

MONSANTO COMPANY
Texas City, Texas

April 11, 1966

Monomers Laboratory

VINYL CHLORIDE MONOMER'S COMPETITOR QUALITY EVALUATION

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During the past six months we have analyzed five competitor Vinyl Chloride Monomer samples. The samples were obtained from Allied, Dow, Goodrich, Monochem, and Union Carbide [Texas City]. Prior to this time we had analyzed samples from Ethyl - November, 1963, Goodyear - November, 1962, Tenneco - November, 1964 and Union Carbide [South Charleston] - March, 1962. The analyses of these nine samples and a typical analysis of Monsanto's Vinyl Chloride Monomer are recorded in Table I. The current as well as past analyses are recorded, by producer, in Tables I through X. Figure 1 shows the total impurities found in each sample of Vinyl Chloride Monomer when analyzed by chromatograph. All chromatograph results are the average of duplicate analyses.

The competitor's samples have not been analyzed for HCl. Past experience has demonstrated that we are unable to obtain reliable acid analyses on samples taken in metal containers.

It should be noted that methods of reporting certain analyses have changed during the past years because of improved analytical procedures. This is reflected in the various Tables.

In the Summary of Findings below, we have treated the four competitor Vinyl Chloride Monomer samples analyzed in 1962, 1963 and 1964 as current product by comparing them to Monsanto's current Vinyl Chloride Monomer quality and manufacturing specifications.

CONCLUSIONS:

1. Monsanto Vinyl Chloride Monomer ranks behind Dow, Goodrich, Ethyl, Monochem, Union Carbide [S.C.] and Goodyear in total impurities, when analyzed by chromatograph.
2. Monsanto Vinyl Chloride Monomer contains more methyl chloride than any of the competitor's evaluated.
3. Based on total impurities, Dow is the quality leader among the competitor's evaluated.
4. Dow and Monochem are the only Vinyl Chloride Monomer producers evaluated that have made a significant improvement in quality during the past three years.
5. Dow has made a significant improvement in Vinyl Chloride Monomer quality by reducing the levels of butadiene and methy chloride. Monochem has reduced the butadiene level.
6. Vinyl Chloride Monomer produced by Goodrich, Monochem, Tenneco, and Union Carbide [T.C.] fail to meet Monsanto's manufacturing specifications.

SUMMARY OF FINDINGS:

Allied:

One sample was analyzed by the Texas City Laboratory in October, 1965.

Allied VCM:

1. Contains less impurities than Monsanto's VCM.
2. Contains 12 ppm methyl chloride and 3.8 ppm ethyl chloride as its major impurities.
3. Meets Monsanto's manufacturing specifications.
4. Has made no significant improvement in quality since 1962.
5. Ranks as one of the quality leaders in the industry.

DOW:

One sample was analyzed by the Texas City Laboratory in October, 1965.

Dow VCM:

1. Contains less imprurities than Monsanto's current product or any other producer's VCM.
2. Contains 2.2 ppm 1,3 butadiene as its major impurity.
3. Meets Monsanto's manufacturing specifications.
4. Has made a significant improvement in quality since November, 1963, by reducing the butadiene and methyl chloride levels. Methyl chloride in the previous samples received from Dow analyzed 43, 117 and 51 ppm. The October, 1965, sample analyzed less than one ppm.
5. Ranks as one of the quality leaders in the industry.

SUMMARY OF FINDINGS: [Continued]

Ethyl

The last sample analyzed by the Texas City Laboratory was in November, 1963.

Ethyl's 1963 VCM sample:

1. Contained less impurities than Monsanto's current product.
2. Contained 12 ppm methyl chloride as its major impurity.
3. Meets Monsanto's present manufacturing specifications.
4. Made no significant changes in quality during 1962 and 1963. Since no current samples have been received, we do not know if any changes have been made since 1963.
5. Ranks as one of the quality leaders in the industry.

Goodrich

Two samples were analyzed by the Texas City Laboratory in October, 1965. The samples were taken four hours apart.

Goodrich VCM:

1. Contains less impurities than Monsanto's VCM.
2. Contains 9.0 ppm 1,3 butadiene as its major impurity.
3. Does not meet Monsanto's manufacturing specifications. The dilatometer values for the two samples were 5.1 and 5.5. This is below Monsanto's 5.6 minimum specification. The low polyrate is apparently due to the high butadiene level.

SUMMARY OF FINDINGS: [Continued]GoodrichGoodrich VCM: +

4. Has shown little change in quality since 1962. It should be noted that this observation is based on comparing analyses performed by three different laboratories and is not as reliable as comparing analytical data produced by a single laboratory.
5. Does not rank as a quality leader because of the high level of butadiene. If Goodrich were to reduce the butadiene level, their VCM would be comparable to any other VCM in the industry.

Goodyear

The last sample analyzed by the Texas City Laboratory was in November, 1962.

Goodyear's 1962 VCM sample:

1. Contained less impurities than Monsanto's current product.
2. Contained 7.5 ppm methyl chloride and 4.0 ppm n-butane as its major impurities.
3. Meets Monsanto's present manufacturing specifications.
4. Quality changes are unknown because only one sample has been analyzed in our Laboratory.
5. Ranks as one of the quality leaders in the industry.

Monochem

One sample was analyzed by the Texas City Laboratory in October, 1965.

Monochem VCM:

1. Contains less total impurities than Monsanto's VCM.
2. Contains 5.7 ppm propane and 4.9 ppm n-butane as its major impurities.
3. Fails to meet Monsanto's propane and butane manufacturing specifications.

SUMMARY OF FINDINGS: [Continued]Monochem VCM:

4. Has improved its quality by reducing the butadiene level from 12 ppm to 0.5 ppm. The dilatometer value increased from 5.7 to 6.4. Monochem's current product, however, contains a higher level of propane and butane.
5. Ranks as a quality leader in the industry in spite of the higher levels of propane and butane.

Tenneco

One sample was analyzed by the Texas City Laboratory in November, 1964.

Tenneco's 1964 VCM sample:

1. Contained more impurities than Monsanto's current product.
2. Contained 56 ppm methyl acetylene and 15 ppm allene as its major impurities.
3. Does not meet Monsanto's manufacturing specifications. The high levels of methyl acetylene and allene exceed the 10 ppm maximum allowed for the sum total of methyl acetylene, allene and butene-1.
4. Quality changes are unknown because only one sample has been analyzed in our Laboratory.
5. Ranks low in quality because of the high level of methyl acetylene and allene. Chromatograph scans show Tenneco to contain more impurities than any of the other producers evaluated.

Union Carbide - South Charleston, West Virginia

The last sample analyzed by the Texas City Laboratory was in March, 1962.

Carbide's 1962 sample:

1. Contained less impurities than Monsanto's current product.
2. Contained 11 ppm methyl chloride and 3.0 ppm propane as its major impurities.

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SUMMARY OF FINDINGS: [Continued]

Union Carbide - South Charleston, West Virginia [continued]

Carbide's 1962 sample:

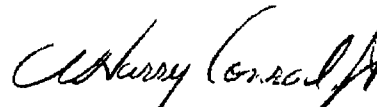
3. Meets Monsanto's present manufacturing specifications.
4. Quality changes are unknown because only one sample has been analyzed in our Laboratory.
5. Ranks as one of the quality leaders in the industry.

Union Carbide - Texas City, Texas

One sample analyzed by the Texas City Laboratory in December, 1965.

Carbide's VCM:

1. Contains more impurities than Monsanto's VCM.
2. Contains 18 ppm methyl chloride, 9.7 ppm n-butane and 6.4 ppm butadiene as its major impurities.
3. Does not meet Monsanto's manufacturing specifications. The 5.5 polyrate is below the minimum specification of 5.6. It is also out-of-specifications in C-3 and C-4's.
4. Has made little change in quality during the past two years. There has been a decrease in methyl chloride and an increase in propane and butane.
5. Ranks poorly in quality because of the higher level of impurities and the low polyrate.


A. Harry Conrad, Jr.


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AHCjr/RCR:mh
Attachments

TABLE II
REPORT OF ANALYSIS
VINYL CHLORIDE MONOMER
ALLIED - MOUNDSVILLE, W. VA.

PROPERTY	DATE	SAMPLE	RECEIVED	AND	ANALYZED	MONSANTO MANUFACTURING SPECIFICATIONS	TYPICAL MONSANTO VCM
	March, 1962	November, 1962	November, 1963		October, 1965		
Acetaldehyde, wt. ppm	1	< 1	1		< 1	5 Max.	< 1
Acidity, wt. ppm	-	-	-		-	1 Max.	< 0.1
Appearance	C & C	C & C	C & C		C & C	C & C	C & C
High Boiling Impurities, wt. %	< 0.05	< 0.05	< 0.05		< 0.001	0.05 Max.	0.0010
Iron, ppm	0.1	0.1	0.1		0.1	0.5 Max.	0.1
Phenol, wt. ppm	-	< 0.1	< 0.1		< 0.1	0.1 Max.	< 0.1
Expansion Rate [Dilatometer]	6.6	6.0	6.4		6.3	5.6 to 6.6	5.95
Sulfur dioxide, wt. ppm	5	< 5	< 5		-	5 Max.	< 5
Water, wt. ppm	-	-	-		-	300 Max.	< 300
Acetylene, mol ppm	1	< 1	0.3		0.4	2 Max.	< 0.1
Ethane, mol ppm	< 0.1	2.6	0.4		0.3	10 Max.	0.2
Ethylene, mol ppm							
1, 3, Butadiene, mol ppm	< 0.1	< 0.1	< 0.1		0.9	10 Max.	1.5
Monovinyl acetylene, mol ppm	< 0.1	0.8	< 0.1		< 0.1		4.0
Diacetylene, mol ppm	< 0.1	< 0.1	< 0.1		< 0.1		< 0.1
2-Chloroprene, mol ppm	< 0.1	< 0.1	< 0.1		< 0.1		< 0.1
Methyl acetylene, mol ppm	< 0.1	< 0.1	< 0.1		< 0.1	10 Max.	0.4
Allene, mol ppm	< 0.1	< 0.1	< 0.1		< 0.1		0.2
Butene-1, mol ppm	< 0.1	< 0.1	< 0.1		0.3		< 0.1
2-Chloropropene, mol ppm	1.7	< 0.1	< 0.1		< 0.1	10 Max.	< 0.1
Trans 1,2 Dichloroethene, mol ppm	< 0.1	< 0.1	< 0.1		< 0.1		< 0.1
1,1 Dichloroethene, mol ppm	< 0.1	< 0.1	< 0.1		< 0.1		< 0.1
Methyl chloride, mol ppm	234	12	21		12	75 Max.	27
Ethyl chloride, mol ppm	1.6	< 0.1	2.8		3.8	10 Max.	1.0
Propane, mol ppm	< 0.1	< 0.1	0.4		0.6	10 Max.	0.3
i-Butane, mol ppm	< 0.1	< 0.1	< 0.1		0.7		0.3
n-Butane, mol ppm	< 0.1	< 0.1	0.4		0.4		0.4
Styrene oxide, mol ppm	-	-	-		-	1 Max.	< 0.2
Phenylacetaldehyde, mol ppm	-	-	-		-		< 0.2

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TABLE III
REPORT OF ANALYSIS
VINYL CARBONIDE MONOMER
DOW - FREEPORT, TEXAS

PROPERTY	DATE SAMPLE RECEIVED AND ANALYZED				MONSANTO MANUFACTURING SPECIFICATIONS	TYPICAL MONSANTO VCM
	March, 1962	November, 1962	November, 1963	October, 1965		
Acetaldehyde, wt. ppm	<1	3.1	<1	<1	5 Max.	<1
Acidity, wt. ppm	-	-	-	-	1 Max.	<0.1
Appearance	C & C	Brown	Yellow White ppt. present	C & C	C & C	C & C
High Boiling Impurities, wt. %	<0.05	<0.05	0.10	<0.001	0.05 Max.	0.0010
Iron, wt. ppm	0.1	>1.0	0.1	0.1	0.5 Max.	0.1
Phenol, wt. ppm	-	<0.1	>70	85	0.1 Max.	<0.1
Polymerization Rate [Dilatometer]	6.4	5.8	5.0 [1]	6.1	5.6 to 6.6	5.95
Sulfur dioxide, wt. ppm	<5	<5	<5	-	5 Max.	<5
Water, wt. ppm	-	-	-	-	300 Max.	<300
Acetylene, mol ppm	2	<1	<0.1	0.2	2 Max.	<0.1
Ethane, mol ppm	<0.1	<0.1	<0.1	0.2	10 Max.	0.2
Ethylene, mol ppm	<0.1	<0.1	<0.1	0.2	10 Max.	0.2
1, 3. Butadiene, mol ppm	2	6	11	2.2	10 Max.	1.5
Monovinyl acetylene, mol ppm	<0.1	0.7	1.8	1.0		4.0
Diacetylene, mol ppm	<0.1	<0.1	<0.1	<0.1		<0.1
2-Chloroprene, mol ppm	<0.1	<0.1	<0.1	<0.1		<0.1
Methyl acetylene, mol ppm	<0.1	<0.1	<0.1	<0.1	10 Max.	0.4
Allene, mol ppm	<0.1	<0.1	<0.1	<0.1		0.2
Butene-1, mol ppm	<0.1	<0.1	1.0	<0.1		<0.1
2-Chloropropene, mol ppm	<0.1	<0.1	<0.1	<0.1	10 Max.	<0.1
Trans 1,2 Dichloroethene, mol ppm	<0.1	<0.1	<0.1	<0.1		<0.1
1,1 Dichloroethene, mol ppm	<0.1	<0.1	<0.1	<0.1		<0.1
Methyl chloride, mol ppm	43	117	51	<1	75 Max.	27
Ethyl chloride, mol ppm	<0.1	<0.1	<0.1	<0.1	10 Max.	1.0
Propane, mol ppm	<0.1	<0.1	<0.1	<0.1	10 Max.	0.3
i-Butane, mol ppm	<0.1	<0.1	<0.1	<0.1		0.3
n-Butane, mol ppm	<0.1	<0.1	<0.1	<0.1		0.4
Styrene oxide, mol ppm	-	-	-	-	1 Max.	<0.2
Phenylacetaldehyde, mol ppm	-	-	-	-		<0.2

[1] Could not remove all of the inhibitor by caustic scrubbing.

TABLE IV
REPORT OF ANALYSIS
VINYL CHLORIDE MONOMER
ETHYL - BATON ROUGE, LA.

PROPERTY	DATE SAMPLE RECEIVED AND ANALYZED				MONSANTO MANUFACTURING SPECIFICATIONS	TYPICAL MONSANTO VCM
	March, 1962	November, 1962	November, 1963			
Acetaldehyde, wt. ppm	1	<1	<1		5 Max.	<1
Acidity, wt. ppm	<1	<1	<1		1 Max.	<0.1
Appearance	C & C	Cloudy	C & C		C & C	C & C
High Boiling Impurities, wt. %	<0.05	<0.05	<0.05		0.05 Max.	0.0010
Iron, wt. ppm	0.1	0.1	0.1		0.5 Max.	0.1
Phenol, wt. ppm	-	<0.1	<0.1		0.1 Max.	<0.1
Polymerization Rate [Dilatometer]	6.7	6.2	5.9		5.6 to 6.6	5.95
Sulfur dioxide, wt. ppm	<5	<5	<5		5 Max.	<5
Water, wt. ppm	-	-	-		300 Max.	<300
Acetylene, mol ppm	<1	<1	<0.1		2 Max.	<0.1
Ethane, mol ppm	<0.1	<0.1	<0.1		10 Max.	0.2
Ethylene, mol ppm						
1, 3. Butadiene, mol ppm	<0.1	<0.1	1.6			1.5
Monovinyl acetylene, mol ppm	<0.1	<0.1	0.6			4.0
Biacetylene, mol ppm	<0.1	<0.1	<0.1		10 Max.	<0.1
2-Chloroprene, mol ppm	<0.1	<0.1	<0.1			<0.1
Methyl acetylene, mol ppm	<0.1	<0.1	<0.1			0.4
Allene, mol ppm	<0.1	<0.1	<0.1		10 Max.	0.2
Butene-1, mol ppm	<0.1	<0.1	<0.1			<0.1
2-Chloropropane, mol ppm	<0.1	<0.1	<0.1			<0.1
Trans 1,2 Dichloroethane, mol ppm	<0.1	<0.1	<0.1		10 Max.	<0.1
1,1 Dichloroethane, mol ppm	<0.1	<0.1	<0.1			<0.1
Methyl chloride, mol ppm	5.5	5.8	12		75 Max.	27
Ethyl chloride, mol ppm	<0.1	<0.1	<0.1		10 Max.	1.0
Propane, mol ppm	<0.1	<0.1	<0.1			0.3
i-Butane, mol ppm	<0.1	<0.1	<0.1		10 Max.	0.3
n-Butane, mol ppm	<0.1	<0.1	<0.1			0.4
Styrene oxide, mol ppm	-	-	-			<0.2
Phenylacetaldehyde, mol ppm	-	-	-		1 Max.	<0.2

TABLE V
REPORT OF ANALYSIS
VINYL CHLORIDE MONOMER
GOODRICH - CALVERTY CITY, KY.

PROPERTY	DATE SAMPLE RECEIVED AND ANALYZED				MONSANTO MANUFACTURING SPECIFICATIONS	TYPICAL MONSANTO VCM
	November, 1962 ^[1]	October, 1965 ^[1]	October, 1965 ^[1]	October, 1965 ^[1]		
Acetaldehyde, wt. ppm	N. R. ^[2] - 2.6	<1	<1	<1	5 Max.	<1
Acidity, wt. ppm	0 - 0.25	-	-	-	1 Max.	<0.1
Appearance	C & C	C & C	C & C	C & C	C & C	C & C
High Boiling Impurities, wt. %	N. R. - 0.042	0.0033	0.0030	0.0030	0.05 Max.	0.0010
Iron, wt. ppm	0 - 0.25	0.1	0.1	0.1	0.5 Max.	0.1
Phenol, wt. ppm	N. R. - 0.20	<0.1	<0.1	<0.1	0.1 Max.	<0.1
Polymerization Rate [Dilatometer]	5.28 - 6.06	5.5	5.1	5.1	5.6 to 6.6	5.95
Sulfur dioxide, wt. ppm	N. R. - 3.3	-	-	-	5 Max.	<5
Water, wt. ppm	N. R. - 45	-	-	-	300 Max.	<300
Acetylene, mol ppm	N. R. - 4.9	0.2	0.3	0.3	2 Max.	<0.1
Ethane, mol ppm	0 - 1.8	0.1	0.2	0.2	10 Max.	0.2
Ethylene, mol ppm						
1, 3. Butadiene, mol ppm	1.3 - 4.5	9.4	8.5	8.5		1.5
Monovinyl acetylene, mol ppm	N. R. - 10	0.2	<0.1	<0.1	10 Max.	4.0
Diacetylene, mol ppm	N. R.	<0.1	<0.1	<0.1		<0.1
2-Chloroprene, mol ppm	N. R.	<0.1	<0.1	<0.1		<0.1
Methyl acetylene, mol ppm	N. R.	0.5	0.5	0.5		0.4
Allene, mol ppm	N. R.	0.3	0.3	0.3	10 Max.	0.2
Butene-1, mol ppm	0.3 - 0.9	1.5	0.2	0.2		<0.1
2-Chloropropene, mol ppm	N. R. - 27	<0.1	<0.1	<0.1		<0.1
Trans 1,2 Dichloroethene, mol ppm	N. R.	<0.1	<0.1	<0.1	10 Max.	<0.1
1,1 Dichloroethene, mol ppm	N. R.	<0.1	<0.1	<0.1		<0.1
Methyl chloride, mol ppm	N. R. - 74	1.4	1.5	1.5	75 Max.	27
Ethyl chloride, mol ppm	N. R.	<0.1	0.4	0.4	10 Max.	1.0
Propane, mol ppm	N. R. - 0.6	<0.1	<0.1	<0.1		0.3
i-Butane, mol ppm	0 - Trace	0.1	<0.1	<0.1	10 Max.	0.3
n-Butane, mol ppm	N. R. - 0.25	0.1	<0.1	<0.1		0.4
Styrene oxide, mol ppm	N. R.	<0.2	-	-	1 Max.	<0.2
Phenylacetaldehyde, mol ppm	N. R.	<0.2	-	-		<0.2

[1] Range of analyses of 4 tank cars analyzed by Goodrich and/or Monsanto's Springfield Laboratory.

[2] N. R. - Not Reported.

TABLE VI
REPORT OF ANALYSIS
VINYL CHLORIDE MONOMER
GOODYEAR - NIAGARA FALLS

PROPERTY	DATE	SAMPLE	RECEIVED	AND	ANALYZED	MONSANTO MANUFACTURING SPECIFICATIONS	TYPICAL MONSANTO VCM
	November, 1962						
Acetaldehyde, wt. ppm	<1					5 Max.	<1
Acidity, wt. ppm	-					1 Max.	<0.1
Appearance	C & C					C & C	C & C
High Boiling Impurities, wt. %	<0.05					0.05 Max.	0.0010
Iron, wt. ppm	0.1					0.5 Max.	0.1
Phenol, wt. ppm	<0.1					0.1 Max.	<0.1
Polymerisation Rate [Dilatometer]	6.4					5.6 to 6.6	5.95
Sulfur dioxide, wt. ppm	<5					5 Max.	<5
Water, wt. ppm	-					300 Max.	<300
Acetylene, mol ppm	<1					2 Max.	<0.1
Ethane, mol ppm	<0.1					10 Max.	0.2
Ethylene, mol ppm							
1, 3. Butadiene, mol ppm	2.0					10 Max.	1.5
Monovinyl acetylene, mol ppm	1.4						4.0
Diacetylene, mol ppm	<0.1						<0.1
2-Chloroprene, mol ppm	<0.1						<0.1
Methyl acetylene, mol ppm	2.6					10 Max.	0.4
Allene, mol ppm	<0.1						0.2
Butene-1, mol ppm	<0.1						<0.1
2-Chloropropene, mol ppm	<0.1					10 Max.	<0.1
Trans 1,2 Dichloroethene, mol ppm	<0.1						<0.1
1,1 Dichloroethene, mol ppm	<0.1						<0.1
Methyl chloride, mol ppm	7.5					75 Max.	27
Ethyl chloride, mol ppm	0.9					10 Max.	1.0
Propane, mol ppm [1]	<0.1					10 Max.	0.3
i-Butane, mol ppm	<0.1						0.3
n-Butane, mol ppm	4.0						0.4
Styrene oxide, mol ppm	-					1 Max.	<0.2
Phenylacetaldehyde, mol ppm	-						<0.2

[1] Contains 1.8 ppm Propylene.

TABLE VII
REPORT OF ANALYSIS
VINYL CHLORIDE MONOMER
MONOCHEM - GRISMAR, LA.

PROPERTY	DATE	SAMPLE	RECEIVED	AND	ANALYZED	MONSANTO MANUFACTURING SPECIFICATIONS	TYPICAL MONSANTO VCM
	Sept., 1964	October, 1965					
Acetaldehyde, wt. ppm	1	<1				5 Max.	<1
Acidity, wt. ppm	-	-				1 Max.	<0.1
Appearance	C & C	C & C				C & C	C & C
High Boiling Impurities, wt. %	<0.05	-				0.05 Max.	0.0010
Iron, wt. ppm	0.1	0.1				0.5 Max.	0.1
Phenol, wt. ppm	<0.1	<0.1				0.1 Max.	<0.1
Polymerization Rate [Dilatometer]	5.7	6.4				5.6 to 6.6	5.95
Sulfur dioxide, wt. ppm	<5	-				5 Max.	<5
Water, wt. ppm	-	-				300 Max.	<300
Acetylene, mol ppm	<0.1	<0.1				2 Max.	<0.1
Ethane, mol ppm	0.1	<0.1				10 Max.	0.2
Ethylene, mol ppm							
1, 3. Butadiene, mol ppm	12	0.5					1.5
Monovinyl acetylene, mol ppm	<0.1	<0.1				10 Max.	4.0
Biacetylene, mol ppm	<0.1	<0.1					<0.1
2-Chloroprene, mol ppm	<0.1	2.6					<0.1
Methyl acetylene, mol ppm	0.2	<0.1					0.4
Allene, mol ppm	<0.1	0.9				10 Max.	0.2
Butene-1, mol ppm	4.2	<0.1					<0.1
2-Chloropropene, mol ppm	<0.1	<0.1					<0.1
Trans 1,2 Dichloroethene, mol ppm	<0.1	<0.1				10 Max.	<0.1
1,1 Dichloroethene, mol ppm	<0.1	<0.1					<0.1
Methyl chloride, mol ppm	<1	<1				75 Max.	27
Ethyl chloride, mol ppm	<0.1	<0.1				10 Max.	1.0
Propane, mol ppm	0.5	5.7					0.3
i-Butane, mol ppm	0.7	0.7				10 Max.	0.3
n-Butane, mol ppm	2.1	4.9					0.4
Styrene oxide, mol ppm	<0.2	-				1 Max.	<0.2
Phenylacetaldehyde, mol ppm	<0.2	-					<0.2

TABLE VIII
REPORT OF ANALYSIS
VINYL CHLORIDE MONOMER
TENNECO - HOUSTON, TEX.

PROPERTY	DATE	SAMPLE	RECEIVED	AND	ANALYZED	MONSANTO MANUFACTURING SPECIFICATIONS	TYPICAL MONSANTO VCM
	November, 1964						
Acetaldehyde, wt. ppm	< 1					5 Max.	< 1
Acidity, wt. ppm	-					1 Max.	< 0.1
Appearance	C & C					C & C	C & C
High Boiling Impurities, wt. %	< 0.05					0.05 Max.	0.0010
Iron, wt. ppm	0.1					0.5 Max.	0.1
Phenol, wt. ppm	-					0.1 Max.	< 0.1
Polymerization Rate [Dilatometer]	6.6					5.6 to 6.6	5.95
Sulfur dioxide, wt. ppm	< 5					5 Max.	< 5
Water, wt. ppm	-					300 Max.	< 300
Acetylene, mol ppm	< 0.1					2 Max.	< 0.1
Ethane, mol ppm Ethyene, mol ppm	< 0.1					10 Max.	0.2
1, 3. Butadiene, mol ppm Monovinyl acetylene, mol ppm Biacetylene, mol ppm 2-Chloroprene, mol ppm	1.2 < 0.1 < 0.1 < 0.1					10 Max.	1.5 4.0 < 0.1 < 0.1
Methyl acetylene, mol ppm Allene, mol ppm Butene-1, mol ppm	56 15 1.0					10 Max.	0.4 0.2 < 0.1
2-Chloropropene, mol ppm Trans 1,2 Dichloroethene, mol ppm 1,1 Dichloroethene, mol ppm	< 0.1 < 0.1 < 0.1					10 Max.	< 0.1 < 0.1 < 0.1
Methyl chloride, mol ppm	4.2					75 Max.	27
Ethyl chloride, mol ppm	< 0.1					10 Max.	1.0
Propane, mol ppm i-Butane, mol ppm n-Butane, mol ppm	1.0 0.1 0.1					10 Max.	0.3 0.3 0.4
Styrene oxide, mol ppm Phenylacetaldehyde, mol ppm	< 0.2 < 0.2					1 Max.	< 0.2 < 0.2

TABLE IX
REPORT OF ANALYSIS
VINYL CHLORIDE MONOMER
UNION CARBIDE - SOUTH CHARLESTON, W. VA.

PROPERTY	DATE	SAMPLE	RECEIVED	AND	ANALYZED	MONSANTO MANUFACTURING SPECIFICATIONS	TYPICAL MONSANTO VCM
	March, 1962						
Acetaldehyde, wt. ppa	< 1					5 Max.	<1
Acidity, wt. ppm	-					1 Max.	<0.1
Appearance	C & C					C & C	C & C
High Boiling Impurities, wt. %	< 0.05					0.05 Max.	0.0010
Iron, wt. ppm	0.1					0.5 Max.	0.1
Phenol, wt. ppm	-					0.1 Max.	<0.1
Polymerization Rate [Dilatometer]	6.0					5.6 to 6.6	5.95
Sulfur dioxide, wt. ppm	< 5					5 Max.	<5
Water, wt. ppm	-					300 Max.	<300
Acetylene, mol ppm	1					2 Max.	<0.1
Ethane, mol ppm	< 0.1					10 Max.	0.2
Ethylene, mol ppm							
1, 3. Butadiene, mol ppm	1.0						1.5
Monovinyl acetylene, mol ppm	< 0.1					10 Max.	4.0
Diacetylene, mol ppm	< 0.1						< 0.1
2-Chloroprene, mol ppm	< 0.1						< 0.1
Methyl acetylene, mol ppm	< 0.1						0.4
Allene, mol ppm	< 0.1					10 Max.	0.2
Butene-1, mol ppm	2.0						< 0.1
2-Chloropropene, mol ppm	< 0.1						< 0.1
Trans 1,2 Dichloroethene, mol ppm	< 0.1					10 Max.	< 0.1
1,1 Dichloroethene, mol ppm	< 0.1						< 0.1
Methyl chloride, mol ppm	11					75 Max.	27
Ethyl chloride, mol ppm	< 0.1					10 Max.	1.0
Propane, mol ppm	3.0						0.3
i-Butane, mol ppm	< 0.1					10 Max.	0.3
n-Butane, mol ppm	< 0.1						0.4
Styrene oxide, mol ppm	-						< 0.2
Phenylacetaldehyde, mol ppm	-					1 Max.	< 0.2

TABLE X
REPORT OF ANALYSIS
VINYL CHLORIDE MONOMER
UNION CARBIDE - TEXAS CITY, TEX.

PROPERTY	DATE SAMPLE RECEIVED AND ANALYZED				MONSANTO MANUFACTURING SPECIFICATIONS	TYPICAL MONSANTO VCM
	November, 1963	December, 1965				
Acetaldehyde, wt. ppm	< 1	< 1			5 Max.	< 1
Acidity, wt. ppm	5.0	-			1 Max.	< 0.1
Appearance	C & C	C & C			C & C	C & C
High Boiling Impurities, wt. %	< 0.05	0.0096			0.05 Max.	0.0010
Iron, wt. ppm	0.2	0.1			0.5 Max.	0.1
Phenol, wt. ppm	< 0.1	< 0.1			0.1 Max.	< 0.1
Polymerization Rate [Dilatometer]	5.1	5.5			5.6 to 6.6	5.95
Sulfur dioxide, wt. ppm	< 5	-			5 Max.	< 5
Water, wt. ppm	-	-			300 Max.	< 300
Acetylene, mol ppm	1	< 0.1			2 Max.	< 0.1
Ethane, mol ppm	2.0	0.8			10 Max.	0.2
Ethylene, mol ppm						
1, 3. Butadiene, mol ppm	8.0	6.4			10 Max.	1.5
Monovinyl acetylene, mol ppm	1.2	0.9				4.0
Biacetylene, mol ppm	< 0.1	< 0.1				< 0.1
2-Chloroprene, mol ppm	< 0.1	< 0.1				< 0.1
Methyl acetylene, mol ppm	3.0	1.1			10 Max.	0.4
Allene, mol ppm	3.0	2.3				0.2
Butene-1, mol ppm	< 0.1	2.5				< 0.1
2-Chloropropene, mol ppm	< 0.1	< 0.1			10 Max.	< 0.1
Trans 1,2 Dichloroeth , mol ppm	< 0.1	< 0.1				< 0.1
1,1 Dichloroethene, mol ppm	< 0.1	< 0.1				< 0.1
Methyl chloride, mol ppm	42	18			75 Max.	27
Ethyl chloride, mol ppm	< 0.1	< 0.1			10 Max.	1.0
Propane, mol ppm	< 0.1	1.3			10 Max.	0.3
i-Butane, mol ppm	< 0.1	2.1				0.3
n-Butane, mol ppm	0.6	9.7				0.4
Styrene oxide, mol ppm	-	< 0.2			1 Max.	< 0.2
Phenylacetaldehyde, mol ppm	-	< 0.2				< 0.2

FINISHED MATERIAL SPECIFICATION

PLANT TEXAS CITY, TEXAS	SPECIFICATION NO. VCM-300 (tentative)
MATERIAL VINYL CHLORIDE MONOMER	GRADE EXPIRATION DATE 9-1-65
SUPPLEMENTARY SPECIFICATION NO. VCM-300(tent.) 12-1-63	MAILED 10/15/64

PROPERTY	SPECIFICATION		TEST METHOD
	MIN.	MAX.	
Acetaldehyde, Wt. ppm	-	5	602.288(WC)
Acetylene, Wt. ppm	-	2	602.292(GC)
Acidity as HCl, Wt. ppm	-	1	602.286(WC)
Appearance	Clear & Colorless, No Suspended Matter		Visual Insp.
High Boiling Impurities (above 25°C) Wt. ppm	-	500	602.294(WC)
Iron, Wt. ppm	-	0.5	602.289(WC)
(1) Peroxides	None detectable		602.297(WC)
(2) Polymerization Rate, %	85	-	602.298(WC)
Phenol, Wt. ppm	-	0.1**	602.299(WC)
Sulfur Dioxide, Wt. ppm	-	5	602.295(WC)
Water, ppm	-	300	On stream analyzer

*Polymerization Rate, %	5.6	6.6	602.291(WC)
*Ethane } mol ppm	-	10	602.292(GC)
*Ethylene }			
*1,3 Butadiene }			602.292(GC)
*Monovinyl Acetylene }	mol ppm	10	602.296(GC)
*Bi Acetylene }			602.292(GC)
*Chloroprene }			
*Methyl Acetylene }			
*Allene }	mol ppm	10	602.292(GC)
*Butene-1 }			
*2-Chloropropene }	mol ppm	10	602.296(GC)
*Trans 1,2 Dichloroethene }			
*1,1 Dichloroethene }	mol ppm	75	602.292(GC)
*Methyl Chloride, }			602.296(GC)
*Ethyl Chloride, }	mol ppm	10	602.292(GC)
*Propane }			
*i-butane }	mol ppm	10	602.304(GC)
*n-butane }			
*Styrene Oxide }	mol ppm	1	
*Phenyl Acetaldehyde }			

- (1) Not run routinely.
(2) For customers requiring polymerization rate by Coke Bottle method.

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*Information on this property is restricted and is not available for general distribution. Approval for release will be obtained through the Supervisor, Standards Section.

** Unless addition of phenol inhibitor is specified by Marketing.