INDUSTRIAL HYGIENE REPORT
PERCHLOROETHYLENE

at

Gold Medal Cleaners
1123 Central Avenue, Wilmette
Chicago, Illinois 60651

IWS-71.39

SURVEY CONDUCTED BY:
Dennis R. Roberts
Tom Maham

DATE OF SURVEY:
July 16, 1979

REPORT WRITTEN BY:
Dennis R. Roberts

DATE OF REPORT:
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REPORT #
71.39

Industrial Hygiene Section
Industry-wide Studies Branch
Division of Surveillance, Hazard Evaluations and Field Studies
National Institute for Occupational Safety and Health
Cincinnati, Ohio

PURPOSE OF SURVEY:	This survey is part of industrywide mortality and industrial hygiene studies of dry cleaning workers exposed to perchloroethylene. Current exposure levels of perchloroethylene were determined.
EMPLOYER REPRESENTATIVE CONTACTED:	Ed Fishman Owner
EMPLOYEE REPRESENTATIVE CONTACTED:	Mrs. Learner Laundry, Dry Cleaning and Dye House Workers International Union Local #46
STANDARD INDUSTRIAL CLASSIFICATION OF PLANT:	7216

Mention of a company or its products does not constitute endorsement by the National Institute of Occupational Safety and Health.

ABSTRACT

An industrial hygiene survey of an Illinois dry cleaning facility using perchloroethylene (PCE) was conducted in July 1979. Air samples were collected using battery-operated pumps and charcoal tubes. The exposure to PCE of the dry cleaner/spotter was 28 ppm. Peak exposures over 5-minute intervals to the dry cleaner/spotter during garment transfer were 51 and 7.3 ppm; a 15-minute peak sample during transfer was 24 ppm of PCE.

INTRODUCTION

The National Institute for Occupational Safety and Health (NIOSH) is required under Section 20(a)7 of the Occupational Safety and Health Act of 1970 to conduct and publish industrywide studies of the effect of chronic or low level exposure to industrial materials, processes, and stresses on the potential for illness, disease, or loss of functional capacity in aging adults.[1] The industrywide study of workers using perchloroethylene (PCE) was initiated in response to a long-term study reported by the National Cancer Institute (NCI) in October 1977 demonstrating PCE to be carcinogenic in laboratory mice.[2] The results of this experiment were similar to those seen in studies with trichloroethylene, i.e., an increase in hepatocellular carcinoma in mice. Substances that cause cancer in experimental animals must be considered potentially capable of inducing cancer in man. Although a safe threshold limit for exposure to carcinogenic substances has not been shown, the probability of cancer development may be lessened by decreasing exposure. To date, the effects on humans from long-term low-level exposure to PCE is unknown.

In January 1978, NIOSH recommended that PCE in the workplace be handled as if it were a human carcinogen (see Attachment I).[3] This was an interim recommendation, pending further study of the carcinogenic potential of PCE in the workplace. A NIOSH study will assess the health effects from exposure to PCE by analysis of cause specific mortality among an identified group of dry cleaning workers. A cause of death for each individual in the cohort will be determined retrospectively and the observed deaths will be compared to those expected based on a matched control population. The industrial hygiene evaluation at this facility will supplement the mortality study by documenting the extent of exposure to PCE and historic changes in dry cleaning techniques and work practices.

DESCRIPTION OF THE FACILITY AND WORK FORCE

Gold Medal Cleaners has been using PCE as a dry cleaning solvent at this location since 1958. The facility is housed in a one-story building with dimensions of approximately 50 feet by 100 feet. About 200 gallons of PCE are consumed each month during dry cleaning and about 3750 lbs. of clothing are dry cleaned each week. The work force of 11 includes the dry cleaner/spotter, two pressers, two shirt operators, and an inspector on the full-time staff with four counter clerks and the janitor as part-time employees.

DESCRIPTION OF PROCESS

Process equipment includes a 110 lb. capacity washer and a 110 lb. capacity dryer as well as a smaller capacity dryer for special items such as delicates. Clothing is loaded into the washing unit and agitated

in PCE for 15 minutes. After the PCE is drained, excess PCE adhering to the garments is extracted by centrifugal spinning for 5 minutes and also drained. The dry cleaner then manually transfers the clothes into one of the dryers. The transfer operation takes about a minute and the clothes are dried for 15 minutes followed by a 5-minute cooling cycle. There are about 30 washing-drying cycles per week. PCE extracted following the washing cycle is piped to a solvent maintenance system where demucking (filtering) and cooking (distilling) takes place. Back-washing of the filter and distilling the PCE for reuse is done daily. All process equipment is vented through a charcoal adsorber. Bulk deliveries of PCE are made by truck when needed.

DESCRIPTION OF PAST EXPOSURES

Air samples for PCE were previously collected by the PCE supplier but the results were not available. The dry cleaner felt that exposures to PCE had not changed much over past years since the same dry cleaning equipment has been in use for many years and the volume of business has not increased drastically.

DESCRIPTION OF MEDICAL, INDUSTRIAL HYGIENE AND SAFETY PROGRAMS

There are first aid supplies on the premises, but there is no one with formal first aid training. There is a routine maintenance program every six months to inspect gaskets and seals and check for leaks. Respiratory protection is available for use during emergency situations, however, the respirator components are not NIOSH-approved.

DESCRIPTION OF SURVEY METHODS

Personal air samples were collected in the breathing zone of the dry cleaner using 150 milligram SKC, Inc. activated charcoal tubes. Area samples were collected at the pressing station and in the dry cleaning area. Peak samples were also collected in the breathing zone of the dry cleaner/spotter over 5-minute and 15-minute periods. During this time, about a minute was spent loading and unloading the dry cleaning machine; the remainder of the time was spent doing spotting or hanging clothes. The sampling pumps used were MDA Accuhalers, which were calibrated at a flow rate of 20 milliliters per minute for personal and area samples and 100 milliliters per minute for peak samples. The air samples were analyzed using NIOSH Method Number P&CAM 127.[4] The samples were desorbed with carbon disulfide and analyzed by a gas chromatograph equipped with a flame ionization detector. No other substances were observed in significant quantities in the analysis. A Turner Model L9-1157 halide torch was used to detect sources of PCE leaks. Temperature and relative humidity measurements were made with an Environmental Tectonics Corporation Model CP-147 Psychrometer. Ventilation air velocities were measured with an Alnor type 8100 velometer.

RESULTS AND DISCUSSION

The day of the survey was fairly typical at this facility. Five loads of clothing were dry cleaned with dry cleaning completed at 1:00 p.m. The results of air samples collected for PCE are reported in Table 1. During the 153 minutes of dry cleaning, the dry cleaner/spotter's time-weighted average (TWA) exposure was 28 parts of PCE per million parts of air (ppm). Average exposures to PCE at the pressing station and in the dry cleaning area were 0.5 and 33 ppm, respectively. The PCE concentrations of two 5-minute peak samples collected during garment transfer were 51 and 7.3 ppm; a 15-minute peak sample was 24 ppm. The exhaust ventilation into the washer measured 100 feet per minute with the door open and there were no leaks detected with the halide torch with the door closed. Temperature and relative humidity readings are reported in Table 2. Dry bulb temperatures ranged from 25.3 to 25.8°C with the relative humidity varying between 50 and 55 percent.

CONCLUSIONS AND RECOMMENDATIONS

The current Occupational Safety and Health Administration (OSHA) standard[5] for occupational exposure to PCE was originally adopted in August 1977. The permissible 8-hour TWA concentration is 100 ppm. The acceptable ceiling concentration is 200 ppm, not to exceed a maximum peak of 300 ppm for 5 minutes in any 3 hour period.

In July 1976, NIOSH recommended that no employees be exposed to PCE in excess of 50 ppm, determined as a TWA for up to a 10-hour work day, 40-hour work week, and also recommended that a ceiling concentration of 100 ppm as determined by 15-minute samples, twice daily, not be exceeded.[6] The OSHA standard or the NIOSH recommendation may not provide adequate protection from the potential carcinogenic effects because they were selected to prevent toxic effects other than cancer (i.e. liver and kidney damage, irritation of the eyes and upper respiratory tract, central nervous system depression, etc.).

The results of the sampling conducted on July 16, 1979, indicate that exposures to PCE are well within the current standards. However, since the question of PCE being a carcinogen has not as yet been answered, it is recommended that exposure to PCE be limited as much as possible. Enclosed as Attachment III is the NIOSH Recommended Standard for Occupational Exposure to Tetrachloroethylene (PCE). Recommendations in this attachment include:

1. Preplacement physical examinations.

2. Engineering controls such as exhaust ventilation (if warranted).

3. Respiratory protection for use during emergencies, such as spill clean-up. A NIOSH-approved chemical cartridge respirator should be obtained. (See Attachment IV, NIOSH Certified Equipment List, DHEW (NIOSH) Pub. No. 79-107.)

4. Protective clothing to prevent skin contact (i.e. gloves, which are impervious to PCE, worn during transfer of garments. An IAPA memorandum rates polyvinyl alcohol gloves as excellent for use with PCE).

5. Informing all employees as to the hazards, relevant symptoms, effects of overexposure to, and the precautions concerning the safe use and handling of PCE.

6. Storage containers, equipment, piping, and valves should be checked periodically for leakage and repaired as needed.

BIBLIOGRAPHY

1. Williams-Steiger Occupational Safety and Health Act of 1970, Public Law 91-596, 91st Congress, S.2193, December 29, 1970.

2. Bioassay of Tetrachloroethylene for Possible Carcinogenicity, DHEW Publication No. (NIH) 77-813, U.S. Department of Health, Education, and Welfare, Public Health Service, National Institute of Health, National Cancer Institute, October 1977.

3. Current Intelligence Bulletin 20, Tetrachloroethylene (perchloroethylene) DHEW (NIOSH) Publication No. 78-112. U.S. Department of Health, Education, and Welfare, Public Health Service, Center for Disease Control, National Institute for Occupational Safety and Health, January 1978.

4. NIOSH Manual of Analytical Methods, DHEW (NIOSH) Publication No. 77-157-A,C. U.S. Department of Health, Education, and Welfare, Public Health Service, Center for Disease Control, National Institute for Occupational Safety and Health, April 1977.

5. General Industry Standards, U.S. Department of Labor, Occupational Safety and Health Administration, OSHA 2206, Revised November 7, 1978, GPO Stock No. 029-015-00054-6.

6. Criteria for a recommended standard . . . Occupational Exposure to Tetrachloroethylene (perchloroethylene). HEW (NIOSH) Publication No. 76-185. U.S. Department of Health, Education, and Welfare, Public Health Service, Center for Disease Control, National Institute for Occupational Safety and Health, July 1976.

7. Technical Services Memorandum #8, Glove Selection Chart, Industrial Accident Prevention Association, Toronto, Canada.

Table 1

Perchloroethylene Exposures at Gold Medal Cleaners
(Chicago, Illinois) on 7/16/79

Sampling Time	Sample Description	Concentration (ppm)
1042-1315	Dry Cleaner/Spotter	28
1052-1336	Area, Pressing Station	0.5
1058-1243	Area, Near Washer	33
1110-1115	Peak Sample During Transfer	51
1141-1146	Peak Sample During Transfer	7.3
1152-1207	Peak Sample During Transfer	24

Table 2

Temperature and Relative Humidity Readings at
Gold Medal Cleaners (Chicago, Illinois) on 7/16/79

Time	Temperature, °C		% Relative Humidity
	Dry Bulb	Wet Bulb	
1100	25.3	18.9	55
1200	25.6	18.9	52
1300	25.8	18.6.	50

ATTACHMENT II
GOLD MEDAL CLEANERS (CHICAGO, ILLINOIS)
PLANT LAYOUT