MONSANTO CHEMICAL COMPANY — Inter-Office Correspondence

From LOCATION : Texas City

DATE : February 12, 1963

SUBJECT : VCM PROGRAM

REFERENCE :

TO : FILE

cc : W.E. Alexander
H.H. Bible
J.M. Chamberlin
R.T. Clark
C.P. Fullerton
O.C. Jones
R.W. Kienker
R.H. Kittner
R.E. Lenz
W.R. Nisbet
~~R.B. Stobaugh~~
R.C. Tallman
B.L. Williams

On Thursday, February 7, Messrs Reese, Chamberlin, Nisbet, Williams, O.C. Jones, Alexander and Kienker met to review the vinyl chloride monomer program from the standpoint of divisional and functional objectives in the areas of capacity, quality, and cost. Presented below are the conclusions arising from this discussion:

1. A minimum level of 150 $\overline{M}$ lbs./yr. of VCM must be obtained to achieve acceptable manufacturing costs.

2. Captive outlets are available for a maximum of 120 $\overline{M}$ lbs./yr.

3. Additional outlets for an additional 30 $\overline{M}$ lbs./yr. of VCM are to be obtained by Marketing - preferably in one or two places and via commercial arrangements which will insure continuity of demand.

4. Present plant facilities will have the nominal capacity of 170 $\overline{M}$ lbs./yr. when present programs on oxidative chlorination and plant modifications are brought to a successful conclusion.

5. No further work should be done on expanded VCM capacity or alternate VCM processes except as this work relates to reduced manufacturing costs and is applicable within the framework of our existing capital commitments.

6. By the end of 1963 the present programs on acetylene purification will lead to further improvement in VCM quality - which is generally competitive at present. However, research will review and recommend programs on methyl and ethyl chloride removal.

7. Our quality "level" tends to vary because of our "system" of three processes (acetylene, ethylene, and oxidative). Future effort will be directed toward tightening of quality variations within each of the processes as the only way to reduce variations within the "blend".

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8. Approval is given to Marketing to use our dilatometer test for poly rate as a sales tool at selected customers. C. P. Fullerton should review this with Plastics Division (C. L. Knowles) before releasing the information.

9. Raw materials at 4.0¢/lb. out of 6.6¢/lb. in 1962 is the major manufacturing cost factor for VCM. Our lack of a "chlorine economy" hurts us vis-a-vis Dow and Ethyl.

10. Research will undertake work aimed at a process based on by-product HCl, a "cheap" available carbon source, and flexibility for operation in "package plants" at locations where the company has excess HCl.

DETAILS

A. Industry Position

The projected industry position in 1963 for VCM is as follows:

Captive and committed production	1,050,000,000 lbs.	- 58%
Merchant sales	350,000,000 lbs.	- 20%
Idle plant	400,000,000 lbs.	- 22%
Total Industry Capacity	1,800,000,000 lbs.	100%

The above figures include the Tenneco Plant and highlight the low percentage of non-captive business and the high percentage of idle capacity in relation to "free" merchant business.

The VCM industry is, and will continue to be, one characterized by a dominant "captive" market. The captive markets may be actual organizational integrations (e.g., Carbide, Monsanto, Goodrich, etc.) or long-term financial and commercial arrangements (e.g., Tenneco - Cary, Ethyl - Firestone, Dow - Firestone, etc.). The percentage of the market tied up via integrations and "arrangements" is expected to increase.

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B. Monsanto Position

The anticipated 1963 position of Monsanto is as follows:

	Budget	Minimum	Possible
Plastics Division	120 $\overline{M}$ lb.	115 $\overline{M}$ lb.	120 $\overline{M}$ lb.
Monsanto-Mexicana	5 $\overline{M}$ lb.	5 $\overline{M}$ lb.	5 $\overline{M}$ lb.

	Budget	Minimum	Possible
Domestic Sales			
Escambia Great American	8 M lb.	0	0
Atlantic Refing			8 M lb.
Total	133 M lb.	120 M lb.	133 M lb.

Long-range it appears that the maximum demand of Plastics Division is 110-120 M lbs./yr. of VCM. Present Plastics Division planning makes no provision for added investment in PVC polymerization capacity - rather the emphasis is on upgrading profitability through product modification at existing polymer capacity. In actuality, the Plastics Division has not taken over 100 M lbs./yr. of VCM in any year, although present process improvement programs should increase their "take" - off-set by the extent that product modification is achieved by adding co-monomers to the polymerization formula and replacing VCM.

Long-range, also, it is assumed that the Monsanto-Mexicana business will be lost because of trade barriers. Also, the MOCAN business does not seem available because of tariff barriers.

In view of the above, the total captive or committed business which we have available is 120 M lbs./yr. maximum.

Although the published price of VCM is 8.0¢/lb. it is probable that a large segment of the material in inter-company commerce is moving directly, or indirectly, under this price. Prices as low as 7.0¢/lb. are rumored with one unsubstantiated report of 6.8¢/lb.

In contrast to these sales prices, our Cost of Goods at 136 M lbs/yr. rate was 6.6¢/lb. in 1962. It is true that out-of-balance operation contributed to the cost, but basically our manufacturing cost position is not in good shape for a depressed market price.

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An examination of our cost-volume relationships indicate the following factors:

Operating Level	Approx. Mfg. Cost Differential vs. 170 M lbs./yr.
110 M lbs./yr.	0.6¢/lb.
130 M lbs./yr.	0.3¢/lb.
150 M lbs./yr.	0.1¢/lb.
170 M lbs./yr.	---

Beyond 170 M lbs./yr., the manufacturing cost decreases become minimal as a function of volume.

From the above it was concluded that we should strive for an operating level of 150 M lbs./yr. in order to reduce our volume related cost to a practical minimum.

Since our internal needs are 120 M lbs./yr., Marketing is to pursue an additional 30 M lbs./yr. of committed business. This business will have to be "bought" and should be pursued in one or two outlets for minimum disturbance to the total market picture.

C. Plant Capacity

The VCM plant currently is rated at 150 M lbs./yr. However, the various segments of the plant have been run independently at rates which would indicate that 170 M lbs./yr. could be obtained - although not necessarily at minimum cost. In view of this potential capability and the problems facing us on product disposal, technical effort should cease on increasing capacity beyond 170 M lbs./yr. Technical effort may proceed on eliminating proven bottlenecks which stand in the way of reaching 170 M lbs./yr; however, this work should take second priority to cost or quality related projects.

D. Product Quality

Our average product quality is competitive and by late '63 we hope to be as good, or better than the best on all factors which have been cited as undesirable components. See the attached charts.

At the present our C_3 - C_4 content is undesirably high because of natural gas purging of our acetylene purification beds. However, later this year we plan to switch to a nitrogen purge. We have had little or no effort on ethyl and methyl chloride removal since these

were not believed of significance. However, there is increasing interest in having these contaminants reduced. Research will review the problem and initiate appropriate action.

We do suffer in comparison with competition because of variation in quality which our monomer exhibits. This variation arises from our system of blending two processes, and it is anticipated that the variability will increase as we bring oxidative chlorination on stream as a third process. With the achieving of our gross product quality goals in 1963, Research will re-orient their process control efforts toward the individual process routes in order to raise purity levels in each process and thus "squeeze" the purity level of the system higher with less variability.

C. P. Fullerton had requested permission to release information on our dilatometer test for poly-rate to selected customers to use as a sales "tool". It was agreed that this should be done after checking with Plastics Division to insure that their interests are not jeopardized. C. P. Fullerton will handle with Plastics (presumably C. L. Knowles).

E. Manufacturing Cost

In addition to volume effects (see Section B), the major cost factors in VCM manufacture include:

Raw materials	4.0¢/lb.
Maintenance	0.75¢/lb. (0.50¢/lb. - 1963 goal)
Utilities	0.25¢/lb.
Ethyl variances, Exc. cost	0.70¢/lb.

The manufacturing goals in 1963 call for a Cost of Goods of 6.675¢/lb. @ 133 M lb. (including a 0.2¢/lb. increase associated with re-allocation of the Heyden fee). Attainment of this goal will call for successful exploitation of a wide variety of process and equipment developments including successful operation of oxidative chlorination and acetylene purification. Success in these process and equipment areas will essentially exhaust the known areas of process improvement for the existing process.

Other activities which will continue are the graded catalyst study by Engineering and Technical Service and a preparation of an economic model by Manufacturing to optimize the process "system".

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The most challenging area on cost reduction continues to be the area of raw materials. Our failure to have a basic position in chlorine leaves us at a basic disadvantage with many producers. Despite repeated studies we have not been able to find a sound approach to a basic position in chlorine. However, since the company and its associates (e.g., Mobay) have an excess HCl position, tie-in to this HCl position should represent an improvement in the overall company cost structure. The oxidative chlorination technique offers potential in this area although it is limited in its present form because of its dependence on ethylene. The following target was developed for Research for alternative process work:

Produce VCM or an intermediate utilizing:

1. By-product HCl.
2. Cheap "carbon" - i.e., ethane or methane.
3. A process subject to a package plant which could be located at locations having excess HCl.

R. B. Stobaugh has been asked to survey availability of excess HCl at various company locations.

Alternate process work which is not aimed at the above objective or at a major cost reduction in the present plant should not be pursued.

The status of the VCM tars being disposed of at no cost through Hard-Lowe was reviewed. It was agreed that this disposal route still is attractive for Monsanto since it relieves us of a disposal cost and the recovery of components is a break-even operation even for Hard-Lowe.

F. E. Reese

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TABLE I

SPECIFICATION TEST ANALYSES OF COMPETITORS
VCM BY MONSANTO TEXAS CITY LABORATORY

November 1962

Component	Allied	Ethyl	Goodyear	Dow	Monsanto
Appearance	Sl.-Cloudy	C & C	C & C	Clear Sl. Brown	C & C
Aldehydes, ppm	< 1	< 1	< 1	3.0/3.2	< 1
Acetylene, ppm	< 1	< 1	< 1	< 1	< 1
Acidity, ppm	< 1	< 1	< 1	< 1	< 0.1
SO_2, ppm	< 5	< 5	< 5	< 5	< 5
Iron, ppm	0.1	0.1	0.1	1/>1	0.1
Non-Vol. %	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Inhibitor, ppm	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Polyrate, %	6.0/6.0	6.2/6.3	6.4/6.5	5.4/5.8	6.2
Water	Trace-Free	No Free	No Free	No Free	No Free

No Samples from Goodrich or Carbide

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TABLE II

GLPC ANALYSES OF COMPETITOR SAMPLES OF VCM

Monsanto T. C. Lab Unless Otherwise Noted - ppm (Mol)

November 1962

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	Monsanto (Typical)	Allied	Dow	Ethyl	Goodyear	Goodrich (Spfld. Lab)	Goodrich (Goodrich Lab)	Carbide (Carbid Lab)
C_2's	Tr.	2.6	< 0.1	< 0.1	< 0.1	1	Tr.	-
Propane	17	< 0.1	< 0.1	< 0.1	< 0.1	0.5	-	-
Propylene	< 0.1	2.8	< 0.1	< 0.1	< 0.1	0.6	0.8	-
Acetylene	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1			-
N Butane	22	Tr.	< 0.1	< 0.1	4	0.2	-	-
i Butane	14	< 0.1	< 0.1	< 0.1	< 0.1	-	Tr.	-
Butenes	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	1.6	0.6	-
Allene	1.31	< 0.1	< 0.1	< 0.1	< 0.1	-	-	-
M-Acetylene	Tr.	< 0.1	< 0.1	< 0.1	2.6	-	-	-
MVA	0.42	0.75	0.7	Tr.	1.4	-	10	-
Butadiene	1.0	0.3	6	< 0.1	2.0	1.5	4	-
Methyl Chloride	22	12.4	117	5.8	7.5	70	-	20
Ethyl Chloride	0.64	< 0.1	< 0.1	< 0.1	0.9	-	-	-
2 Chloropropene	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.5-27	-	-
1-1 Dichloroethylene	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	-	2.3	-
1-2 Dichloroethylene	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	-	12	-
1-1 Dichloroethane	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	-	50	-
1-2 Dichloroethane	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	-	200	-

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TABLE III

PUBLISHED SPECIFICATIONS - VCM

	Allied	Ethyl	Carbide	Dow	Monsanto	Typical Performance Monsanto
Appearance	-	C & C	Clear	-	C & C	C & C
Aldehydes, ppm, Max.	5	5	4	5	5	< 1
Acetylene, ppm, Max.	2	2	2	10	2	< 1
Acidity, ppm, Max.	5	10	5	10	10	< 0.1
SO_2, ppm, Max.	2*	6*	-	20*	5	< 5
Iron, ppm, Max.	0.5	0.5	0.4	0.5	0.5	0.1
Non Vol., % Max.	0.01	0.05	-	0.10	0.10	< 0.05
Inhibitor, ppm	As Req.	0-500	50-150 2 Max.	25-100	40-100	< 0.1
Polyrate, %	90(5Hr.)	80	-	80(40°C)	80(7Hr.)	-
Water, ppm	250	200	300	100	No Free	No Free
Color APHA	-	-	20	-	-	-
Dorell Weather ΔT	0.2	0.5	-	-	-	-
Rel. Viscosity, Min.	2.80	2.75	-	-	-	-
Peroside, ppm, Max.	- -	.06	-	-	-	N. D.

* These companies actually specify this property expressed as sulfur thus, Allied is 1 ppm S, Ethyl is 3 and Dow is 10.

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