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U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
NATIONAL INSTITUTE OF OCCUPATIONAL SAFETY AND HEALTH
CINCINNATI, OHIO 45202

HEALTH HAZARD EVALUATION DETERMINATION
REPORT NO. 75-146-254
CUSTOM FURNITURE AND CABINETS, INC.
POST FALLS, IDAHO

JANUARY 1976

I. TOXICITY DETERMINATION

It has been determined that the air concentrations of solvents (acetone, aliphatic naphtha, butyl alcohol, ethylene glycol monoethyl ether acetate, isopropyl alcohol, methyl isobutyl ketone, N-butyl acetate, and toluene) used in the materials being sprayed in the paint room on August 19 and 20, 1975, were toxic as used or found. This determination is based on: (1) air concentrations that ranged from 0.32 to 2.18 times the current Time Weighted Average Federal Standards and 0.40 to 2.78 times the American Conference of Governmental Industrial Hygienists and NIOSH recommended Time Weighted Averages; and, (2) questionnaire information obtained from exposed employees which revealed the presence of eye irritation, dizziness, light-headedness, headaches and dry hands.

II. DISTRIBUTION AND AVAILABILITY OF DETERMINATION REPORT

Copies of this Determination Report are available upon request from the Hazard Evaluation Services Branch, NIOSH, U.S. Post Office Building, Room 5038, 5th and Walnut Streets, Cincinnati, Ohio, 45202.

Copies have been sent to:

a. Custom Furniture and Cabinets, Inc., Post Falls, Idaho
b. U.S. Department of Labor, Region X
c. NIOSH, Region X

For the purposes of informing the approximately five workers, the employer will promptly "post" the Determination Report in a prominent place(s) near where affected employees work 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(s) 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 health hazard evaluation request from the Vice President of Custom Furniture and Cabinets, Inc., regarding exposure to solvent vapors present in the paint room.

IV. HEALTH HAZARD EVALUATION

A. Description of Plant Process

Custom Furniture and Cabinets, Inc., manufactures custom-built kitchen cabinets. The cabinets are manufactured and then are transferred to the paint room where they are sprayed with stain, sealer, and lacquer. This request involved only the spray operations in the paint room. The paint room is approximately 45 feet by 30 feet. A spray booth is located in the room and is 12 feet wide and 8 feet high. Directly opposite the booth is a large door approximately 10 feet by 9 feet. All the air entering the paint room enters through this door. The face velocity of the air entering the booth is 130-140 feet per minute. The air moving through the room is channeled from the door directly to the booth. The areas outside of this air flow have very little air movement as was indicated by smoke tube tests. Spraying is done in all areas of the paint room, thus only a portion of the painting is done directly in the air flow. This situation is conducive to high exposures of paint vapors in the room.

There are four and sometimes five employees working in the paint room. They are the stainer, sealer, lacquerer, lead man, and sometimes a sander. These employees often work overtime, thus an eight-hour workday may be exceeded resulting in additional exposures to the solvent vapors.

Respirators are worn only when an individual is spraying. Although respirators are worn, a respirator program did not exist. The employees stated that the cartridges are changed only every two to three weeks.

The solvents present in the materials used include acetone, aliphatic naphtha,butyl alcohol, ethylene glycol monoethyl ether acetate, isopropyl alcohol, methyl isobutyl ketone, N-butyl acetate, and toluene (ethylene glycol monoethyl ether, methyl amyl alcohol, and xylene may have been present in several formulations; however, they were not detectable on the samples collected and are therefore not mentioned again in this report).

B. Evaluation

1. Environmental Evaluation

Thirty-nine environmental air samples were collected in the breathing zone of the workers exposed during the day shift of August 19 and 20, 1975. The sampling methods consisted of collection of the vapors on charcoal tubes with subsequent analysis by gas chromotography[1]. The flow rate used during the sampling was from 50 cc per minute to 100 cc per minute. A Sipin pump was used to draw the air through the charcoal tubes.

2. Medical Evaluation

Medical evaluation consisted of the administration of medical questionnaires by a NIOSH industrial hygienist. Non directed questions were asked initially to elicit past and current complaints of symptoms which the individual attributed to his work. Specific questions were then asked concerning the presence and frequency of eye irritation, throat irritation, upper respiratory irritation, nasal irritation, cough, headaches, dizziness, sensation of intoxication, and skin problems.

C. Evaluation Criteria

The evaluation criteria applicable to this evaluation are as follows: the occupational health standards as promulgated by the U.S. Department of Labor, Federal Register, October 18, 1972, Title 29 Chapter XVII, Subpart G., Tables G-1 and G-2; American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values for Chemical Substances and Physical Agents in its Workroom Environment for 1975; and NIOSH Criteria for Recommended Standards, Occupational Exposure to Toluene.

SUBSTANCE	8-HOUR TIME WEIGHTED AVERAGE		
	U.S. Dept of Labor Standards ppm	ACGIH Recommended Levels ppm	NIOSH Recommended Levels ppm
Acetone	1000*	1000*	-
Aliphatic naphtha	250*	250*	-
N-butyl acetate	150	150	-
Butyl alcohol - skin	100	100	-
Ethylene glycol monoethyl either acetate - skin	100	100	-
Isopropyl alcohol - skin	400	400	-
Methyl isobutyl ketone (Hexone) - skin	100	100	-
Toulene - skin	200	100	100

*TLV Based on composition of mixture

Skin - Refers to the potential contribution to the overall exposure by the cutaneous route including mucous membranes and eye, either by airborne, or more particularly, by direct contact with the substance.

D. TOXIC EFFECTS

Acetone[2]. Acetone is slightly irritating to the skin, moderately irritating to the eyes, nose and throat. In high concentrations narcosis is produced with symptoms of headache, nausea, vomiting, dizziness, and incoordination.

Aliphatic Naphtha[2]. The aliphatic naphtha used in the evaluation is a mixture of straight and branched chained pariffins and naphthenes. These compounds are general anesthetics. The vapors are mildly irritating to mucous membrane. The liquids will defat the skin and can cause dermatitis.

N-Butyl Acetate[4]. High vapor concentrations of N-butyl acetate may irritate mucous membranes of the eyes, nose, and throat. Repeated contact with the liquid can produce dry, scaly and fissured dermitis. Inhalation of the vapor may produce narcotic effects.

Butyl Alcohol[3]. Butyl alcohol may cause eye irritation and may cause a narcotic effect. Mild irritation has been reported at 25 ppm which was objectionable and was followed by headaches at 50 ppm.

Ethylene Glycol Monoethyl Ether Acetate (2-Ethoxyethylacetate Cellosolve Acetate)3. Ethylene glycol monoethyl ether acetate may produce eye and nose irritation.

Isopropyl Alcohol[3]. Isopropyl alcohol may cause mild irritation of the eyes, nose and throat. The most important toxic action of isopropyl alcohol is narcosis. Four hundred ppm is considered to be low enough to prevent narcosis although slight irritation may occur.

Methyl Isobutyl Ketone (Hexone)[3]. Methyl isobutyl ketone may cause eye and nose irritation, headaches,dizziness or nausea. Complaints of headache, nausea and irritation of respiratory passages have been reported from workers exposed at about 100 ppm.

Toluene[5]. Toluene may cause mild eye irritation. Other symptoms include headache, nausea, dizziness and impairment of coordination and reaction time. Mild fatigue may begin occurring at 50 ppm.

All of the chemicals listed above produce similar effects. When the person is exposed to a mixture of solvents that have similar effects, the effects are considered additive; thus, when looking at the symptoms of the people exposed, the total exposure to these solvents must be considered.

E. Evaluation Results

1. Environmental Results

Thirty-nine charcoal tube samples were collected for vapor mixtures of methyl isobutyl ketone, acetone, aliphatic naphtha, N-butyl acetate, butyl alcohol, ethylene glycol monoethyl ether acetate, isopropyl alcohol, and toluene. The samples were collected during the day shift on August 19 and 20, 1975. All time weighted average concentrations were based on sample times ranging from 325 minutes to 458 minutes. The individual sample times ranged from 77 to 138 minutes.

Table I shows the individual time weighted average for each substance as well as the total exposure. All the solvents sampled have similar health effects. When this occurs, the equivalent combined exposure of the mixture must be considered.

The evaluation criteria (Federal Standards and ACGIH Recommended TLV's) based on the combined exposure of the mixture varies from sample to sample as the substances in the mixture on the sample are not constant. Based on the equivalent exposure method, on August 19, 3 out of 4 employees had exposures that were in excess of the Federal standard. The range was 0.32 to 2.18 times the standard. On August 20, 1 out of 4 exceeded the Federal Standard with a range of 0.69 to 1.34 times the standard. Since both the ACGIH and NIOSH have recommended the threshold limit values for toluene to be 100 ppm, the equivalent exposures are also compared to these recommended levels and are shown in Table 1. Three of the four employees on August 19 and two of the four on August 20 had exposures that were in excess of these recommended levels.

2. Medical Evaluation Results

Medical questionnaires were administered to a total of five workers, one of which was spending his first day of employment with the firm. The time worked in the paint room varied from six months to four years.

All the workers reported a past experience of eye irritation, one reported throat irritation and one reported dizziness. One had dry and scaly hands probably from contact with the solvents. One individual, the stainer, is presently under medical care for peripheral neuropathy. Exposure to methyl butyl ketone (MBK) has been reported to be associated with the occurrence of peripheral neuropathy in exposed workers. From December 1973 to December 1974, methyl butyl ketone was substituted for methyl isobutyl ketone (MIBK) in the formulation of the material sprayed. MBK is no longer being used. In addition to his inhalation exposure, he washed his hands at the end of the shift to remove the stain. Another individual, who is no longer employed there and was the previous stainer, is also being treated for peripheral neuropathy.

At the end of the shift, all five of the individuals who were questioned had watery eyes and one had bloodshot eyes. None of the four regular workers related any headaches, dizziness, narcotic effects, nausea or upper respiratory tract irritation. The other employee, who was on the job for the first day, had a severe headache and felt light-headed. He was sanding that day, did no spraying and wore a respirator with a cloth booty between the respirator and the face. The general air samples collected were taken in his breathing zone. His exposure was 160 ppm total exposure which is calculated to be 1.00 times the Federal standard or 1.25 times the ACGIH and NIOSH recommended levels. He did not report for work the next day.

F. Conclusions

It has been determined that employees in the spray room are experiencing toxic effects of eye irritation, dizziness, light-headedness, headaches, and dry skin from exposure to solvents where the materials are being sprayed. This determination is based on: (1) environmental measurements that ranged from 0.32 to 2.18 times the current Federal standard and 0.49 to 2.78 times the recommended ACGIH and NIOSH levels; and, (2) questionnaire information from the exposed employees on the days environmental samples were collected.

G. Recommendations

1. A respirator program should be established. This would include:

   a. Selection and provision of a NIOSH approved respirator for use with organic vapors and paint and lacquer mist. The respirators currently in use are not NIOSH approved.

   b. Written instructions covering selection and use of the respirator must be available.

   c. Employees should be trained in the use of respirators, their limitations, proper fitting and maintenance.

   d. Respirators should be cleaned at the end of each day's use. They should be taken apart, washed, dried and defective parts replaced.

   e. Two people should never wear the same respirator unless it has been cleaned and disinfected between uses.

   f. Filters should be replaced when an employee can smell solvent vapors in the mask, when breathing becomes difficult or when the respirator has been used for the specified life of the cartridge.

2. Respirator cartridges should be changed daily. The employees stated that the cartridges are changed every two or three weeks. Cartridge life is based on the exposure levels and the amount of solvent the cartridges will hold before breakthrough occurs (as determined by NIOSH). Calculations based on the highest exposure indicates the cartridges life is as follows:

Stainer	- approximately 12 hrs.
Sealer	- approximately 12 hrs.
Lacquerer	- approximately 8 hrs.
Lead man	- approximately 16 hrs.

In three of the four jobs, the cartridges will not last two eight-hour shifts and the fourth one just two eight-hour shifts. Based on this data, the cartridges should be changed on a daily basis.

3. The paint room should be a mandatory respirator area during the entire time an employee is in the room. At present, workers wear their respirator only when they are spraying. The general air samples indicate that a high exposure may also exist when not spraying.

4. A supplied air hood would be most desirable here, however, the movement of the workers and other factors could render this impractical.

5. Several changes could be made in the work practices and the room prior to the construction of a new paint room.

   a. Install additional paint booths in the rooms.

   b. Provide additional filtered openings evenly spaced on the wall opposite the booth to provide for more uniform air distribution through the room.

   c. Spray only directly in front of the booth.

   d. Position the cabinets so that the sprayer is always up wind of the booth.

   e. Position additional cabinets to be sprayed so that the air currents through the sprayer's area are not blocked.

   f. Long sleeve shirts and head covers should be worn by the painters.

   g. The employee who sprays the stain should wear rubber gloves (cotton inserts can be used to prevent sweating). This will prevent the stain from getting on the hands which then has to be removed at the end of the day.

   h. Do not permit the employees to wash material off the skin using lacquer thinner. Only products developed for this purpose should be used.

V. AUTHORSHIP

Report Prepared By:

Arvin G. Apol
Regional Industrial Hygienist
NIOSH, Region X, Seattle, Washington

Originating Office:

Jerome P. Flesch
Hazard Evaluation Services Branch
NIOSH, Cincinnati, Ohio

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2. Industrial Hygiene and Toxicology

Volume II, 2nd Edition, 1963, Frank A. Patty, Interscience Publisher

3. Documentation of the Threshold Limit Volume for Substances in Workroom Air

American Conference of Governmental Industrial Hygienist, 3rd Edition, 1971

4. Occupational Diseases, A Guide to Their Recognition and Control

Public Health Service Publication No. 1097, 1964

5. National Institute for Occupational Safety and Health Criteria for Recommended Standards, Occupational Exposure to Toluene, 1973

RESULTS OF BREATHING ZONE SAMPLES
COLLECTED AUGUST 19 & 20, 1975 IN THE PAINT SPRAY ROOM

SUBSTANCE[2]	FEDERAL STANDARDS TABLE G-1 & G-2 8-HR TWA ppm	ACGIH RECOMMENDED LEVELS ppm	8-HR TIME WEIGHTED AVERAGES (TWA) ppm[1]									
			Stainer		Sealer		Lacquerer		Lead Man		General Air	
			Aug 19 Sample Time 452min	Aug 20 Sample Time 415min	Aug 19 Sample Time 457min	Aug 20 Sample Time 458min	Aug 19 Sample Time 466min	Aug 20 Sample Time 456min	Aug 19 Sample Time 453min	Aug 20 Sample Time 348min	Aug 19 Sample Time 325min	Aug 20 Sample Time 398min
MIBK (Hexone)	100	100	87	69	28	11	79	83	13	28	37	12
Toluene	200	100[3]	29	21	73	55	119	49	14	26	50	18
Aliphatic Naphtha[5]	250[6]	250[6]	3	3	10	5	42	16	4	4	15	5
Acetone	1000	1000	ND	ND	56	60	ND	ND	ND	ND	ND	ND
N Butyl Acetate	150	150	40	30	19	13	23	13	6	14	14	9
Butyl Alcohol	100	100	34	30	17	12	25	13	6	14	12	8
Ethylene Glycol Monoethyl Ether Acetate	100	100	5	3	ND	ND	ND	ND	ND	2	ND	ND
Isopropyl Alcohol	400	400	ND	ND	16	8	55	6	ND	3	32	ND
Total ppm Exposure / 8-hr			198	156	219	164	343	130	43	91	160	52
Total Equivalent Exposure of the Mixture[4] Times the Federal Standard			1.69	1.34	1.10	0.70	2.18	0.89	0.32	0.69	1.00	0.37
Total Equivalent Exposure of the Mixture[4] Times the ACGIH & NIOSH Recommended Levels			1.83	1.44	1.46	0.97	2.78	1.14	0.40	0.82	1.25	0.46

ND Not detectable 0.01 mg of the substance analyzed in the samples.

1 ppm - Parts of vapor per million parts of air.

2 Xylene, methyl amyl alcohol and ethylene glycol monoethyl ether were not detectable.

3 NIOSH criteria document for toluene also recommends a TWA of 100 ppm.

4 When there are 2 or more substances present that have similar health effects, the exposure levels are combined and a equivalent permissible exposure level determined. Any value greater than 1.0 indicates this level was exceeded.

5. This aliphatic naphtha has a B.P. range of 205°F to 270°F.

6. TLV listed by supplier based on the composition of the mixture