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. 77-104-446

ARAPAHOE PATTERN COMPANY
ENGLEWOOD, COLORADO

NOVEMBER 1977

I. TOXICITY DETERMINATION

A health hazard evaluation was conducted by the National Institute for Occupational Safety and Health (NIOSH) at the Arapahoe Pattern Company, Englewood, Colorado, on September 28 and 29, 1977. At the time of this evaluation, breathing zone air samples were taken on all workers for methyl ethyl ketone (MEK), isopropanol, acetone, and wood dust. Concentrations of MEK, isopropanol, and acetone were below the most recent evaluation criteria. The non-allergenic wood dust evaluation criteria was exceeded in one out of six samples. Confidential employee interview forms were completed on all workers. One of the workers complained of nasal congestion and an allergic reaction to mahogany dust. Dermatitis was also found on another worker which could have been work related. None of the other workers had complaints. A health hazard existed at the time of this survey. This conclusion is based on confidential employee interview forms and the overexposures to wood dust.

II. DISTRIBUTION AND AVAILABILITY

Copies of this determination report are currently available upon request from NIOSH, Division of Technical Services, Information and Dissemination Section, 4676 Columbia Parkway, Cincinnati, Ohio 45226. After 90 days the report will be available through the National Technical Information Service (NTIS), Springfield, Virginia. Information regarding its availability through NTIS can be obtained from NIOSH, Publications Office, at the Cincinnati address.

Copies of this report have been sent to:

A. Arapahoe Pattern Company
B. International Office, Patternmakers League of North America (Los Angeles)
C. Patternmakers League of North America (Denver)
D. U.S. Department of Labor/OSHA - Region VIII
E. NIOSH - Region VIII

For the purpose of informing the six affected employees, a copy of this report shall be posted in a prominent place accessible to the employees for a period of 30 calendar days.

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 any 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.

NIOSH received such a request from the Patternmakers League of North America, Denver, Colorado, to evaluate potential exposures associated with the making of wood patterns that are to be used in a non-ferrous foundry.

IV. HEALTH HAZARD EVALUATION

A. Process Evaluated (Pattern Shop)

The Arapahoe Pattern Company manufactures wood patterns that are to be used in the Arapahoe Foundry located in an adjoining building. Wood patterns are made by carefully machining, planing, and sanding of wood to develop a pattern that is later used in the foundry to make non-ferrous (usually aluminum) products. During the woodworking process, various wood dusts are generated. Among one of the most hazardous is mahogany. Various filler compounds and paints are used that contain MEK, isopropanol, and acetone.

B. Evaluation Design and Methods

Breathing zone air samples to determine the concentrations of MEK, isopropanol, and acetone were taken on all workers in the pattern shop, using organic vapor charcoal tubes and low volume pumps operated at approximately 50 cubic centimeters per minute. Wood dust samples were taken on pre-weighed filters, using pumps operated at 1.5 liters per minute. All charcoal tube samples were analyzed by gas chromatography according to NIOSH method #127. All workers were interviewed.

C. Criteria for Assessing Workroom Concentrations of Air Contaminants

The three sources of criteria used to assess workroom concentrations of air contaminants were: (1) recommended threshold limit values (TLV's) and their supporting documentation as set forth by the American Conference of Governmental Industrial Hygienists (ACGIH), 1976; (2) Occupational Safety and Health Administration (OSHA) standards (29 CFR 1910), January 1976; and (3) NIOSH criteria for recommended standard for isopropanol, March 1976.

Substances	TLV	Permissible Exposures 8-Hour Time-Weighted Exposure Basis (mg/M^3) OSHA Standard	NIOSH Criteria For Recommended Standard
Methyl Ethyl Ketone . . .	590	590	---
Isopropanol	980	980	980
Acetone	2400	2400	---
Wood Dust*	5	---	---

mg/M^3 = approximate milligrams of substance per cubic meter of air

* = the non-allergenic TLV of 5 mg/M^3 will protect the non-sensitized worker. This level would not provide adequate protection for a sensitized worker. Mahogany is used in this shop and is a strong sensitizer and also produces dermatitis.

Occupational health standards are established at levels designed to protect individuals occupationally exposed to toxic substances on an 8-hour per day, 40-hour per week basis over a normal working lifetime.

D. Toxicology

1. Methyl Ethyl Ketone (MEK)

MEK is a widely used industrial solvent. Prolonged exposures above 590 mg/M^3 may cause mucous membrane irritation, nausea, vomiting, dermatitis, headache, and paresthesias. Workers strongly object to its odor. However, there have been very few reports of serious ill effects.

2. Isopropanol

Overexposures to isopropanol are rare. Isopropanol acts as a local irritant and in high concentrations as a narcotic. It can cause corneal burns and often eye damage. It is not considered an important industrial toxic hazard. It should be noted that in the production of isopropanol, hazardous compounds are used.

3. Acetone

Acetone is one of the least hazardous of the volatile solvents. Eye, nose, and throat irritation occur only after very high exposures such as in tanks and closed compartments. Narcotic (anesthetic) effects with headache, drowsiness, and incoordination should not occur under usual conditions.

Acetone is not known to produce chronic or accumulative systemic effects. Repeated and prolonged skin contact with the liquid can cause dryness and mild irritation of the skin.[1]

A concentration of 2400 mg/M^3 would not produce narcotic symptoms or mucous membrane irritation. It is practically devoid of inhalation hazard.[2]

4. Wood Dust

The health effects from exposure to wood dust concern four categories: cancer, dermatitis, respiratory disease, and miscellaneous. Cases of cancer of the nasal cavity and sinuses have been reported among chair and cabinetmakers and wood machinists in the furniture industry of Great Britain. The carcinogenic agent is believed to be derived from some constituent of hard wood. The types of wood involved are oak, beech, and mahogany. Other woods have also been implicated. Dermatitis may develop from handling of almost any wood, both domestic and imported. Respiratory conditions resulting from exposure to wood dust range from bronchial asthma to fibrotic lung conditions.[3]

E. Environmental Results and Discussion

Results of environmental sampling showed that workers were not overexposed to MEK, isopropanol, and acetone. One out of six workers was overexposed to wood dust. The other five workers were receiving exposures, but they were below the evaluation criteria. However, the mahogany dust should be decreased as much as possible, since it is a suspect carcinogen. All workers were monitored, and results may be reviewed in Tables I and II.

Ventilation was provided at each work station. The air velocity was about 200 linear feet per minute at each station. This is adequate to exhaust the wood dust that is produced. However, the flexible hose was not long enough in most cases to extend to the work site. The ventilation hose was improperly positioned. All workers were interviewed. Two workers complained of upper respiratory irritation, and one worker had an active case of dermatitis on his arms. These symptoms could be work related.

There were numerous safety hazards located throughout the pattern shop. These consisted of electrical extension cords across aisles and inadequate fire extinguishers. There was no clean area provided for eating meals.

Conclusions

Results of environmental data and confidential employee interviews illustrate that a health hazard existed from exposures to wood dust at the time of this evaluation.

V. RECOMMENDATIONS

1. Ventilation should be extended to the immediate work area so the wood dust will be exhausted. It should be noted that the ventilation system is adequate. The only thing that is needed is extension of the flexible hose to the appropriate site.

2. Workers that develop dermatitis and respiratory symptoms when working with various woods should either be transferred or wear a respirator and use barrier creams, since any slight exposure might initiate some response.

3. A clean area should be provided for eating.

4. Adequate fire prevention devices should be installed.

VI. REFERENCES

[1]Acetone, Chemical Safety Data Sheet SD-87, August 1962.

[2]Acetone, Hygienic Guide Series, American Industrial Hygiene Association, January 1964.

[3]Documentation of the Threshold Limit Values for Substances in Workroom Air. American Conference of Governmental Industrial Hygienists, third edition, 1971, pp. 279-281.

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TABLE I

ATMOSPHERIC CONCENTRATIONS OF
MEK, ISOPROPANOL, AND ACETONE

Arapahoe Pattern Company
Englewood, Colorado

September 28-29, 1977

Sample Number	Location	Job Classification	Time of Sample	MEK	Isopropanol	Acetone	Type of Sample
				(mg/M^3)			
1	Pattern Shop	Patternmaker	7:10 AM-1:30 PM	2.5	*	*	BZ
2	Pattern Shop	Patternmaker	7:15 AM-1:30 PM	3.6	*	*	BZ
3	Pattern Shop	Patternmaker	7:15 AM-1:30 PM	10.0	*	*	BZ
4	Pattern Shop	Patternmaker	7:15 AM-1:30 PM	4.4	*	*	BZ
5	Pattern Shop	Patternmaker	7:15 AM-1:30 PM	3.5	*	*	BZ
6	Pattern Shop	Patternmaker	7:15 AM-1:30 PM	17.0	2.7	2.0	BZ
			EVALUATION CRITERIA	590	980	2400	
			LIMIT OF DETECTION	0.01 mg/s	0.01 mg/s	0.01 mg/s	

mg/M^3 = approximate milligrams of substance per cubic meter of air
BZ = breathing zone
* = below detection limits
mg/s = milligrams per sample

TABLE II

ATMOSPHERIC CONCENTRATIONS OF WOOD DUST

Arapahoe Pattern Company
Englewood, Colorado

September 28-29, 1977

Sample Number	Location	Job Classification	Time of Sample	Wood Dust (mg/M^3)	Type of Sample
1240	Pattern Shop	Patternmaker	7:10 AM-2:00 PM	4.2	BZ
1269	Pattern Shop	Patternmaker	7:15 AM-2:00 PM	1.3	BZ
1287	Pattern Shop	Patternmaker	7:15 AM-2:00 PM	0.6	BZ
1295	Pattern Shop	Patternmaker	7:15 AM-2:00 PM	1.0	BZ
1256	Pattern Shop	Patternmaker	7:15 AM-2:00 PM	3.4	BZ
1301	Pattern Shop	Patternmaker	7:15 AM-2:00 PM	8.0	BZ
			EVALUATION CRITERIA	5.0	

SAMPLE WEIGHTS WERE TAKEN TO AN ACCURACY OF 0.01 mg/sample

mg/M^3 = approximate milligrams of substance per cubic meter of air

BZ = breathing zone