U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
CENTER FOR DISEASE CONTROL
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH
CINCINNATI, OHIO 45226

HEALTH HAZARD EVALUATION DETERMINATION
REPORT NO. 76-57-307

CHEM CLEAN
HUDSON FALLS, NEW YORK
JULY 1976

I. TOXICITY DETERMINATION

A health hazard evaluation was conducted by the National Institute for Occupational Safety and Health (NIOSH) at Chem Clean, a furniture stripping and refinishing shop in Hudson Falls, New York, on April 22, 1976. Breathing zone and general area air samples were taken to determine employees exposure to xylene, dimethylformamide, benzene and toluene.

Based on the analysis of environmental samples and the review of medical interviews, it was determined that the employees working in this plant were not exposed to harmful concentrations of solvents on the day of this study which was considered a normal work day. It is recommended, however, that the current practice of respirator use be continued during periods of potential exposure.

II. DISTRIBUTION AND AVAILABILITY OF DETERMINATION REPORT

Copies of this Determination Report are available upon request from NIOSH, Division of Technical Services, Information Resources and Dissemination Section, 4676 Columbia Parkway, Cincinnati, Ohio 45226. Copies have been sent to:

a) Chem Clean
b) U.S. Department of Labor - Region II
c) NIOSH - Region II

For the purpose of informing the two affected employees, the employer shall promptly "post" for a period of 30 calendar days the Determination Report in a prominent place(s) near where exposed employees work.

III. INTRODUCTION

Section 20(a) (6) of the Occupational Safety and Health Act of 1970, 29 U.S.C. 669 (a) (6), authorizes the Secretary of Health, Education and Welfare following a written request by an employer or authorized representative of employees, to determine whether any substance normally found in the place of employment has potentially toxic effects in such concentrations as used or found.

The National Institute for Occupational Safety and Health (NIOSH) received such a request from the employer to evaluate potential hazards to employees in the furniture stripping and refinishing operations at Chem Clean.

IV. HEALTH HAZARD EVALUATION

A. Process Description

Furniture stripping at Chem Clean is a two step operation. Objects to be stripped are placed in an automatic stripping machine which is an enclosure approximately six feet high and four feet square. The objects sit on a turntable inside the machine and are sprayed with stripping solvent during a ten minute cycle. The machine and the process both resemble a large dish washing operation. At the end of the cycle, the operator removes the objects from the automatic stripper and completes the stripping procedure on a large metal work table. He uses an abrasive agent to loosen remaining finish and hoses solvent onto the object to wash the finish off. At the end of the operation, excess solvent is wiped from the object, and it is placed in front of an air exhaust to dry.

A small, covered, agitated dip tank (referred to as the "GE machine") is used to submerse small painted objects in stripping solvent. This tank remains covered except for two or three periods per day of approximately ten minutes each during removal or addition of objects. One employee also spends varying amounts of time involved in a spray painting operation.

B. Evaluation Design

Environmental samples were collected from the breathing zones of both the refinisher and the stripper by the use of battery powered personal sampling pumps worn by those people. Similar pumps also were placed in fixed locations throughout the work area. Atmospheric contaminants were collected by adsorption onto the charcoal and were subsequently analyzed by gas chromatography for the various compounds. Attempts to measure peak concentrations of xylene were made by using detector tubes.

Measurements of air flow were made throughout the work area under various conditions by the use of an Alnor "Senior" velometer. Medical and occupational histories were taken.

C. Evaluation Criteria

The maximum xylene concentration considered safe for exposure up to ten hours per day, or forty hours per week, is 100 parts of xylene per million parts of air (approximately 434 milligrams per cubic meter). This value is recommended by both NIOSH[1] and The American Conference of Governmental Industrial Hygienists[2], and is also the current OSHA standard[3]. A ceiling concentration of 200 PPM (approximately 868 mg/m^3) is recommended by NIOSH

as a value not to be exceeded even for short periods of time. According to Patty[4], the absorption of xylene through the skin is not of industrial significance.

Dimethylformamide (DMF) has a recommended threshold limit value (TLV)[2] and an OSHA standard[3] of 10 PPM (30 mg/m^3). It is capable of being absorbed through the skin with resulting abdominal pain and liver damage.[5]

The criteria for toluene exposure recommended by NIOSH[6] is 100 PPM (375 mg/m^3) as a time-weighted average for an eight hour work-day, with a ceiling value of 200 PPM (750 mg/m^3) not to be exceeded. ACGIH[7] also recommends a 100 PPM time weighted average TLV although it does not set a maximum concentration.

Since xylene, DMF, and toluene are present simultaneously in the work environment, their combined effects should be considered as additive. If the sum of the fractions

$$\frac{C_x}{TLV_x} + \frac{C_{DMF}}{TLV_{DMF}} + \frac{C_T}{TLV_T}$$

is greater than one, then the threshold limit value of the mixture should be considered as being exceeded. C_x, C_{DMF}, and C_T indicate the concentration of xylene, DMF, and toluene respectively, found in a sample. TLV_x, TLV_{DMF}, and TLV_T indicate the threshold limit value of xylene, DMF and toluene.

D. Evaluation Results

The concentrations of xylene, DMF and toluene measured during this investigation are shown in Table 1. No benzene was detected. Most samples were of approximately four hour duration, the first two sets being taken with the personal sampling equipment carried by the workers. Concentrations of xylene up to the TLV were estimated for short periods of time within a foot of the work table with the use of detector tubes, but peak concentrations were no more than a fourth of the TLV in the workers' breathing zones.

Measurements of air velocity at the slot exhaust on the work table indicated an average air flow of approximately 2200 feet per minute. This is 10% greater than the velocity recommended for this type of system by the ACGIH[8]. General exhaust ventilation, totaling approximately 5500 cubic feet per minute when the work table ventilation is not in operation, is sufficient to produce an air change in the shop every few minutes.

Evaluation of the medical and occupational histories did not indicate any abnormalities which were attributable to exposure to either xylene, DMF, or toluene.

E. Summary and Conclusions

Based on environmental sampling and review of medical information, it is concluded the employees are not exposed to toxic levels of vapors from the stripping or refinishing operations. It is important, however, that current safety measures be continued.

V. RECOMMENDATIONS

Since the use of respirators has become an accepted work practice in this plant, and since xylene and toluene have ceiling TLV's, it is recommended that the current practice of using respirators during periods of potentially high exposure to solvent vapors be continued. Even though solvent concentrations were generally well below potentially toxic levels during this survey, higher concentrations could result from such factors as a decrease in ventilation, a longer work day due to a heavy work load, or higher vapor pressure of the solvent during hot weather.

Storage of respirators should be away from areas of solvent usage and in airtight containers. Respirators should be cleaned periodically and inspected for cracks, bad seals, worn or missing gaskets, worn straps, etc.

From the description of the process of cleaning the automatic stripper it is felt that this is a potentially dangerous situation. Since the worker is entering a somewhat confined space, and since there is a high probability of extremely high concentrations of solvent vapor and possibly low concentrations of oxygen near the floor, it is strongly recommended that a second person be nearby during the process, outside the enclosure but within constant visual contact with the first person, to give immediate assistance in case of dizziness or unconsciousness. Due to the short duration of this process, the nature of the operation, and safety precautions already in effect (such as respirators, protective clothing, and removal of as much solvent as possible), more elaborate precautions do not appear practical.

Periodic visual inspections should be made of the ventilation system, including ducts and outlets, to maintain a clean and efficient system.

These recommendations are intended to supplement, not replace, the current work practices. Continued careful and intelligent handling of these chemicals, including the use of personal protective equipment such as gloves and aprons, is encouraged.

VI. REFERENCES

1. Criteria for a Recommended Standard, Occupational Exposure to Xylene, 1975, NIOSH

2. Documentation of the Threshold Limit Values for Substances in Workroom Air, 1971, ACGIH

3. U.S. Department of Labor, Occupational Safety and Health Standards, Federal Register Title 29, Part 1910.1000

4. Patty, F.A., Ed., Industrial Hygiene and Toxicology, Volume II, Interscience Pub., 1963

5. Potter, H.P., "Dimethylformamide - Induced Abdominal Pain and Liver Injury," ARCH ENV HEALTH 27 (1973) 340

6. Criteria for a Recommended Standard, Occupational Exposure to Toluene, 1973, NIOSH

7. Threshold Limit Values for Chemical Substances and Physical Agents in the Workroom Environment with Intended Changes for 1975, ACGIH

8. Industrial Ventilation, A Manual of Recommended Practice, 13th Ed., 1974, ACGIH

VII. AUTHORSHIP AND ACKNOWLEDGEMENTS

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TABLE I

ATMOSPHERIC VAPOR CONCENTRATION

CHEM CLEAN COMPANY
HUDSON FALLS, NEW YORK

APRIL 22, 1976

DESCRIPTION	TIME PERIOD	CONCENTRATION, mg/m^3 XYLENE	TOLUENE	DMF
Personal Sample on Refinisher	A.M.	32.0	4.6	<0.2
	P.M.	20.4	3.7	<0.2
Personal Sample on Stripper	A.M.	43.1	<0.3	<0.3
	P.M.	17.1	1.3	<0.3
Area Sample - 4' from Work Tray	A.M.	38.0	<0.2	<0.2
	P.M.	15.4		
Area Sample - Breathing Zone Level, Directly above Work Tray	A.M.	46.5	<0.2	<0.2
	P.M.	7.9	0.6	<0.3
Area Sample - Breathing Zone Level, above GE machine	A.M.	47.2	1.1	<0.2
	P.M.	12.5	0.8	<0.3
Area Sample - In Storage Room	8 HR.	7.2	0.1	<0.1
Area Sample - Breathing Zone Level in Paint Spray Room	A.M.	17.3	2.6	<0.1
	P.M.	20.9	2.2	<0.7
Area Sample - Desk Level, Stripping Room	8 HR.	4.9	<0.4	<0.4