had an excellent visit with the Research and Development Group at GAF in Vails Gate, New York. They outlined specific problems faced in the present manufacturing floor tile operations and we have begun screening work to identify resins that may be helpful in solving some of their problems.

V. Rigid Wire Compounds

We have reformulated our rigid wire compound to improve the ultimate elongation of wire coatings. Initial work looks promising and samples have been sent to Western Electric for their evaluation. These evaluations will be completed in the early part of June.

VI. Pipe Fittings

We have two pipe fitting compounds based on resins 1200 and 2200 which appear competitive in preliminary screening with a commercial compound from Ethyl Corporation. One-hundred pounds of each of the two compounds will be prepared at Middlesex in early June and trials will be run at the Grinnel company. We plan also to prepare a compound based on the 400 Resins to be run at the same time to determine the commercial value, if any, for 400 compounds in this application.

VII. Saran Resins and Film

Cryovac's interest in our saran resin was not strong enough to break through their arrangement with Dow. Heat stability and barrier properties were rated good with shrinkage rated fair in our visit of May 3. Low temperature flexibility emerged as the next important property. Trade-off of barrier properties for low temperature flexibility is a necessary though unwelcome compromise, according to Cryovac. Saran resin demand peaking in 1971 is predicted by Cryovac and carried some weight in their lack of interest in a working arrangement with APCI.

Crude torsional stiffness data show that Dow 864 and Cryovac bag film are better in low temperature flexibility than SV-1706-E resin compounded (2 phr) with either dibutyl sebacate or acetyl tributyl citrate. Higher levels of either of these would be needed to attain competitive low temperature flexibility, with commensurate loss of barrier properties. Additional direct-blow film processing of saran compounds on the Killion line has had a few successful periods but is plagued with the difficult control of the post-extrusion stage process parameters.

VIII. Fusion Resins

A laboratory fluidized bed unit is operational at Linwood. Self-supported (stripped) coatings have been prepared for a Tech Service job. Improved methods are being studied and materials accumulated to evaluate a number of Escambia and competitive resins under both adhered and stripped conditions.

IX. Delco Remy

Two samples have been submitted for evaluation at Delco Remy. One is a Pearl resin prepared in the Calvert City pilot plant by a preemulsification process. The second sample was a 3185 resin ground in the Trost Mill. Both products performed well in laboratory screening tests in terms of fusion, strength properties of the fused sheet and porosity. Neither product meets the molecular weight specification set by Delco Remy based on their use of Ethyl resins. The importance of this for final acceptance of our product remains to be established.

POLYMER SYNTHESIS

X. Pearl Resins

The crusting phenomenon in 4185-SP was studied at greater length in the Swiss reactor.

Lower polymerization temperatures, use of $CaCl_2$ in place of calcium phosphate, presence of non-ionic surfactants, lower H_2O to monomer ratio, use of dispersants, and removal of latex anionic surfactant did not eliminate crusting.

Crusting was minimized by use of a second agitator placed at the midpoint of the agitator shaft. A twin pitched blade turbine was the most effective arrangement.

With the twin pitched blade agitator, crusting was completely eliminated at high agitation speed. Degree of crusting is inversely proportional to agitation rate. At the highest speed studied (600 rpm) a very uniform resin of 115 μ median particle size and 33 lbs./cu.ft. bulk density was obtained.

Reduction of batch size was also observed to eliminate crusting.

PVC Pearl 2185 was found to have approximately 10 times the ash content of Dow 2103, 2053 and Vygen 310. The chief component of the ash from 2185 is calcium oxide (47%) and from either Dow or Vygen products Na_2O or Fe_2O_3. PVC Pearl 2185 contains much less water extractable material than the Dow or Vygen resins.

XI. Polymerization Initiator Studies -- In-Situ and Other Catalysts

Various in-situ initiators have been used to polymerize a 90/10 charged VCl/P copolymer. The chloroformate components used were ethyl, n-butyl and i-butyl. As a standard IPP has been used for comparison. The IPP and n-butyl chloroformate initiator systems react unfavorably with cumene yielding both reduced molecular weight and reduce polymerization yields as the cumene content is increased. The presence of the cumene serves as an agent to prevent "early yellowing".

The ethyl chloroformate and i-butyl chloroformate initiators also show a trend toward lower molecular weight but no effect on rate of polymerization as the cumene content is increased.

There is a considerable level of cumene still in the polymer. Its importance to FDA acceptance remains to be established.

The effects of various parameters on vinyl chloride homopolymerization such as --

1) alkyl chloroformate
   alkyl sulfonyl chloride

2) hydrogen peroxide
   peracetic acid

3) pH of aqueous phase

have been investigated. The following systems polymerize VCl.

Alkyl sulfonyl chlorides/peracetic acid	@ pH = 11.3
Alkyl chloroformate/hydrogen peroxide	@ pH = 6.65
Alkyl sulfonyl chlorides/peracetic acid	@ pH = 6.65
Alkyl chloroformate/peracetic acid	@ pH = 4.45

Several systems described above are not within the scope of the Goodyear patent.

Air Products and Chemicals, Inc.

XII. Post-Chlor Resins

Post-chlorination of PVC 3185 and several porous vinyl chloride/propylene copolymers were completed using a fluid bed method. Chlorinations were also carried out in chloroform solution. All products "look good" and remain to be compared in depth.

Chlorinations in carbon tetrachloride solution to produce post-chlorinated polymers in the 67-68% Cl level of 404 and 241 have been made. Our first attempts at post-chlorination in carbon tetrachloride at 60°C for four hours produced polymers containing 72% chlorine. Runs of very short duration have been made since. A one-hour run at 60°C in carbon tetrachloride yields a product containing 65% Cl. Homopolymer 241 post-chlorinated under the same conditions produced a product with a chlorine content of 67.8%.

XIII. Polymer Characterization

The Robinowitch correction of melt viscosity data is demonstrated. The melt viscosities of thirteen samples from different projects (Post-Chlorination of PVC, Copolymer Program and Saran) were measured at two or three temperatures. Theoretical studies of branching in heterogeneous PVC polymerization have been completed. The degree of branching is negligibly small. This work will be separately reported. Besides the thirteen samples for melt viscosity measurements, service work included two samples for GPC and five samples for density determination.

GJM:cmc

cc: C. E. Blades
J. L. Cost/R.A.Walde
G. B. DeLaMater
L. C. Doelp
L. Dranikoff
D. G. Holland
N. C. Robertson/D. G. Manly
R. J. Tedeschi

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Air Products and Chemicals, Inc.

PUT IT IN WRITING

Date June 15, 1971

To A. R. Adams Subject Monthly Report, May 1971

From W. R. Brynes

( ) Take Action ( ) For Your Approval ( ) For Your Info ( ) Discuss With Me

( ) For Your Comments ( ) As Requested ( ) File ( ) Note & Return

I. Pricing Sensitivity Analysis-400 Resins

With the aid of W. R. Whitaker a marketing analysis for 400 resins at lower pricing levels was prepared, and in a slightly revised form fed into a linear programming computer run in Trexlertown. The results of this analysis have been submitted in a separate report.

In summary it appeared as though a 1¢ per lb. decline in low level pricing for 400 resins would allow penetration of existing PVC markets for more standard PVC resins at a level roughly equivalent to our present capacity for 400 resins at Calvert City (approximately 33% of the total Calvert City production capacity.) It was further concluded, that additional reduction in price to a low level of 15¢ per lb. would allow rather rapid increases in sales up to approximately the 50% level. Beyond this point, there is little incentive for further price reduction, because of the relatively low level of profitability resulting.

This study is preliminary in a revised form of the market forecast and has already been prepared for submission into the program again.

II. Post-Chlorinated 400 Resin Program

New market projections for Post-Chlorinated 400 Resins were developed and incorporated with the aid of Dr. C. A. Heiberger, in the research evaluation summary submitted by Dr. Heiberger for approval.

III. Meetings Attended

A. The AMA Packaging Show in Chicago
B. The Chemical Market Research Association Meeting in New York City

The writer prepared a separate report covering the CMRA meeting submitted independent of this report. Of particular note was Mr. John Auchter's projections for PVC through 1980 which included an over-all growth rate of 11 to 12% per year. Also a strong need for pricing increase to support further capital investment in our research and development expense in the future.

IV. Tariff Commission Summary

The accompanying figures show summarys for pertinent sales and production data relating to PVC through March 1971. Results for both Feb. and March for the PVC industry were far more encouraging than those

recorded in January of this year. For March in particular the total sales results (domestic and foreigh) were the best in the history of PVC reflecting an annualized rate of sales of 3.4 billion lbs. per year. Later contributors to this improvement were calendered and extruded products as well as piping fittings plus wire cable. March results do not meet the extremely poor results of January and February however.

The results of the first 3 months of 1971 are annualized to 3.08 billion lbs. this level is slightly excessive the somewhat disappointing results for 1970, and certainly well below the projected sales for 1971. Continued improvement in the PVC market picture as anticipated.

W. R. Brynes

Western Plastics and Chemicals

PUT IT IN WRITING

Date June 23, 1971

To A. R. Adams Subject MONTHLY REPORT - MAY 1971

From J. M. Davidson

( ) Take Action ( ) For Your Approval ( ) For Your Info ( ) Discuss With Me

( ) For Your Comments ( ) As Requested ( ) File ( ) Note & Return

Sales for the month of May and year-to-date are as follows:

	Year to date March-May	May
Compound		
Injection Molding	802,350	200,000
Film	533,480	75,480
Bottles	53,400	40,200
Total	1,389,230	315,680
400 Resin	803,150	149,000

Electrical & Appliance

BTL Handset

Molded samples of four experimental compounds were submitted for preliminary investigation. These materials appear to be equivalent or superior to the present Ethyl 7042, although Ethyl has submitted several improvements of this material for testing also. Presently 7042 has tentative acceptance; however, they are low in izod, questionable in HDT, and reportedly went from white to blue over night at 70° C. We have not experienced a color change in this test and feel that we can now offer a superior material. A meeting with BTL is scheduled for June with a resultant molding trial expected. A June 9th meeting of BTL and Western is to be held to set a timetable for future PVC product acceptance.

BTL Battery

C&D has been the successful bidder for this years requirements. A trial was held but due to machine problems, parts were not molded. Another trial will be scheduled shortly with production expected at C&D thereafter.

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Date June 23, 1971

To A. R. Adams Subject MONTHLY REPORT - MAY 1971

From J. M. Davidson - Page 2 -

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Electrical & Appliance - cont.

Black & Decker

A meeting has been set for June to review our PVC as a competitive material to the KA they presently use (priced 32.5¢/#). It is expected that a trial will also be scheduled for June or July.

Singer

They have received quotes from Drako on a tool part in PVC at a 12% cost reduction in our material. A trial is scheduled for June which could lead to acceptance at Singer for PVC in their tool line.

Teletype

The Teletype cover was run at Mac-Ray in 2003A and D591. A splay problem was noted, which can be eliminated by proper gating. Presently these parts are in testing at Teletype. The competitive material is KA @ 53¢ which also has a tendency to sink more than our material. At present our main problems will be in tool design due to shrinkage which would require Teletype to adjust the holes in the molded part for our materials.

G.E. - Photo Lamp

Adjustments were made to the runners which resulted in our ability to run 482. We still require a high FR as well as a color match for G.E. for the flash cube.

G.E. - Air Conditioner Cover

Prints were received of the tool and are presently being reviewed. A meeting will be held in June to review mold designs as well as flow properties of compounds which have been submitted.

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Date June 23, 1971

To A. R. Adams Subject MONTHLY REPORT - MAY 1971

From J. H. Davidson - Page 3 -

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Foster Grant

Presently re-tooling for next year's eye-glass frame. We expect production to start in PVC during August or September.

American Optical

Has purchased 1,000 pounds of our material for trials.

Bausch & Lombe

They have run both 5011 and 2003A with success and are considering these materials for other applications along with eye-glass frames.

Packaging

Wheaton

A trial material of 7014 as well as an initial truck load order has been obtained. It appears that this account is now starting to obtain PVC bottle business. As previously pointed out we are the only PVC supplier and are forwarding all leads in order to build our business through Wheaton.

Creative Packaging

They have withdrawn from the PVC bottle market. Their volume is estimated at 200MM bottles which will be absorbed by the remaining producers such as Kerr, Wheaton, O-I, etc.

J&J

Baby oil bottle and CP account will be placed with Kerr or O-I. The estimated volume when released could be 1MM# of C-141 if our color problems are resolved. There is also interest at J&J in E-465 for Future Wax bottles.