

DPMC VCM MONITORING PROGRAM REVIEW

OCTOBER 1980

1. OVERVIEW

Vinyl Chloride Monomer (VCM)

Employee exposure monitoring at DPMC presently consists of: (1) Fixed point area monitoring (2) spot grab sampling by means of plastic syringes and a GLC, (3) portable hydrocarbon detector use and (4) personnel 8 hour time weighted average air sampling. This report represents a review of the data collected by personnel TWA "breathing zone" monitoring from January 1978 to September 25, 1980 and offers recommendations for future VCM personnel monitoring.

II. OSHA REGULATIONS 29 CFR 1910.1017

(c) Permissible Exposure Limit

1 ppm - 8 hr. TWA, and

5 ppm - Ceiling

(c) Permissible exposure limit. (1) No employee may be exposed to vinyl chloride at concentrations greater than 1 ppm averaged over any 8-hour period, and

(2) No employee may be exposed to vinyl chloride at concentrations greater than 5 ppm averaged over any period not exceeding 15 minutes.

(3) No employee may be exposed to vinyl chloride by direct contact with liquid vinyl chloride.

(d) Monitoring

Required:

(i) Monthly if exposure exceeds 1.0 ppm TWA

(ii) Quarterly if exposure exceeds 0.5 ppm TWA

(iii) Provision for discontinuing monitoring where levels are below 0.5 ppm

(d) Monitoring. (1) A program of initial monitoring and measurement shall be undertaken in each establishment to determine if there is any employee exposed, without regard to the use of respirators, in excess of the action level.

(2) Where a determination conducted under paragraph (d)(1) of this section shows any employee exposures, without regard to the use of respirators, in excess of the action level, a program for determining exposures for each such employee shall be established. Such a program:

(i) Shall be repeated at least monthly where any employee is exposed, without regard to the use of respirators, in excess of the permissible exposure limit.

(ii) Shall be repeated not less than quarterly where any employee is exposed, without regard to the use of respirators, in excess of the action level.

(iii) May be discontinued for any employee only when at least two consecutive monitoring determinations, made not less than 5 working days apart, show exposures for that employee at or below the action level.

III. REVIEW OF VCM EXPOSURE LEVELS

A. Summary Personnel TWA Exposure Data (1/78-9/80) *

TABLE 1

SHELL PERSONNEL

	<u>NO. MEAS</u>	<u>NO. >.5</u>	<u>NO. >1.0</u>
<u>1980</u> (Jan.-Sept.25)	300	18 (6%)	9 (3%)
<u>1979</u>	626	39 (6%)	25 (4%)
<u>1978</u>	<u>513</u>	<u>36 (7%)</u>	<u>22 (4%)</u>
	1439	93 (6%)	56 (4%)

Since January 1978, 1439 personnel TWA samples have been collected on Shell personnel. An additional 350 samples were collected on contractor employees, (Table 2). This surveillance has averaged 54 samples per month, with typically 44 measurements being collected on Shell employees. Presently all Shell operators and assigned maintenance personnel are monitored on a monthly basis. Monitoring coverage for Shell employees has included 20 separate job categories.

TABLE 2

CONTRACTOR PERSONNEL

	<u>NO. MEAS</u>	<u>NO. >.5</u>	<u>NO. >1.0</u>
<u>1980</u> (Jan.-Sept.25)	56	0	0
<u>1979</u>	159	5	3
<u>1978</u>	<u>135</u>	<u>3</u>	<u>3</u>
	350	8 (2%)	6

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*Includes Shutdowns, Startups and normal operating conditions

Overall, 96% of all Shell TWA personnel monitoring data collected during the specified time period has been below 1.0 ppm (Table 1). Approximately one half of the samples collected which exceed 0.5 ppm also exceeded 1.0 ppm, TWA. Ninety-eight percent of Contractor exposure data is below 1.0 ppm (Table 2).

Seventy-five or 81% of the 93 measurements on Shell employees which exceeded 0.5 ppm were collected on the 4 job categories of (1) Edc (100) Operator, (2) Gauger/Utility Operator (3) VCM Loader-Site III and the VCM 200 Operator, (See Attachment 1). In 1980 sampling coverage to 9/25/80 for these 4 job categories represented 41% of all samples collected.

Representing the job categories with greatest apparent exposure potential, a detailed evaluation of the measurements collected on these 4 job categories has been completed. Table 3 below presents a statistical summary of the data. A detailed review of all 75 samples analyzed to be in excess of 0.5 ppm is provided as Attachment 2. Where available, information pertaining to the cause of exposure has been incorporated.

TABLE 3					
<u>No. Samples (n)</u>	<u>No. > .5</u>	<u>No. > 1.0</u>	<u>($\bar{x}$) Avg.</u>	<u>Sample Std. Dev. Sx</u>	<u>$\bar{x} \pm (cv) \frac{Sx}{\sqrt{n}}$ 95% Conf. Interval</u>
<u>Edc (100) Operator</u>					
177*	12	3	.19	.44	.13 - .25 ppm
178	13	4	.78	7.9	0 - 1.94 ppm
<u>Gauger/Utility Operator</u>					
159	20	12	.36	1.2	.17 - .55 ppm
<u>VCM Loader - Site III</u>					
90	33	21	.92	2.2	.47 - 1.37 ppm
<u>VCM 200 Operator</u>					
166	9	7	.32	1.5	0.09 - 0.55 ppm
593	75	44	-	-	-

*Confidence interval for population mean calculated without a 3/78 105 ppm result included.

Edc (100) Operator: 13 of 178 or approximately 7% exceeded 0.5 ppm. For 1980, 2 of 37 or 5% exceeded 0.5 ppm (none exceeded 1.0 ppm). Based on this data the mean average exposure level has been calculated to lie between .13 and .25 ppm.

Gauger/Utility Operator: 20 of 159 or approximately 12% exceeded 0.5 ppm. For 1980, 8 of 32 or 25% exceeded 0.5 ppm (15% exceeded 1.0 ppm). Based on this data the mean average exposure level has been calculated to lie between .17 and .55 ppm.

VCM Loader - Site 111: 33 of 178 sample or approximately 7% exceeded 0.5 ppm. For 1980, 7 of 22 or 32% exceeded 0.5 ppm (18% exceeded 1.0 ppm). Based on this data the mean average exposure level has been calculated to lie between .47 and 1.37 ppm. Leaks during tank car loading were most frequently reported as sources of exposure exceeding 1.0 ppm.

VCM 200 Operator: 9 of 166 samples or approximately 5% exceeded 0.5 ppm. For 1980, none exceeded 0.5 ppm. Based on this data the mean average exposure level has been calculated to lie between 0.09 and .55 ppm.

5. Ten Point "OSHA" Area Monitoring Data

While area monitoring data may not always reflect actual employee exposure, a limited review of available data collected by the 10 area sampling stations was completed to further assess exposure potential to employees working in the VCM unit.

Based on a nominal 28 samples per day, per sampling station, data has been summarized for 154 day period May - September 1980, (See Attachment 3).

In summary, only 186 measurements above 0.5 ppm were recorded. These "alarm" readings represented approximately 0.5% of all samples. Measurements greater than 1.0 ppm represented less than .2% of all samples collected.

Readings above 0.5 ppm were recorded on 89 of the 154 days; on 40 days levels in excess of 1.0 ppm were recorded. No trend was found which indicated one month as having more "alarm days" than another.

The greatest number of measurements above 0.5 ppm were recorded for sampling stations No. 5, 7 and 10; the sampling streams that had the greatest number of "alarm days" were noted to be 6, 7 and 10. A review of the available records indicated several sources of emission including plugging of bleeders, pump seal leaks, overhead condensor leaks and leaking sample bombs.

- C. During the time period of 1/78-9/25/80 the VCM monitoring data indicates that DPMC is routinely in compliance with the 1.0 ppm TWA standard on all job categories except the :

Gauger/Utility Operator.

VCM Loader - Site III Operator

For the above time period, measurements in excess of the 0.5 ppm action level have been recorded on 12 Shell and 2 Contractor jobs. Personnel and Area Monitoring suggest that occasional VCM excursions occur due to non-routine events (leaks, fugitive emissions, etc.) thereby resulting in 8 hr. samples in excess of 0.5 ppm.

OSHA monitoring requirements (Section 11) specify "representative" monitoring monthly where exposures exceed 1.0 ppm (TWA) and quarterly where exposures exceed 0.5 ppm. Sampling may be discontinued where consecutive sampling shows exposure levels below 0.5 ppm, TWA (sec. 1910.1017 (d) (iii)).

OSHA requires that a monitoring program meeting the minimum requirements outlined above, be relied upon to "determine if there is any employee exposed... in excess of the action level" and to determine when controls are required. Further, exposures in excess of either the 1.0 ppm 8 hr. TWA or the 5.0 ppm Ceiling must be controlled by feasible engineering, work practice controls and/or respiratory protection. For the monitoring conducted, the exposure of each employee must be represented, however, all employees need not be sampled.

The frequency and coverage of exposure surveillance presently afforded for Vinyl Chloride at DPMC exceeds the OSHA requirements for 8 hour TWA monitoring. However, during the specified time period, short term (ca. 15 minutes) monitoring has not been performed to assess actual peak exposure levels during tasks of higher exposure potential. Short term ceiling measurements would document compliance with 1910.1017 (c)(2), the 5.0 ppm ceiling limit, and/or identify peak exposures on job categories generally within the 1.0 ppm TWA limit.

IV. RECOMMENDED VCM PERSONNEL MONITORING PROGRAM

Based on the review of the VCM exposure data which has been completed, it is recommended that the sampling frequency and coverage be adjusted to reflect current needs and past exposure history.

Changing from the present extensive program of monitoring all employees monthly, the revised routine surveillance program to be implemented would place the greatest emphasis where the exposure potential is highest. Overall monitoring would be decreased, but still maintained at a level in excess of OSHA requirements.

Consistent with current Industrial Hygiene practice and in compliance with OSHA's requirements, it is further proposed that future monitoring address representative employee exposure on a job category basis. While monitoring coverage will be rotated so as to include all employees on at least a yearly basis, not all employees would be monitored routinely eg. monthly.

The proposed monitoring program will:

1. a. provide as a minimum, quarterly TWA monitoring for job categories historically associated with "low relative exposure potential", eg. HCLN Operator, Oxy Operator.
- b. provide for the monitoring of all employees on at least an annual basis.
- c. provide for increased monitoring to two times per month where quarterly monitoring shows 8 hour TWA exposure to be in excess of the 0.5 ppm action level. Monitoring will continue to be performed twice monthly until 4 such TWA measurements are analyzed to be below the action level (2 months).
2. Provide as a minimum, monitoring two times per month for job categories historically associated with higher relative exposure potential, eg. VCM Loader-Site III, Gauger/Utility Operator.
3. Provide for an "initial", and as a minimum, semiannual monitoring for peak exposure levels during specific work activities. Routine work duties on each job category having potential exposure in excess of 5.0 ppm are to be scheduled for evaluation.
4. Provide for better utilization of Industrial Hygiene personnel without compromising the integrity of the surveillance program. At the present time, approximately 90% of 1 Industrial Hygiene Technicians time is dedicated to VCM exposure surveillance. At the end of 1981 the VCM monitoring program would again be reviewed so as to address the needs identified at that time.
5. Provide for flexibility. Non-routine exposure surveys will be performed on a request basis so as to address changes in work practices, controls or production.

6. Personnel monitoring of assigned Contractor personnel will continue to be performed monthly.
7. Shutdowns and Startups, as well as other major maintenance activities will continue to be handled on a case by case basis. Typically, all personnel are individually monitored during turn-arounds.
8. The recommended frequency of routine VCM monitoring is presented as Table 4 below.

TABLE 4
RECOMMENDED VCM MONITORING PROGRAM

<u>Job Category</u>	<u>Minimum Sampling Frequency</u>		
	<u>Twice Monthly</u>	<u>Quarterly</u>	<u>Monthly</u>
EDC (100) Operator	X		
Gauger/Utility Oper.	X		
VCM Loader-Site III	X		
VCM 200 Operator	X		
Shift Foreman (VCM)	X		
Facility Oper.-Site III		X	
Foreman Maintenance		X	
VCM Operations-Staff		X	
Quality Control Lab Tech.		X	
Oxy 150 Operator		X	
Shift Foreman-Site III		X	
HCIN		X	
Instrument Mechanic		X	
Assigned Shell Maintenance Personnel			X
<u>MINI</u>			
Boilermaker			X
Foreman			X
General Maintenance			X
Pipefitter			X
<u>PANELITE</u>			
Instrument Mechanic			X
<u>SLUXE</u>			
Painter			X

ATTACHMENT I

SUMMARY OF VCM TWA EXPOSURE DATA: SHELL EMPLOYEES

(January, 1978-September 25, 1980)

Monitored 1978, 1979 and 1980

<u>Job Category</u>	<u>No. of Samples</u>		<u>No. > .5 ppm</u>
1. EDC Operator (100 Operator)	178		13 (7.3%)
2. Gauger/Utility Operator	159	81% of all samples above 0.5 ppm	20 (12.5%)
3. VCM Loader - Site III	90		33 (37.0%)
4. VCM 200 Operator	166		9 (5.4%)
5. Shift Foreman (VCM)	152		7
6. Facility Operator - Site III	111		1
7. Foreman (Maintenance)	12		0
8. VCM Operations - Staff	28		1 (3.6%)
9. Quality Control Lab Technician	99		3
10. Oxy 150 Operator	144		2
11. Shift Foreman - Site III	2		0
12. RCIN	200		2
13. Instrument Mechanic	49		0

Monitored 1978 & 1979

1. Electrician	1	0
2. Mechanic	12	0
3. Boilermaker	4	0
4. Helper	5	0
5. Machinist	4	1
6. Painter	1	0
7. Pipefitter	22	1 (4.5%)

ATTACHMENT ISUMMARY OF VCM TWA EXPOSURE DATA: CONTRACTOR EMPLOYEES

(January, 1978 - September 25, 1980)

<u>Job Category</u>	<u>No. of Samples</u>	<u>No. >.5 ppm</u>
<u>MIMI</u>		
1. Boilermaker	102	3
2. Foreman	38	0
3. General Maintenance	28	0
4. Pipefitter	114	5
<u>Panelite</u>		
1. Instrument Mechanic	22	0
<u>Sline</u>		
1. Painter	46	0

ATTACHMENT 11

<u>Job Category</u>	<u>Date</u>	<u>Name</u>	<u>Sample Result</u>	<u>Exposure Due To</u>
VCM Gauger	1/12/78	Hayter	1.2	Sampling light ends from light ends dryers
VCM Gauger	6/07/78	O'Valle	3.9	Sample collection
VCM Gauger	8/10/78	Smith	0.7	
VCM Gauger	8/11/78	Rodriguez	0.9	
VCM Gauger	8/13/78	O'Valle	0.5	
VCM Gauger	2/14/79	Thompson	2.7	Blocking in light ends feed pump
VCM Gauger	6/26/79	Dues	.6	
VCM Gauger	9/04/79	Booker	1.7	Undetermined/routine tasks
VCM Gauger	9/24/79	Stokes	6.2	Leaking sample bomb station fittings in rundown area
VCM Gauger	12/04/79	Novak	2.3	Undetermined/EDC tank car loading
VCM Gauger	12/05/79	Dille	1.3	Undetermined/routine tasks
VCM Gauger	12/19/79	Booker	.5	
VCM Gauger	01/11/80	Doc	1.3	Leaking sample bomb valve
VCM Gauger	01/24/80	Doc	0.9	
VCM Gauger	01/24/80	Hedger	1.3	Sample station inlet valve leak
VCM Gauger	04/02/80	Weathers	0.5	
VCM Gauger	04/16/80	Dues	12.1	Undetermined/routine tasks
VCM Gauger	07/09/80	Sirman	1.5	Undetermined/routine tasks
VCM Gauger	07/16/80	Mc Dill	0.5	
VCM Gauger	08/29/80	Sirman	4.6	Lincoln fittings at storage spheres - sample collection

Note: Measurements analyzed to be ≥ 1.0 ppm are not investigated as to cause of exposure.

ATTACHMENT 11

<u>Job Category</u>	<u>Date</u>	<u>Name</u>	<u>Sample Result</u>	<u>Exposure Due To</u>
EDC 100 Oper.	02/03/78	Barraza	0.6	
EDC 100 Oper.	02/14/78	Hayter	5.5	High concentration in spent caustic pumped to V-6104
EDC 100 Oper.	03/09/78	Flex	105.0	Sampling C-6101 reflux pump
EDC 100 Oper.	09/03/78	Hayter	0.6	
EDC 100 Oper.	08/11/78	Koppello	1.3	Losing water wash seal legs during C-6101 wash
EDC 100 Oper.	08/11/78	Thompson	0.5	
EDC 100 Oper.	08/12/78	Holt	0.5	
EDC 100 Oper.	08/12/78	Fate	0.5	
EDC 100 Oper.	08/13/78	Thompson	1.0	
EDC 100 Oper.	08/14/78	Hightower	1.3	Washing V-6102
EDC 100 Oper.	11/15/79	Nelson	1.0	
EDC 100 Oper.	04/09/80	Hayter	0.9	
EDC 100 Oper.	08/05/80	Jones	0.5	
VCM 200 Oper.	05/10/78	Clark	1.9	Unplugging top tap of LAL on C-6211
VCM 200 Oper.	07/18/78	Clark	.5	
VCM 200 Oper.	08/11/78	Williamson	1.2	Block valve leak while flushing V-6203
VCM 200 Oper.	08/26/78	Williamson	2.8	Instrument transmitters
VCM 200 Oper.	01/16/79	Castaneda	.9	
VCM 200 Oper.	10/31/79	Follard	2.8	Decontamination VCM, HCl columns
VCM 200 Oper.	11/02/79	Jones	3.5	Washing VCM column
VCM 200 Oper.	11/16/79	Magallan	19.3	Gauge glass broken
VCM 200 Oper.	12/11/79	Magallan	1.9	P-6201 pump seal leak

Note: Measurements analyzed to be ≥ 1.0 ppm are not investigated to cause of exposure.

ATTACHMENT II

<u>Job Category</u>	<u>Date</u>	<u>Name</u>	<u>Sample Result</u>	<u>Exposure Due To</u>
VCM Loader - Site III	01/23/78	Hilton	4.9	Leaking loading hose and swing joint
VCM Loader - Site III	03/14/78	Jackson	1.1	Leaking flex hose at Spot 10C52
VCM Loader - Site III	06/20/78	Carter	2.2	Leaking sample valve on tank car at 10V53
VCM Loader - Site III	07/13/78	Coleman	3.9	
VCM Loader - Site III	07/26/78	Brown	3.5	Liquid leak from Sensall device at 10V53 (premature disconnection of flex hose)
VCM Loader - Site III	09/20/78	Wolford	1.5	Faulty slip tube needle valve
VCM Loader - Site III	12/13/78	Cornett	.9	
VCM Loader - Site III	12/20/78	Hilton	.9	
VCM Loader - Site III	01/18/79	Ramos	2.9	Tank car valve leak
VCM Loader - Site III	01/24/79	Mulcare	0.5	
VCM Loader - Site III	02/13/79	Kennedy	0.7	
VCM Loader - Site III	02/21/79	Cornett	5.6	Leaking tank car slip tube valve
VCM Loader - Site III	03/19/79	Ambres	18.9	Leaking tank car slip tube valve
VCM Loader - Site III	03/23/79	Ramos	2.6	Leaking Jamesbury valve on purge line
VCM Loader - Site III	04/17/79	Ambres	0.8	
VCM Loader - Site III	04/23/79	Ramos	1.6	Bleeder valves on liquid line adapter
VCM Loader - Site III	04/26/79	Kennedy	0.9	
VCM Loader - Site III	05/11/79	Allen	0.6	

ATTACHMENT II

<u>Job Category</u>	<u>Date</u>	<u>Name</u>	<u>Sample Result</u>	<u>Exposure Due To</u>
VCM Loader - Site III	05/16/79	Ambres	1.2	Leaking tank car slip tube valve
VCM Loader - Site III	07/03/79	Kennedy	0.7	
VCM Loader - Site III	07/10/79	Ambres	1.4	Undetermined/tank car unloading
VCM Loader - Site III	07/12/79	Ramos	1.0	
VCM Loader - Site III	08/01/79	Kennedy	1.6	Leaking tank car slip tube valve
VCM Loader - Site III	08/07/79	Ramos	.6	
VCM Loader - Site III	08/15/79	Hilton	2.1	Leaking tank car slip tube valve
VCM Loader - Site III	10/17/79	Ambres	2.9	Leaking tank car slip tube valve
VCM Loader - Site III	01/28/80	Arceneaux	2.5	Undetermined/tank car loading
VCM Loader - Site III	01/30/80	Arceneaux	1.1	Leaking liquid valve on tank car
VCM Loader - Site III	01/31/80	Bingham	1.1	Leak at liquid line connection on tank car
VCM Loader - Site III	02/12/80	Bingham	0.6	
VCM Loader - Site III	02/26/80	Bingham	2.8	Leak at load valve and line on tank car
VCM Loader - Site III	03/12/80	Mahan	0.6	
VCM Loader - Site III	05/18/80	Wright	0.9	

ATTACHMENT III

DPMC AREA VCM MONITORING DATA 5/1/80 - 9/31/80

<u>Stream No.</u>	<u>No. Alarms Reported</u>	<u>No. Days Affected</u>	<u>VCM Area Levels</u>		
			<u>Avg. Alarm</u>	<u>Peak</u>	<u>Max. No. >1.0</u>
* 1	9 (9/10-5/31)	9	1.20	3.1	2
* 2	13 (9/5-6/5)	10	2.00	>10.	5
* 3	7 (7/15-6/6)	4	2.03	4.1	5
* 4	12 (9/5-6/30)	7	1.38	7.2	4
* 5	23 (10/1-5/9)	14	.86	1.7	6
* 6	20 (9/19-5/3)	18	1.19	3.8	5
* 7	37 (9/5-5/5)	17	1.52	>10.	15
* 8	15 (9/26-5/2)	14	1.82	>10.	6
* 9	20 (9/22-5/5)	14	1.02	3.1	6
*10	30 (9/26-5/6)	21	1.26	8.0	15

<u>* Stream #</u>	<u>OSHA 10 POINT MONITORING SYSTEM</u>	<u>Area</u>
1	10' NE of EDC Rx E-6101 by P-6106	100
2	10' NE of Vent scrubber	100
3	Control Room	
4	5' E of V-6105 L.E. Accumulator by P-6105	100
5	20' SE of HCL Stripper Column C-6204	150
6	3' W of HCL Stripper Column C-6204	200
7	5' NE of HCL Column C-6202	200
8	Below and N end of Quench Column Accumulator V-6201	200
9	5' NE of Quench Column C-6201 (Furnace Area)	200
10	Tank farm pump pad E of P-6004B	Utility