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INDUSTRIAL HYGIENE REPORT TEXAS OPERATIONS

DOW CHEMICAL U.S.A.

FILE NUMBER: OC-3138-89C

DATE ISSUED: JULY 31, 1990

PLANT CODE: 58274

TITLE: EVALUATION OF EMPLOYEE EXPOSURES TO CHLORINATED HYDROCARBONS AT
THE UNIT I/VINYL CHLORIDE PLANT, OYSTER CREEK, 1989

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SUMMARY

Personnel monitoring was conducted in 1989 to evaluate employee exposures to vinyl chloride, ethylene dichloride, ethyl chloride, 1,1,1-trichloroethane, 1,1,2-trichloroethane, and carbon tetrachloride. Both 8-hour time-weighted average (TWA) and short-term exposures were evaluated.

Eight-hour TWA exposures were measured for Process Technicians and Contractors. The average exposures for each job classification were significantly less than the acceptable guidelines for each respective chemical with two exceptions. The Technicians in the loading area exceeded the OSHA Action Level for vinyl chloride and the Contractors exceeded the OSHA Permissible Exposure Limit (PEL) for ethylene dichloride (EDC). Quarterly monitoring is required for the Loading Technicians.

Short-term personal exposures were monitored during specific job activities including process sampling and analysis, tank car unloading activities, and during various maintenance activities. Exposures were within acceptable guidelines with a few exceptions. Process Technicians in the direct chlorination and repair areas exceeded the Short-Term Exposure Limit (STEL) for EDC and Process Technicians in the loading area and vinyl distillation area exceeded the STEL for vinyl chloride. New sampling systems have been implemented in the loading and direct chlorination areas to reduce exposures. Employees wear full face airline respirators whenever there is a significant potential for exposure.

Recommendations include follow-up monitoring to verify the effectiveness of the new sampling systems.

All personnel of Unit I have been informed of the results of this survey.

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**EVALUATION OF EMPLOYEE EXPOSURES TO CHLORINATED HYDROCARBONS
AT THE UNIT I/VINYL CHLORIDE PLANT, OYSTER CREEK, 1989**

INTRODUCTION

Personnel monitoring was conducted at the Unit I/Vinyl Chloride plant to evaluate employee exposures to vinyl chloride, ethylene dichloride, ethyl chloride, 1,1,1-trichloroethane, 1,1,2-trichloroethane, and carbon tetrachloride. Both short-term and 8-hour time-weighted average (TWA) exposures were evaluated as outlined in the 1988-89 protocol for Unit I (IHS File #OC-3138-89).

RESULTS AND CONCLUSIONS

1. Results of 8-hour TWA personnel monitoring are summarized in Table I. Process Technicians from seven areas of the plant and Contractors were monitored for exposures to vinyl chloride, ethyl chloride, 1,1,1-trichloroethane, 1,1,2-trichloroethane, carbon tetrachloride, and ethylene dichloride. The average exposures from all monitored job classifications were less than the acceptable guidelines with the two exceptions. The Loading Technicians exceeded the OSHA Action Level for vinyl chloride of 0.5 ppm and the Contractors exceeded the OSHA Permissible Exposure Limit (PEL) of 1 ppm for ethylene dichloride (EDC).
2. Individual 8-hour TWA exposures are summarized in Table II. Individual exposures were less than the acceptable guidelines with a few exceptions. One vinyl distillation technician and four loading technicians had exposures exceeding the OSHA PEL for vinyl chloride. The reason for the Vinyl Distillation technician exposure that exceeded the guideline was not identified. Short-term monitoring identified tank car sampling/analysis and Shintech meter test as a possible reason for the Loading Technician exposures.
3. One contractor sample exceeded the OSHA PEL for EDC. On the day in which this exposure occurred the contractor was breaking up cement with chlorinated hydrocarbons below it. The contractor exposure was potential as full face airline respirators were used while breaking up the cement.
4. Short-term personal exposures were monitored for Process Technicians during specific job activities including process sampling and analysis, tank car unloading activities, quench pump removal, E-35 head removal, and during the repair of a compressor (C-203). Results are summarized in Table III.
5. Short-term exposures were below acceptable guidelines with a few exceptions. The Process Technicians in the direct chlorination area had exposures that exceeded the short-term exposure limit (STEL) for EDC during sampling and analysis. Since the completion of this survey, a new sampling system with quick connect fittings has been installed in this area. Analysis procedures were also changed that included filling the sample vials in a laboratory hood as opposed to on an open lab bench.
6. Repair Technicians exceeded the STEL for EDC during the quench pump removal and E-35 (exchanger) head removal. These exposures were potential as full face airline respirators were used during both tasks.
7. One Process Technician in the vinyl distillation area had an exposure that exceeded the STEL for vinyl chloride. On the day in which this exposure occurred, the sample bomb O ring failed, causing a very brief elevated exposure.
8. One Process Technician in the loading area had an exposure above the STEL for vinyl chloride. A new sampling system remote from the tank cars has been installed in the loading area to reduce exposures.

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RECOMMENDATIONS

1. Follow-up excursion monitoring needs to be conducted for Process Technicians in the direct chlorination area to evaluate the effectiveness of the new sampling system in reducing exposures to EDC.
2. The average exposure for Loading Technicians exceeded the Action Level for Vinyl Chloride of 0.5 ppm, therefore quarterly monitoring is required. However, monthly monitoring is recommended as a significant number of the individual 8-hour TWA exposures exceeded the PEL of 1 ppm.
3. Follow-up 8-hour TWA and excursion monitoring needs to be conducted for Loading Technicians to verify the effectiveness of the new sampling system in the tank car unloading area in reducing exposures to vinyl chloride.
4. Full face airline respirators should continue to be used for line openings and manway removals.
5. An improved maintenance system for the sample bombs needs to be developed to reduce the chance of leaks.

EXPOSURE EVALUATION CRITERIA

The evaluation of the chemical exposure levels in this survey was based on the following criteria:

<u>AGENT</u>	<u>EXPOSURE GUIDELINE</u>	<u>SOURCE</u>
Vinyl Chloride	1 ppm - 8-hour TWA	OSHA - PEL
	5 ppm - STEL	OSHA - PEL
Ethylene Dichloride	1 ppm - 8-hour TWA	OSHA - PEL
	2 ppm - STEL	OSHA - PEL
1,1,1-Trichloroethane	350 ppm - 8-hour TWA	OSHA - PEL
	450 ppm - STEL	OSHA - PEL
Ethyl Chloride	1000 ppm - 8-hour TWA	OSHA - PEL
1,1,2-Trichloroethane	10 ppm - 8-hour TWA, Skin	OSHA - PEL
Carbon Tetrachloride	2 ppm - 8-hour TWA	OSHA - PEL

Eight-hour TWA exposures represent time-weighted average airborne concentrations for an 8 hour workday, 40 hour work week. Limited exposures greater than the 8-hour TWA are acceptable for most materials as long as the 8-hour TWA exposure does not exceed the acceptable guideline. Short-term exposure limits (STEL) are 15 minute TWA's and are established for materials which could cause adverse effects from brief exposures to elevated concentrations. For chemicals in which a short term acceptable guideline does not exist, excursion concentrations should not exceed three times the 8-hour TWA for more than a total of 30 minutes and under no circumstances should they exceed five times the 8-hour TWA. A "skin" ranking indicates the material may be absorbed through the skin and may cause effects other than at the point of contact with the skin.

**EVALUATION OF EMPLOYEE EXPOSURES TO CHLORINATED HYDROCARBONS
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SAMPLING AND ANALYSIS METHODOLOGY

Both 8-hour TWA and excursion samples were collected on 1 gram charcoal tubes using an air sampling pump. Pumps were calibrated before and after use at 50 cc/min for the 8-hour TWA samples and 200 cc/min for the excursion samples (as outlined in DLI-IHM-83-25A). Samples were collected by lab personnel from Unit I. Analysis was performed by Analytical Services.

Samples were also analyzed for vinylidene chloride and benzene however the data was inconclusive and the monitoring will be repeated.

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TABLE I
SUMMARY OF AVERAGE 8-HOUR TWA EXPOSURES
UNIT I/VINYL CHLORIDE, 1989

JOB CLASS/ JOB CODE	NUMBER OF SAMPLES	8-HOUR TWA CONCENTRATION (PPM) ^{1,2}	
		VINYL CHLORIDE	ETHYLENE DICHLORIDE
Process Technician			
Oxychlorination/ 12700580OX	4	ND (0.07)	0.06
Direct Chlorination/ 12700580DC	7	0.10	0.25
Vinyl Distillation/ 12700580VD	7	0.40	0.11
Vinyl Furnace/ 12700580VIF	4	0.09	0.18
By-Product Recovery/ 12700580BPR	4	0.09	0.14
Loading/ 12700580LO	10	0.94	ND (0.04)
Repair/ 12700580R	4	0.17	0.36
Contractor/ Utility Man	2	0.09	1.7
IHG (8-HR TWA) =		1	1

¹ Ethyl Chloride, 1,1,1-Trichloroethane, 1,1,2-Trichloroethane, and Carbon Tetrachloride were also monitored however all samples were less than 5% of their respective IHG's

² ND = non-detectable; The detection limit is in parenthesis.

TABLE II
SUMMARY OF INDIVIDUAL 8-HR TWA PERSONNEL EXPOSURES
UNIT I/VINYL CHLORIDE, 1989

JOB CLASSIFICATION	MASTER NUMBER	DATE	SAMPLE TIME (MIN)	8-HOUR TWA CONCENTRATION (PPM) ^{1,2}	
				VINYL CHLORIDE	ETHYLENE DICHLORIDE
Process Tech.					
Oxychlorination	202732	07-19-89	480	ND	0.07
	202732	07-20-89	480	ND	0.06
	202070	07-28-89	480	ND	0.06
	141895	08-08-89	425	ND	ND
Direct Chlorination	202468	06-16-89	480	ND	0.11
	206685	06-20-89	472	ND	0.34
	206685	06-22-89	480	ND	0.23
	206870	06-23-89	480	ND	0.44
	206870	07-13-89	480	0.19	0.35
	206142	07-14-89	480	0.13	ND
	206685	08-11-89	480	ND	0.26
Vinyl Distillation	202182	07-19-89	480	0.12	0.05
	202182	07-20-89	480	0.89	0.07
	144694	07-28-89	480	0.16	0.17
	202432	08-08-89	480	1.1	0.09
	202182	09-02-90	480	0.11	0.08
	144694	09-15-89	520	0.38	0.24
	202432	10-17-89	500	ND	0.07
Vinyl Furnace	202462	10-05-89	480	0.16	0.31
	202407	10-06-89	480	ND	ND
	206558	10-11-89	475	ND	0.20
	206558	10-18-89	480	ND	0.16
By-product Recovery	206801	10-05-89	480	0.14	0.30
	202221	10-06-89	495	ND	0.07
	206312	10-11-89	490	ND	0.13
	202221	10-18-89	480	ND	0.04
Loading	202337	03-21-89	420	0.91	ND
	202101	03-21-89	420	0.70	ND
	202337	05-11-89 ³	420	1.2	ND
	202101	05-11-89 ³	420	1.6	ND
	202101	08-11-89	425	0.47	ND
	202337	08-11-89	425	0.77	ND
	141102	10-19-89	480	0.49	ND
	202337	11-01-89	495	1.0	ND
	202337	11-03-89	500	1.4	ND
	141102	11-09-89	465	0.88	ND
Repair	206813	11-28-89	500	0.16	0.35
	202435	11-28-89	500	0.19	0.54
	281545	11-30-89	465	ND	0.49
	202800	10-19-89	450	0.24	ND
Contractor/Utility Man	606-10-2084	10-27-89	410	0.10	3.2
	461-89-1577	11-01-89	410	0.07	0.26

IHG (8-HR TWA) = 1 1

¹ Ethyl Chloride, 1,1,1-Trichloroethane, 1,1,2-Trichloroethane, and Carbon Tetrachloride were also monitored however all samples were less than 5% of their respective IHG's

² ND = non-detectable; Detection limits are as follows: Vinyl Chloride = 0.07 ppm, Ethylene Dichloride = 0.04.

³ Shintech meter test was performed during the sampling period; full face airline respirators were used during the meter test.

TABLE III
SUMMARY OF PROCESS TECHNICIAN SHORT-TERM EXPOSURES
UNIT 1, 1989

JOB CLASS	MASTER NUMBER	DATE	SAMPLE TIME (MIN)	SHORT-TERM CONCENTRATION (PPM) ^{1,2}		JOB TASK
				VINYL CHLORIDE	ETHYLENE DICHLORIDE	
Oxychlorination	202732	07-19-89	17	ND (0.39)	0.02	Sampling/analysis
	202732	07-20-89	30	ND (0.22)	0.35	Sampling/analysis
	202070	07-28-89	15	ND (0.44)	0.84	Sampling/analysis
			AVE. =	0.35	0.40	
Direct chlorination	202468	06-16-89	24	ND (0.67)	1.2	Sampling/analysis
	206685	06-20-89	17	ND (0.97)	6.6	Sampling/analysis
	206685	06-22-89	20	ND (0.33)	3.8	Sampling/analysis
	206870	06-23-89	24	0.02	4.1	Sampling/analysis
	206870	07-13-89	17	1.3	4.6	Sampling/analysis
	206142	07-14-89	22	ND (0.31)	ND (0.19)	Sampling/analysis
	206685	08-11-89	35	ND (0.30)	2.7	Sampling/analysis
			AVE. =	0.54	3.3	
Vinyl distillation	202182	07-19-89	15	3.3	ND (0.12)	Sampling/analysis
	202736	07-20-89	20	1.6	0.18	Sampling/analysis
	144694	07-28-89	60	0.61	0.71	Sampling/analysis
	202432	08-07-89	60	ND (0.09)	0.15	Sampling/analysis
	202182	09-02-89	21	ND (0.34)	0.71	Sampling/analysis
	144694	09-15-89	45	0.44	0.55	Sampling/analysis
	202432	10-17-89	30	ND (0.22)	0.19	Sampling/analysis
			AVE. =	3.0	0.37	
Cl furnace	202462	10-05-89	15	ND (0.44)	ND (0.28)	Sampling/analysis
	206558	10-11-89	20	ND (0.33)	1.9	Sampling/analysis
	206558	10-18-89	15	ND (0.43)	ND (0.28)	Sampling/analysis
			AVE. =	0.40	0.82	
By-product recovery	206801	10-05-89	30	0.38	0.75	Sampling/analysis
	206312	10-11-89	40	ND (0.17)	0.89	Sampling/analysis
	202221	10-18-89	30	ND (0.17)	0.73	Sampling/analysis
			AVE. =	0.24	0.79	
Loading area	141102	10-19-89	45	0.22	ND (0.10)	T/C Hook-up
	202337	11-01-89	20	0.51	ND (0.21)	T/C Hook-up
	202337	11-03-89	20	1.1	ND (0.21)	T/C Hook-up
	141102	11-09-89	40	0.17	ND (0.11)	T/C Hook-up
			AVE. =	0.50	ND (0.16)	
	141102	10-19-89	20	1.5	ND (0.21)	T/C Sampling
	202337	11-01-89	20	1.1	ND (0.21)	T/C Sampling
	202337	11-03-89	25	3.0	ND (0.21)	T/C Sampling
	141102	11-09-89	20	0.43	ND (0.21)	T/C Sampling
			AVE. =	4.0	ND (0.21)	
	141102	10-19-89	25	0.4	ND (0.17)	T/C Disconnect
	202337	11-01-89	20	0.96	ND (0.21)	T/C Disconnect
	202337	11-03-89	25	0.78	ND (0.17)	T/C Disconnect
	141102	11-09-89	25	0.28	ND (0.17)	T/C Disconnect
			AVE. =	0.63	ND (0.18)	

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TABLE III (CONTINUED)

JOB CLASS	MASTER NUMBER	DATE	SAMPLE TIME (MIN)	SHORT-TERM CONCENTRATION (PPM) ^{1,2}		JOB TASK
				VINYL CHLORIDE	ETHYLENE DICHLORIDE	
Repair	206813	11-28-89	17	ND (0.39)	0.61	Quench Pump
	202435	11-28-89	16	3.7	7.5	Quench Pump
			AVE =	2.1	4.1	
	202468	11-30-89	45	0.31	13.9	E-35 Head Removal
	202800	10-19-89	15	ND (0.43)	ND (0.27)	C-203 Repair
IHG (8-HR TWA) =				1	1	
IHG (STEL) =				5	2	

¹ Ethyl Chloride, 1,1,1-Trichloroethane, 1,1,2-Trichloroethane, and Carbon Tetrachloride were also monitored however all samples were less than 5% of their respective IHG's

² = non-detectable; Detection limits are in parenthesis