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WALK-THROUGH SURVEY

Ethyl Corporation
Pasadena, Texas

SURVEY CONDUCTED AND REPORT WRITTEN BY:

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DATE OF REPORT:

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ENVIRONMENTAL INVESTIGATIONS BRANCH
DIVISION OF FIELD STUDIES AND CLINICAL INVESTIGATIONS
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH
Cincinnati, Ohio

PLACE VISITED:	Ethyl Corporation P. O. Box 4721 Pasadena, Texas 17501
DATE OF VISIT:	May 9, 1974
PERSONS MAKING VISIT:	NIOSH Philip J. Bierbaum James H. Jones CDC Henry Falk, M.D.
PERSONS CONTACTED:	J. H. Browning, Operations Superintendent, Vinyl Chloride Plant J. G. Burdick, M.D., Plant Medical Director T. C. Coerver, Resident Manager Bob Maeser, General Superintendent, Administration W. E. Rinehart, Sc.D., Corporate Toxicologist David Watts, Industrial Hygienist T. C. Thurman, United Steelworkers of America Fabian Greenwell, United Steelworkers of America
PURPOSE OF VISIT:	To observe the operation of a vinyl chloride monomer plant and to obtain preliminary information on vinyl chloride exposure levels.

INTRODUCTION AND DESCRIPTION OF THE PLANT

The National Institute for Occupational Safety and Health (NIOSH) in coordination with the Center for Disease Control (CDC), has underway an industrywide study of the vinyl chloride industry in regard to the occurrence of occupationally-related disease, especially liver disease. Types of operations being studied include monomer and polymer production and polymer processing (fabrication).

On May 9, 1974, Philip Bierbaum and James Jones, Division of Field Studies and Clinical Investigations, NIOSH, conducted a walk-through survey of the Ethyl Corporation in Pasadena, Texas. The major purpose was to observe the manufacture of vinyl chloride (VC) monomer for the industrial hygiene portion of the industrywide study. Henry Falk, M.D. from CDC also was present for the purpose of obtaining information relevant to the medical (morbidity) portion of the study.

Products made at this facility include, tetraethyl lead, aluminum alkyl compounds, 2,6 diethyl aniline, α olefin, ethylene dichloride, sodium, chlorine, ferric chloride catalysts and vinyl chloride. The facility has been involved with VC production since 1960. The VC processing consists of one unit with two parallel cracking furnaces.

The entire workforce of the facility is approximately 1000 persons. Twenty persons are directly involved with the VC production. Another 15 persons perform maintenance work on VC process equipment. The plant operates on a three-shift basis, seven days per week. Production workers are members of the United Steelworkers of America, Local Union 16000. Maintenance workers are members of AFL-CIO craft unions.

MEDICAL, INDUSTRIAL HYGIENE, AND SAFETY PROGRAMS

The plant Medical Director, Dr. J. G. Burdick, is present at the plant on a part-time basis, performs all physical examinations and is available for emergencies.

General employment physical examinations are given to each employee, including chest x-rays and routine urine analysis. Employees are re-examined every 18 months to two years. Recently, all employees have had SMA-12 blood analysis performed for determination of abnormal liver functions. This test will be included in routine examinations hereafter.

Industrial hygiene activities are directed by Dr. W. E. Rinehart, who has offices at Ethyl's Baton Rouge, Louisiana plant. Area sampling for VC has been conducted at the plant since September 1973, using first, impingers,and later, charcoal tubes. In April 1974, a personal sampling program was begun using charcoal tubes. As of this walk-through, samples were taken for four hours in order to obtain a time-weighted average exposure. Results of plant VC monitoring, as of the date of this visit are presented in Attachments 1 and 2.

At the time of this visit, air supplied respirators were required when breaking into equipment for maintenance purposes. Double cartridge respirators were carried by all employees and were required to be worn when a definite possibility of vinyl chloride exposure existed. This included loading and unloading of tank cars and while taking VC samples for quality control, etc. Other than these respirator requirements, there were no specific industrial hygiene or safety requirements. There were no shower or clothing requirements.

DESCRIPTION OF VINYL CHLORIDE PROCESS*

Vinyl chloride is produced by the ethylene dichloride (EDC) cracking process. Ethylene and chlorine gases are first reacted in liquid phase to form EDC.

$$C_2H_4 + Cl_2 \longrightarrow CH_2ClCH_2Cl$$

The crude EDC is dryed and then fed to a purification column (tar column) to remove the heavy ends. The EDC is then vaporized and fed to a cracking column which operates at 460°C. About 50 percent of the EDC is cracked, and the gases are rapidly quenched by direct contact with a circulating stream of cold EDC.

$$CH_2ClCH_2Cl \xrightarrow{\Delta} CH_2{=}CHCl + HCl$$

This stream is fed with refrigerated EDC to an absorber where VC is absorbed in the EDC. Hydrogen chloride (HCl) is removed from the top of the absorber and EDC and VC from the bottom. The EDC and VC are then fed to a stripper where additional HCl is removed. The EDC and VC then go to a distillation column to separate the EDC and VC. VC is taken off the top of the column and EDC off the bottom. The EDC is then sent back to the tar column for recycling. VC is fed to a scrubbing column to remove any remaining HCl and then loaded in railroad tank cars for shipment.

INSPECTION OF THE PLANT

Since the purpose of this visit was to observe vinyl chloride production, this was the only part of the plant toured.

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* A list of raw materials used in this area of the plant is found in Table 1.

Table 1. CHEMICALS HANDLED IN VINYL CHLORIDE PRODUCTION AREA

Ethyl Corporation
Pasadena, Texas

May 9, 1974

Vinyl Chloride	140 million (MM) pounds per year
Ethyl Chloride	140 MM pounds per year
Hydrogen Chloride	83 MM pounds per year
Ethylene	138 MM pounds per year
Chlorine	190 MM pounds per year
Caustic Liquid, 50%	16 MM pounds per year
Sulfuric Acid, 98%	80 MM pounds per year
Aluminum Chloride	500,000 pounds per year
Ethylene Dichloride	260 MM pounds per year
Laboratory Reagents	

Potential Health Hazards

The major potential health hazard observed was respiratory exposure to gaseous VC. The major sources of VC exposure to workers occurs at the following operations:

1. Tank car loading and unloading
2. Quality control sampling of process
3. Fugitive leaks from such equipment as pumps, valves flanges, gaskets, etc.

Control Measures

Since all of the VC process equipment is located out-of-doors, mechanical ventilation is not a necessary control measure. The process is a closed system so a major control procedure is a good maintenance program to prevent leaks from occurring. For early detection of leaks, the plant has purchased a Century Organic Vapor Analyzer (OVA) which is direct reading and can detect small leaks that would otherwise be undetectable. An air-conditioned control room which contains process instrumentation is somewhat removed from the process. This is where several workers spend a large percentage of their time. A filtration system to remove organic vapors from incoming air is needed, especially since the workers prepare and eat food in the control room.

The plant has greatly reduced the amount of VC that was exhausted while loading and unloading tank cars by making piping changes that return VC to the system. They also have redesigned quality control sampling points to eliminate excess pipe downstream of sampling valves in order to reduce the amount of VC lost after sampling.

AIR SAMPLING PROCEDURES

During the tour of the VC process area, air concentrations of organic vapors were measured by the NIOSH personnel using a Century portable OVA. It was difficult to ascertain whether or not the meter readings represented just VC since the Century is a total hydrocarbon detector. In several instances, though, there was a high probability that readings were due to VC because of the location at which the readings were taken, (e.g., leaks from a VC pump). The results are summarized in Table 2.

CONCLUSIONS AND RECOMMENDATIONS

During the time since January 22, 1974, when the B. F. Goodrich Company first announced the occurrence of possible occupationally-induced angiosarcoma of the liver, much has occurred to substantiate the claim that exposure to VC can lead to angiosarcoma of the liver. A total of 25 occupationally-related cases of angiosarcoma of the liver have no been reported throughout the world.[1] This includes one VC monomer plant worker, one worker filling aerosol cans with VC propellant, two vinyl cloth plant workers, and 21 VC polymerization plant workers. Animal studies have shown that exposure of 50 ppm VC and probably lower lead to tumors.[2]

In light of this information, the Occupational Safety and Health Administration (OSHA) has set an emergency temporary standard of 50 ppm ceiling exposure to VC.[3] NIOSH has recommended[4] and OSHA is considering a permanent standard allowing no exposure to VC.[5]

Table 2. RESULTS OF ORGANIC VAPOR MEASUREMENTS

Ethyl Corporation
Pasadena, Texas

May 9, 1974

Location	Level (ppm)
Background	10
Control Room	40*
In vicinity of sampling port--alumina tanks	20
In vicinity of sampling port--bottom of stripper	30
In vicinity of VC pumps (leaks)	200 ——→1000
During loading of tank car	20
In vicinity of sampling port (while worker was drawing sample)	50-100

* Probably EDC not VC because of proximity of EDC process.

From the observations made during this visit, it is apparent due to the closed system and outdoors operation, that for the majority of the time, worker exposure to VC is quite low. Diligent testing and prompt maintenance work must be utilized to maintain the integrity of the VC process.

During few operations where VC exposure potential cannot be eliminated, employees should continue to utilize air supplied respiratory protection. The current practice of using cartridge respirators is not recommended because of the short life of these cartridges for VC. Breakthrough times at 50 ppm VC are approximately 15 minutes. Of major importance is the education of the worker, by both management and labor sources, of the importance for their own health of using respiratory protection.

NIOSH is presently funding research by the Bendix Launch Support Division to determine typical employee exposures to VC in the VC monomer production industry. This report is being forwarded to them and the possibility exists that they will be doing further studies at this plant.

REFERENCES

1. Wagoner, J.K., "Statement Before the Subcommittee on the Environment of the United States Senate Commerce Committee", August 21, 1974.

2. Maltoni, C. and Lefemine, G., "Le potenziailta dei saggi spirimentali nella predizione dei rischi oncogeni ambientali. Un esempiol il chloruro di vinile", Rend. Sci. fis. mat. nat. (Lincei), 66, 1-11 (1974).

3. U. S. Code of Federal Regulations, "Occupational Safety and Health Administration emergency temporary standard for exposure to vinyl chloride." April 5, 1974, 1910.93g, Washington, D.C., U. S. Government Printing Office, pp. 1437-1438.

4. "NIOSH Recommended Standard for Occupational Exposure to Vinyl Chloride", Washington, D.C., U. S. Government Printing Office, 1974.

5. U. S. Code of Federal Regulations, "Proposed Occupational Standard for Vinyl Chloride to be Published in Federal Register by the Labor Department", May 6, 1974, 1910.93q, Washington, D.C., U. S. Government Printing Office, pp. 1567-1573.