



QAS

Interoffice Communication

To G. L. Foshee
From V. M. Fisher
Date March 30, 1981
Subject Impact of VOC Regulations on VCM Plant Expansion

The proposed EPA VOC regulations for control of fugitive emissions are applicable to any degree of expansion within a designated affected facility. However, an affected facility will not be subject to these regulations if there is not a net increase in overall VOC fugitive emissions due to the minor change or expansion. To avoid being subject to the stringent monitoring and recordkeeping requirements of these regulations a feasible alternative would be to reduce the uncontrolled VOC fugitive emissions from designated VOC fugitive emission sources within the existing facility to maintain the overall VOC fugitive emissions at their original level.

The reduction in uncontrolled VOC fugitive emissions in the VCM Plant could be accomplished through retrofitting and minor modifications of certain equipment. These equipment modifications are specified by the VOC regulations (except for the usage of rupture disks which is our most feasible interpretation for relief valves.)

Equipment which would require retrofitting and modification are pumps (on-line and spares), compressors, pressure relief valves and sampling connections in VOC designated service. Emissions from both pumps and compressors occur at the seals. These emissions could be controlled by installing dual mechanical seals and a closed vent system to the incinerator. Emissions from safety/relief valves occur due to defects in valve seating surfaces, improper reseating after relieving, or process operation near the relief valve set point. Rupture disks could be installed upstream of the safety/relief valves to prevent the emissions of VOC through the valve seat during normal processing conditions. Fugitive emissions from sampling connections can be reduced by using a closed-loop sampling system. Once these modifications are made to a specific piece of equipment their emissions become controlled.

In contrast, valves are exclusively an uncontrollable source for VOC fugitive emissions. Reductions in valve emissions cannot be expected except in situations where the particular valve is retired from service (i.e. removed and replaced with either a spool piece, or capped or plugged). This presents a serious problem for the VCM Plant expansion because the VCM Plant can only utilize the reduction in the VOC uncontrolled fugitive emissions from pumps, compressors, and safety/relief valves in attempting to offset the expansion VOC emissions from similar equipment and new valves. The emissions for the number of valves in the expansion are greater than the sum of the emissions

from the expansion pumps, compressors and safety relief valves. In addition, the expected valve emissions comprise the majority of the total VOC fugitive emissions from the expansion and by themselves exceed the available offsets from the existing facility.

Attached are three tables, Table I- Controlled and Uncontrolled Fugitive Emissions in the Existing Plant, Table II - Net Increase in Controlled and Uncontrolled Fugitive Emissions due to Plant Expansion, and Table III - Offsetting of Plant Expansion Emissions. These tables were compiled after a thorough investigation of the equipment list (Appendix A&B) for both the existing facility and the plant expansions for the number of pumps, compressors, sample connections, and safety/relief valves in VOC service. Furthermore, the expansion P&I diagrams were used to provide an estimation of the net increase of valves in VOC services. The equipment to be installed in the expansion will be installed with the specified controls, thus making them controlled fugitive emission sources.

The total expected VOC fugitive emissions increase from the VCM plant expansion is 34.178 lb/hr as detailed in Table II. However, the total available offset which could be provided in the existing facility is 23.350 lb/hr as detailed in Table I. The available offsets from the plant are deficient by 10.828 lb/hr which is equivalent to the removal of 492 valves in VOC service. This deficiency in available offsets would make the VCM Plant liable to the rigors of the VOC regulation after its anticipated final promulgation.

The financial impact of the VOC regulations on the expansion rest upon two conditions:

- 1) Compliance with only the equipment modification portion of the VOC regulation in order to offset the expansion's expected VOC fugitive emissions, defined in Table IV.
- 2) Total compliance (equipment modifications and a regimented monitoring program) if the expansion's expected VOC fugitive emissions cannot be offset, defined in Table V.

First, to retrofit and modify all existing pumps, compressors, sample connections and safety relief valves as defined in the VOC regulation for the VCM Plant the capital cost would be \$700,000. This figure does not include the removal and replacement of the 492 valves (the estimated number of valves needed for a complete offset) with spool pieces. The cost which would be incurred here is \$400,000. Thus the total additional cost for compliance with only the equipment modification portion of the VOC regulations would be \$1.1MM.

On the otherhand, total compliance would not only include retrofitting and modification of all existing items as previously mentioned but a regimented monitoring system as well. Additional capital and operating cost would be

incurred for the following:

- 1) Establishing a monitoring program.
- 2) Making all valves in VOC service accessible.
- 3) The operation of the monitoring program.
- 4) Maintenance cost for valves.

First, the establishing of a monitoring program for 2800 valves would require 15 to 20 man-days of engineering time and 250 to 300 man-days of drafting time. (Periodic minor revisions would require continuous drafting time in addition). The estimated cost for this would be in the range of \$20,000.

Second, all valves must be accessible for monitoring purposes. It is estimated that 20% of the existing 1700 are inaccessible or not easily accessible. An order of magnitude capital cost to make these valves accessible was estimated to be \$2.0MM.

Third, the operation of the monitoring program will require 10 additional personnel. It is reasoned that 6 full time persons (2nd class operators) would be required for monitoring the valves, 1 full time person for record-keeping, 1 full time draftsman for recording revision in the plant P&I diagrams and 2 extra full time maintenance persons. This estimated monitoring system operation cost for these additional personnel would be \$239,000/year.

Fourth, there would be additional maintenance cost incurred due to leaking valves. For practical purposes the assumption is made that 4% of the 2800 valves leak, and 10% of these will have to be changed out each quarter. Thus a capital cost of \$640,000 will be incurred each year for new valves (excluding salvage valves).

The total capital and operating cost for total compliance with the VOC regulations would be \$2.72MM and \$879,000/year.

If reductions in uncontrollable emissions in the VCM Plant is insufficient to offset the net increase from the expansion, then gearing the plant towards total compliance would have to be considered. The expanded VCM plant is scheduled to go on line during the first quarter of 1983 by then the VCM Plant will have to begin implementation of the then promulgated VOC regulations. It is estimated that it would take 27 months lead time for engineering, design, procurement and construction to establish the changes needed for implementation of the VOC regulations.


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TABLE I. CONTROLLED AND UNCONTROLLED FUGITIVE EMISSIONS IN EXISTING PLANT.

EQUIPMENT	No.	UNCONTROLLED EMISSION FACTOR ³ LB/HR	TOTAL UNCONTROLLED EMISSIONS LB/HR	No.	CONTROLLED EMISSION FACTOR ³ LB/HR	TOTAL ¹ CONTROLLED EMISSIONS LB/HR	FUGITIVE EMISSION REDUCTION W/CONTROLLED EMISSIONS
Non-Vinyl Pumps in VOC Service (Presently Existing) ¹	52	0.265	13.780				
Non-Vinyl Pumps in VOC Service (Presently Existing) ²				52	0.079	4.108	9.672
Safety/Relief Valves in VOC Service (Presently Existing) ¹	46	0.353	16.238				
Safety/Relief Valves in VOC Service (Presently Existing) ²				46	0.146	6.716	9.522

NOTE: 1. WITHOUT EQUIPMENT MODIFICATIONS AS SPECIFIED IN THE VOC REGULATIONS.

2. WITH EQUIPMENT MODIFICATIONS AS SPECIFIED IN THE VOC REGULATIONS.

3. SOURCE: GUIDELINE SERIES: CONTROL OF VOLATILE ORGANIC FUGITIVE EMISSIONS
FROM SYNTHETIC ORGANIC CHEMICAL, POLYMER, AND
RESIN MANUFACTURING EQUIPMENT.

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NON-VINYL SAMPLING CONNECTIONS (PRESENTLY, EXISTING)	20	0.033	0.661				
NON-VINYL SAMPLING CONNECTIONS (PRESENTLY ² EXISTING)				20	0	0	0.661
Compressors IN VOC SERVICE (PRESENTLY, EXISTING)	5	0.97	4.850				
Compressors IN VOC SERVICE (PRESENTLY ² EXISTING)				5	.271	1.355	3.495
TOTAL						23.350	

NOTE: 1. WITHOUT EQUIPMENT MODIFICATIONS AS SPECIFIED IN THE VOC REGULATIONS.
 2. WITH EQUIPMENT MODIFICATIONS AS SPECIFIED IN THE VOC REGULATIONS.
 3. SOURCE: GUIDELINE SERIES: CONTROL OF VOLATILE ORGANIC FUGITIVE EMISSIONS FROM SYNTHETIC ORGANIC CHEMICAL, POLYMER, AND RESIN MANUFACTURING EQUIPMENT.

TABLE II. NET INCREASE IN CONTROLLED AND UNCONTROLLED FUGITIVE EMISSIONS DUE TO PLANT EXPANSION.

EQUIPMENT	NO.	UNCONTROLLED EMISSION FACTOR LB/HR	TOTAL UNCONTROLLED EMISSIONS LB/HR	NO.	CONTROLLED EMISSION FACTOR LB/HR	TOTAL CONTROLLED EMISSIONS LB/HR	FUGITIVE EMISSION REDUCTION W/CONTROLLED EMISSIONS
NON-VINYL Pumps IN VOC SERVICE (FROM PLANT EXPANSION)				22	0.079	1.75	0
NON-VINYL SAFETY/RELIEF VALVES IN VOC SERVICE (FROM PLANT EXPANSION)				41	0.146	5.986	0
NON-VINYL COMPRESSORS IN VOC SERVICE (FROM PLANT EXPANSION)				6	0.271	1.626	0
NET INCREASE OF NON-VINYL VALVES IN VOC SERVICE (FROM PLANT EXPANSION)	938	0.022	20.636				0
NET INCREASE OF VINYL VALVES IN VOC SERVICE (FROM PLANT EXPANSION)	190	0.022	4.180				0
TOTAL			24.816			9.362	34.178

1. SOURCE: GUIDELINE SERIES: CONTROL OF VOLATILE ORGANIC FUGITIVE EMISSIONS FROM SYNTHETIC ORGANIC CHEMICAL, POLYMER, AND

TABLE III

OFFSETTING OF PLANT EXPANSION EMISSIONS	
NET CONTROLLED AND UNCONTROLLED EMISSIONS INCREASE FROM PLANT EXPANSION (FROM TABLE II)	34.178 ^{LB} /HR
REDUCTION IN UNCONTROLLED FUGITIVE EMISSION THROUGH MODIFICATION OF EXISTING EQUIPMENT RESULTING IN CONTROLLED EMISSIONS (FROM TABLE I)	23.350 ^{LB} /HR
FUGITIVE EMISSIONS IN EXCESS OF OFFICE FACILITY EMISSIONS	10.828 ^{LB} /HR

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TABLE III FINANCIAL IMPACT OF COMPLIANCE
WITH ONLY THE EQUIPMENT MODIFICATION
PORTION OF THE VOC REGULATIONS FOR
OFFSET PURPOSES.

MODIFICATIONS	CAPITAL COST
EQUIPMENT (ALL PUMPS, COMPRESSORS, SAMPLE CONNECTIONS/SAFETY RELIEF VALVES IN VOC SERVICE. LABOR COSTS ARE INCLUDED)	\$ 700,000
REMOVAL OF 492 VALVES AND REPLACING WITH A SPOOL PIECE (492 VALVES IS THE ESTIMATED NUMBER NEED FOR AN EQUIVALENT OFFSET OF THE VCM PLANT EXPANSION VOC, FUGITIVE EMISSIONS)	\$ 400,000
TOTAL	\$ 1,100,000

TABLE V FINANCIAL IMPACT OF TOTAL COMPLIANCE OF THE VOC REGULATIONS (I.E. EQUIPMENT MODIFICATIONS AND MONITORING PROGRAM).

REGULATION DEMANDS	COST	
	CAPITAL	OPERATING
EQUIPMENT MODIFICATIONS ESTABLISHING A MONITORING PROGRAM (154620 mandays - engineering & 250 to 300 mandays drafting time)	\$700,000 \$20,000	
MAKING ALL VALVES IN VOC SERVICE ACCESSIBLE (20% of the existing 1700 valves are inaccessible.)	\$2,000,000	
THE OPERATION OF THE MONITORING PROGRAM (will require 10 additional personnel: 6 full-time persons for monitoring 1 full-time person for record-keeping 1 full-time draftsman for recording revisions in the plant P&I diagrams 2 extra full-time maintenance persons)		\$239,000/yr
MAINTENANCE COST FOR VALVES (10% of the 4% of the 2800 valves leaking will be replaced each quarter)		640,000/yr
TOTAL	2,720,000	\$879,000/yr

APPENDIX A. EXISTING EQUIPMENT IN VOC SERVICE

P-102 A/B	Caustic Wash
P-103 A/B	L. E. Column Feed
P-104 A/B	L. E. Column Reflux
P-105 A/B	H. E. Column Feed
P-106 A/B	H. E. Column Reflux and Product Transfer
P-109	EDC Tar Still Bottoms
P-110 A/B/C	Water Wash Recycle
P-112	EDC Transfer
P-211A	Tar Still Bottoms EDC
P-402	L. E. Transfer
P-405	EDC Tar Transfer
P-450	EDC Transfer
P-451 A/B	Pure EDC Transfer
P-452	EDC Transfer
P-108	EDC Tar Still Overheads
P-115	Oil Pump (BL-301)
P-255	EDC Circulating Pump
P-425	EDC Unloading
P-435	EDC Tars
P-453	Wet Crude EDC Rerun
P-454	T-453 Water Pumpout
P-460	Slop Tank Transfer
P-504	Tretolite Pump
P-505	Chemical Feed
P-506	Chemical Feed
P-507	Chemical Feed
P-604	C-500 Transfer Pump

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APPENDIX A (CONTINUED)

P-605 A/B	Lube Oil Consol
P-606 A/B	Main Oil Pump (BL-501)
P-607 A/B	Main Oil Pump (BL-605)
P-625	EDC Loading
P-902 A/B/C/D	Liquid Feed to Incinerators
BL-410 A/B	Freon
BL-602 A/B	Freon
BL-501	Propylene

Sample Connections

S-309 EDC	T-103A EDC
S-309 Water	P-110A, B, and C Discharge
S-307 EDC	T-102 EDC
S-306 EDC	R-103
H-201A	
H-201B	
C-204 Reflux	
Vaporizer Feed	
R-101 EDC	
R-102 EDC	
C-203 Bottoms	
T-101 EDC	
C-102 EDC Feed	
C-102 EDC Bottoms	
C-103 EDC Reflux	

APPENDIX B EXPANSION EQUIPMENT IN VOC SERVICE

NP-150	R-150 Purge Pump
NP-151/152	R-150 Reflux Pumps
NP-153/154	R-150 Product Pumps
NP-155/156	EDC Product Pumps
NP-157/158	Vent Condensate Pumps
NP-106 C/D	Heavy Ends Column Product and Reflux Pumps
NP-109B	EDC Tar Still Bottoms Pump
NP-131 A/B	Water Wash Feed Pumps
NP-132 A/B	EDC Tar Still Overhead Pumps
NP-301 A/B	Oxy EDC Pumps
NP-302 A/B NP-451C	Oxy Water Pumps
NBL-304	Recycle Compressor
NBL-305 A/B/C	Ethylene Recovery Compressors
NBL-501A	Propylene Refrigeration Compressor
NBL-413A	Tank Farm Vent Compressor
NBL-413B	Spare Tank Farm Vent Compressor
NBL-414A	BLR Vent Compressor
NBL-414B	Spare BLR Vent Compressor