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. 76-35-301

THE WOOD SHED
BELLE MEAD, NEW JERSEY
JUNE 1976

I. TOXICITY DETERMINATION

A health hazard evaluation was conducted by the National Institute for Occupational Safety and Health (NIOSH) at The Wood Shed, a furniture stripping and refinishing shop in Belle Mead, New Jersey, on March 23 and 24, 1976. Breathing zone and general area air samples were taken to determine employees exposure to xylene and dimethylformamide. Medical records, including blood and urine analysis, were reviewed.

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

II. DISTRIBUTION AND AVIALABILITY 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) The Wood Shed
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 The Wood Shed.

IV. HEALTH HAZARD EVALUATION

A. Process Description

Furniture stripping at The Wood Shed is a two step operation. Objects to be stripped are placed in an automatic stripping machine which is an enclosure approximately seven feet high and five 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 the room to dry.

A large covered dip tank is used occasionally to submerse painted objects in stripping solvent, and spray painting is involved in the refinishing process. However, due to the nature and frequency of these exposures, it is not believed that there is a health hazard involved.

B. Evaluation Design

Environmental samples were collected from the breathing zone 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 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. Measurments of air flow were also made throughout the work area under various conditions.

Biological information included SMA 12's, blood counts, and urine analyses on exposed workers. Results of SMA 12's done previously on current and prior employees were also reviewed. Medical and occupational histories were also 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.

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

$$\frac{C_X}{TLV_X} + \frac{C_{DMF}}{TLV_{DMF}}$$

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

Results of blood and urine tests were evaluated against normally accepted standards for the various parameters being measured.

D. Evaluation Results

The concentrations of xylene and DMF measured during this investigation are shown in Table I. All samples were of approximately four hour duration, the first two sets being taken with the personal sampling equipment carried by the workers. In only one sample, that was taken on the stripper operator on the morning of March 24, did the concentration of contaminants approach the TLV. This sample was 95% of the combined TLV for xylene and DMF. Concentrations of xylene ranging from 100 to 500 mg/m^3 were estimated for short periods of time with the use of three detector tubes in areas and at times when respirators were being used.

Ventilation measurements indicated an air flow of approximately 100 feet per minute past the work tray under normal operation with clean filters in the paint spray room door. With that door open the air flow was 25 to 50% better. When measurements were made with dirty filters in the paint spray room door, air flow was 25 to 50% lower than when the filters were replaced by clean ones.

Evaluation of the medical data did not indicate any abnormalities which were attributable to exposure to xylene or DMF. Evaluation of both current employees was done by using non-directed medical questionnaires, complete blood counts, urinalyses, and SMA 12's (including a liver profile of total bilirubin, alkaline phosphates, LDH and SGOT). No abnormalaties were detected on any test. Also, a review of medical records of previous employees showed no abnormalities that would indicate toxic exposures to the compounds being studied.

E. Summary and Conclusions

Based on environmental sampling and review of medical records, it is concluded that employees are not exposed to toxic levels of vapors from the stripping operation. It is important, however, that current safety measures be continued. Also, since one set of measurements indicated potentially toxic concentrations of solvents, recommendations to further reduce such concentrations are included.

V. RECOMMENDATIONS

Since the use of respirators has become an accepted work practice in this plant, and since xylene has a ceiling TLV, 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 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.

Currently at the finish of the stripping process, the objects that have been stripped are placed in the work area to dry. If these objects could be placed in the paint spray room in front of the exhaust, the solvent evaporating off of them would not contaminate the work area, and since there is a higher air flow in this new location they also would dry faster.

The frequent replacement of paint spray room door filters and exhaust filters will insure maximum air flow through the work area.

Consideration should be given to replacement of the present work table with one which is vented along two sides. There are indications that such a table would significantly reduce vapor concentrations.

From the description of the process of cleaning both the automatic stripper and the dip tank, it is felt that this is a potentially dangerous situation, especially with regard to the dip tank. Since the worker is entering a somewhat confined space (and in the case of the dip tank, with no ventilation), and since there is a high probability of extremely high concentrations of solvent vapor and possibly low concentrations of oxygen, it is strongly recommended that a second person be standing by 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.

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, Fe-eral 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

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Table 1

Atmospheric Concentrations of Xylene and DMF

March 23 and 24, 1976

The Wood Shed
Belle Mead, New Jersey

Location	Time Period	Xylene		DMF	
		mg/m^3	ppm	mg/m^3	ppm
Personal sample on stripper operator	Mar. 23 am	24.4	5.2	<2.4	<.7
	Mar. 23 pm	262.9	55.6	<1.4	<.4
	Mar. 24 am	254.2	53.7	13.3	4.1
Personal sample on refinisher	Mar. 23 am	15.4	3.3	<1.5	<.5
	Mar. 23 pm	47.1	10.0	<1.1	<.3
	Mar. 24 am	36.0	7.6	<1.2	<.4
Breathing zone level, near automatic stripper	Mar. 23 am	68.7	14.5	<.8	<.2
	Mar. 23 pm	109.8	23.2	<.8	<.2
	Mar. 24 am	150.0	31.7	<1.9	<.6
Breathing zone level, work table room	Mar. 23 am	62.4	13.2	<1.0	<.3
	Mar. 23 pm	112.2	23.7	<1.1	<.3
	Mar. 24 am	146.1	30.9	<1.3	<.4
Breathing zone level, paint spray room	Mar. 23 am	55.1	11.6	<1.0	<.3
	Mar. 23 pm	63.3	13.4	<1.3	<.4
	Mar. 24 am	95.7	20.2	<1.4	<.4