

INTEROFFICE COMMUNICATION

Westlake, Louisiana
August 20, 1968

TO: Mr. W. B. Stovall - Ponca City

SUBJECT: LAKE CHARLES VCM PLANT LOSS SUMMARY

A review of the losses from the VCM Plant has been made and a summary of the results is tabulated herein as basis for future discussions.

Raw material consumption ratios are shown in Table I attached. Examples of actual consumption ratios are given by including June 1968, four-month period of April through July 1968, and the July 8-10 performance run in the tabulation.

Plant personnel advise that the standard consumption figures were based on the guarantee quantities and not on any breakdown of loss sources which could be used for comparison. The only design loss pattern we can find is from the Stauffer flow sheets, and we have tabulated these quantities in Table II attached. Note that the flow sheet tabulation totals 0.092 lbs. loss per lb. VCM, where feed to product overall from these same sheets total 0.104 lbs./lb. which is probably just a ten percent closure error in the design loss balance.

We had extracted information on loss sources from all available past correspondence and analyses to formulate the loss reduction program presented to you in my August 6, 1968 letter. Table III attached, summarizes these losses showing quantities previously reported, present loss, and quantity of loss predicted after corrective action is implemented.

Loss tabulations and attempts to assign quantities to each source to-date have of necessity been based on very infrequent data points and were expanded to estimate what the totals might be for one month of steady operation. We have found that this can be very misleading especially since the plant is operating at reduced capacity and suffers frequent shutdowns. For example, in the four-month period of April through July of 1968, the plant produced only 61 percent of design production and by making as detailed as possible accounting of losses during this period we still show a large "unexplained" quantity which is probably attributable to upset conditions

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Mr. W. B. Steva!!

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during the startup/shutdown periods. This loss area will not be shown by the tabulation such as in Table III, but can only be derived by the more detailed procedures such as shown for the four-month period in Table IV attached.

Many of the quantities listed in Table IV can now, or in the near future, be more accurately and routinely measured. I feel that the only way the remaining losses can be defined, tracked and finally reduced is for a loss accounting to be issued on a routine basis and in a form similar to that used for Table IV with assumptions and estimates replaced with actual quantities as available. This accounting would serve not only to point out losses from cyclic or intermittent sources but also to spotlight incipient trouble spots.



R. S. Matthews

RSM-MC

Attachments

cc: SVS, HDB, DCC, DKP, RHG

With Attachments

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TABLE I
RAW MATERIAL CONSUMPTION
POUNDS PER POUND PRODUCT VCM

	Theoretical	Flow Sheets	Standard	Guarantee	Performance Test July 8-10	Actual June 1968	Actual April through July 1968
Ethylene	.448	.478	.499	.499	.530	.545	.556
Chlorine	.568	.642	.662	.662	.687	.713	.742
TOTAL	1.016	1.120	1.161	1.161	1.217	1.258	1.293
Losses	0	0.104	0.145	0.145	0.201	0.242	0.282
Losses (MMA lbs./mo. at capacity-666 hrs.)		5.2	7.25*	7.25*	10.05	12.10	14.10
Losses in excess of expected (MMA lbs./mo)		-	**"expected loss"	*0	2.80	4.85	6.85

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TABLILOSS SOURCE TABULATIONFLOW SHEET DATA

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<u>Stream</u>	<u>Loss Nature</u>	<u>Loss Lbs./Hour</u>	<u>Loss M Lbs./Mo. (666 Hrs.)</u>
1. T-101 vent	EDC	7.5	5
2. Steam Stripper Effluent	-	0	0
3. L. E. Column Vent	EDC	312.5	208
4. H. E. Column Vent	EDC	5.0	3
5. EDC Tar Still Vent	HCl	11.0	7
6. EDC Tar Still Bottoms	EDC; 1,1,2; Tar	1787.7	1,191
7. L. E. Column Overhead	Light Ends	2759.1	1,838
8. VCM Tar Still Vent	-	0	0
9. VCM Tar Still Bottoms	Tar; EDC	861.3	574
10. Oxy Vent	EDC, ETC, CO ₂ , CO	572.5	381
11. HCl in S-309	HCl	600.0	400
TOTAL		6916.6	4,607
Loss, Lbs./Lb. VCM		0.092	

TABLE 111

LOSS SOURCE TABULATION

NOTE: All figures in MM lbs. per month (666 hours)

SOURCE	Nature	Previously Reported Loss	Present Loss	After Present Corrective Action Complete
1. Oxy vent	Ethylene	0.8 to 1.0	0.2 (1)	-
2. Entrainment in Oxy vent	EDC	0.5	Nil (2)	-
3. Chlorine analysis	Cl	0.3	Nil	-
4. Steam Stripper	EDC	0.3	0.15	Nil (3)
5. Atmospheric Losses	EDC	Nil	Nil	-
6. Refrigeration Level	EDC	Part of # 1	Nil	-
7. L. E. Weathering	EDC	0.5	0.5	Nil (4)
8. EDC solubility due HCl	EDC	Nil	Nil	-
9. Ethylene Metering (5)	Ethylene	1.5	0.6	Nil
10. L. E. Column Vent	EDC	Negligible	Neg.	-
11. H. E. Column Vent	EDC	(6) Neg.	Neg.	-
12. T-101 Vent	EDC	(7) Neg.	Neg.	-
13. VCM car venting	VCM	0 to 0.25	Neg.	-
14. Excess Cl to R-101	Cl.	Temporary	Neg.	-
15. Excess HCl antifreeze	HCl	0.03 to 0.06	Neg.	Neg. (8)
16. By-product losses - oxy	Ethylene & Cl ₂	0.2	Neg.	-
17. Tar Still Vent	A. EDC	0.04	0.04	Neg. (9)
	B. VCM	VCM, EDC, HCl	0.5	Neg. (9)
18. Wash System & Upsets	All	No Estimate	2.0 (Est.)	1.0 (Est.) (10)

TABLE III (Continued)

NOTES:

- (1) 0.2 mm lbs./month is probably an economic limit. Further reduction would entail installation of a scrubber to remove chlorine from vent gas.
- (2) Indications during August operation are that demister has again failed and losses are back to 0.3 to 0.4 but recheck will be necessary when plant is near capacity.
- (3) New stripper installation estimated - First Quarter 1969.
- (4) It is our understanding that production accounting method for light ends will be changed January 1, 1969.
- (5) Figures from study show approximately 5.4% difference prior to June and about 2.3% June and July. See letter from Michels to Butter August 13, 1968.
- (6) No sample point -- assumed negligible.
- (7) Negligible at low rates -- test planned to check loss at high rates.
- (8) Meter installation planned.
- (9) Losses not verified -- additional tests to be conducted when orifice installed and plant is at capacity.
- (10) New aqueous phase hold tank is being installed by the plant; should cut wash losses by approximately 1.0 mm lbs./month.

TABLE IV

Actual Losses - April through July 1968

<u>Total Ethylene and Chlorine Feed to Unit</u>	=	148,467,140 lbs.
<u>Total EDC, VCM, HCl, Tar and L. E. Out</u>	=	125,093,993 lbs. (Adjusted for inventory)
<u>Total Losses</u>	=	23,373,147 lbs.

Loss Sources

A.	<u>Hydrogen</u> (as water from reaction)	=	2,200,000 lbs.
	Sub total loss	=	23,373,147 - 2,200,000
		=	21,173,000 lbs.

B. Light Ends Weathering Correction

Design Flow - Total L. E. Overhead = 2759 lbs./hr.

Design Flow - EDC in L. E. Overhead = 406 lbs./hr.

Assume 50% recovery of EDC

Total Pumpout & Weathering Loss = 2556 lbs./hr.

Total L. E. Loss

2556 lb./hr. x 730 hr./mo. x 0.61 PF x 4.0 mo. = 4,550,000 lbs.

Subtract actual pumpout of 470,000, loss = 4,080,000 lbs.

Sub total Loss	=	21,173,000
	=	4,080,000
		<u>17,093,000 lbs.</u>

NOTE: L. E. weathering loss is probably a lower figure. Actual could be determined by inventory accounting and analysis.

C. T-500 Pit Truck Pumpout

Mud Mover invoices for period total - 4540 bbl. which equals 1.9 MM lbs.

Assume 90% organic.

Loss = 1,700,000 lbs.

Sub total Loss = 17,093,000

- 1,700,000

15,393,000 lbs.

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Table IV (Continued)

D. S-309 Acid Losses

Daily Average % HCl in S-309 aqueous effluent	=	6.785%
Total H ₂ O	=	19,784,000 lbs.
Total HCl	=	$\frac{(0.06785)(19,784,000)}{(0.93215)}$
	=	1,440,000 lbs.
Sub total Loss	=	15,393,000
	-	1,440,000
		<u>13,953,000 lbs.</u>

E. Sewer Loss - Soluble EDC

July Estimate = 800,000 lbs.

From: T-102 & T-103	=	190,000
Water Wash	=	230,000
C-500	=	46,000
Other	=	340,000

Total Losses:

4 x 340 m	=	1,360,000
1 x 230 m x 0.61	=	140,000
4 x 236 m x 0.61	=	576,000
		<u>2,076,000 lbs.</u>

Sub total loss	=	13,953,000
	-	2,076,000
		<u>11,877,000 lbs.</u>

F. Vents (Estimated)

VCM Tar Still	-	500,000 lbs./mo.
EDC Tar Still	-	50,000 lbs./mo.
L. E. & T-101 Vent	-	60,000 lbs./mo.
		<u>610,000 lbs./mo.</u>

610,000 x 4 = 2,440,000 lbs.

Sub total Loss		11,880,000 (Rounded)
	-	2,440,000
		<u>9,440,000 lbs.</u>

Table IV (Continued)

G. Mass Flow Meter - Ethylene

June and before	5.4%
June and July Average	2.33%
4-month period Average	3.85% high

$$63,597,000 \times 0.0385 = \underline{2,440,000 \text{ lbs.}}$$

Sub total loss	9,440,000
	- 2,440,000
	<u>7,000,000 lbs.</u>

H. Chlorine Analysis

Assume 0.32% high
Loss = 270,000 lbs.

Subtotal Loss	7,000,000
	- 270,000
	<u>6,730,000 lbs.</u>

I. Oxy Vent Losses

From material balances made in June:

(a)	Average mole/hr. of CO and CO ₂	=	28.40
	Lbs. carbon per month at 61% PF	=	152,000 lbs./mo.
	Four-month loss	=	<u>608,000 lbs.</u>
(b)	Average lb. per hour EDC, ET Cl & HCl	=	128 or 57,000 lb./mo.
	When demister failed	=	581 or 258,000 lb./mo.
	Four-month period with 2-1/2 months of bad demister		
	Total Loss	=	<u>730,000 lbs.</u>
(c)	With old R-4 catalyst and high ethylene vent content	=	1021 lb./hr. Average
	With new R-4 and operation	=	255 lb./hr.
	One month of low ethylene and three with high ethylene		
	Total Loss	=	<u>1,473,000 lbs.</u>
	Total Oxy Vent	=	<u>2,811,000 lbs.</u>

Table IV(Continued)

Subtotal Losses

= 6,730,000

- 2,811,000

3,919,000 lbs.

J. Unexplained Loss

3,919,000 lbs./four months or approximately 1,000,000 per month. This quantity we assume leaves the sewer as a separate EDC layer and as soluble EDC when more water than usual flows to T-500 via T-252, T-103, T-102, or other due to operation, rainfall, upset, equipment drainage and drying, and other miscellaneous sources. Also, vent losses occur between sampling and especially during upset which cannot be measured. Such vent losses would include tank car and filter venting, oxy imbalance, inerts bleeding and pressure correction by venting.

VALUE OF PLANT LOSSES - 1970

Value of Feedstock - Cl_2 = 2.07 cents/lb. x 392,400 M lbs./yr = \$8,122,680/yr.

Design basis - annualized) C_2H_4 = 3.25 cents/lb. x 303,594 M lbs./yr = \$9,866,805/yr.

Average Value of Feedstock = \$17,969,485

695,994,000 = 2.58 cents/lb.

Value of 1.00% Losses of Feedstock = \$179,695/yr.

Value of Indentifiable Plant Yield Losses - per yr.

1)	<u>Oxy Losses</u>	<u>- total</u>	<u>\$1,120,000</u>
a)	Unconverted HCl & C_2H_4		440,000
b)	H ions removed in oxy		250,000
c)	Overburning		130,000
d)	1,1,2 trichloroethane		130,000
e)	ETCl		110,000
f)	Chloroform		60,000
2)	<u>Cracking Furnace Losses</u>	<u>- total</u>	<u>\$ 77,000</u>
a)	1,1,2,2 tetrachloroethane		23,000
b)	1,5 dichloropentane		20,000
c)	Hexachloroethane		14,000
d)	Chloroprene		2,000
e)	Carbon tetrachloride		18,000
3)	<u>Direct Chlorinator Losses-</u>	<u>total</u>	<u>\$ 77,000</u>
a)	1,1,2 trichloroethane		57,000
b)	VCM, Cis and trans dichlors		20,000
4)	T-2 effluent pit waste EDC losses		200,000
5)	Tar still EDC losses		120,000
6)	Heavies and coke formation		110,000
7)	Light ends column overhead EDC losses		43,000
8)	T-101 vent EDC losses		38,000
9)	Wash System Losses (Thru steam stripper being out of service)		27,000
10)	Unknown Losses		160,000

840,000 4.9%

1970 - PLANT LOSSES SUMMARY

Product VCM, EDC, and HCl (to Ancon)	89.0%	90.4
Light Ends Hauled Away	1.1%	
Tars Hauled Away	2.7%	
H ions Removed in Oxy as H ₂ O	1.4%	
Water Effluent Losses	2.7%	
C-500 Vent Gas Losses	2.5%	
Unknown Losses	0.5%	
Total Losses and Production		100 %
as a % of Cl ₂ and C ₂ H ₄ Feedstock		

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Light Ends Hauled Away	1.1%
Tars Hauled Away	2.7%
H ions Removed in Oxy as H ₂ O	1.4%
Water Effluent Losses	2.7%
C-500 Vent Gas Losses	2.5%
Unknown Losses	<u>0.5%</u>
 Total Losses and Production as a % of Cl ₂ and C ₂ H ₄ Feedstock	 100 %

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