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

HEALTH HAZARD EVALUATION DETERMINATION
REPORT NO. 73-178-158

MAGNAVOX COMPANY OF TENNESSEE
ANDREWS, NORTH CAROLINA

NOVEMBER 1974

I. TOXICITY DETERMINATION

It has been determined that the exposures of color patchers and spray booth operators to normal-butyl acetate, methyl isobutyl ketone, toluene, and xylene are not believed toxic at the concentrations measured. The exposure to wood dust is judged to be potentially toxic to roundtable shaper operators at the concentrations measured. This determination is based upon results of air sampling, employee interviews and review of criteria relating to toxicity of substances of the evaluations.

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 508, 5th and Walnut Streets, Cincinnati, Ohio 45202. Copies have been sent to:

a) Magnavox Co., Andrews, North Carolina
b) Authorized Representative of Employees
c) U.S. Department of Labor - Region IV
d) NIOSH - Region IV

For the purposes of informing the approximately 40 "affected employees" the employer will promptly "post" the Determination Report in a prominent place(s) near where exposed 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 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 an authorized representative of employees regarding dust and mist exposure of the Round Table Shaper Operators, Color Patchers, and Cabinet Finishers at the Magnavox Company plant in Andrews, North Carolina.

IV. HEALTH HAZARD EVALUATION

A. Plant Process - Conditions of Use

The Magnavox Company is engaged in the manufacture of television and stereo cabinets at the plant investigated. After the cabinets have been assembled, they are conveyed through the cabinet finishing area where the stain, glaze, lacquer, and shade are applied. The finishes are applied in a number of spray booths, each of which is equipped with local exhaust ventilation. A separate area has been designated for repair of defects which are discovered during final inspection. In this trim-patch area , which is not ventilated, the color patchers are responsible for repairing the defects and respraying the surface involved. Normally ten color patchers and approximately thirty spray booth operators work in the cabinet finishing area of the plant.

The roundtable shaper operation is performed in another area of the plant. Each of the two shapers is equipped with two cutting heads which cut a predetermined pattern in parts such as cabinet tops. Each shaper was operated by one worker, and particle board was being shaped at the time of the evaluation. The shapers are equipped with local exhaust ventilation, however the effectiveness is limited due to the wide arc through which the cutting heads travel while the stationary exhaust dust covers only part of this arc.

B. Evaluation Design

The first shift was selected for evaluation since work activities are greatly curtailed during the second shift. A number of employee symptoms were described in the request and for this reason it was deemed important to determine the exposure of the affected employees with personal breathing zone samples. Five color patchers and both roundtable shaper operators were evaluated with personal breathing zone samples while five of the spray booth operators were evaluated.

C. Evaluation Methods

1. Organic Vapor Sampling

Employee exposures to organic substances were measured using personal air sampling equipment. The vapor concentrations were determined by adsorbing the organic vapors onto charcoal air sampling tubes and analyzing the tubes by the gas chromatographic method of White et al.[1]

2. Dust Sampling

Wood dust exposure was evaluated by collecting an air sample with a closed-face three piece field monitor containing a PVC filter. Respirable dust samples were obtained using a two piece field monitor containing a PVC filter held in a 10 mm nylon cyclone. Filters were preweighed and the amount of dust collected was determined by weight increase.

3. Private Employee Interviews

Employees were asked non-directed questions to obtain any work related symptoms. Employees were also asked whether they had experienced symptoms in the past and if they had noticed them during the day of the investigation.

D. Evaluation Criteria

1. Toxic Effects of Substances [2,3,4,5]

The following discussion describes the toxicological effects that may occur in workers exposed to the substances of this evaluation. These effects are described so workers will know the symptoms and health consequences of overexposure. The effects described depend upon a number of factors such as concentration, length of exposure, individual susceptibility and possibly additive or synergistic effects of two or more compounds. If the combined concentrations of these substances are controlled below the standards presented in the report, it is believed that adverse health effects can be avoided.

Normal Butyl Acetate

Throat irriatation has been reported at 200 ppm becoming quite severe at 300 ppm. The standard is established at a level to prevent significant eye or respiratory irritation.

Methyl Isobutyl Ketone

At 100 ppm headache, nausea, and irritation of respiratory passages have been reported for unacclimated workers, however workers usually become asymptomatic quickly at this level. Human volunteers have experienced eye irritation at a concentration of 200 ppm and nasal irritation at 400 ppm. Other symptoms which may occur at 200 ppm are headache, dizziness, or nausea.

Toluene

For an 8-hour exposure at 50-100 ppm, slight drowsiness and possibly slight headache may be noticed by some workers. At a 200 ppm level unconditioned workers may complain of fatigue, some muscular weakness, with burning, itching or "crawling" skin. There may also be complaints of headaches and some nausea with unconditioned workers possibly

experiencing fatigue of short duration or a few individuals experiencing restless sleep. At 200 to 500 ppm impairment of co-ordination, momentary loss of memory, and loss of appetite have been reported while 500-1000 ppm is strongly irriatating to the eyes and respiratory system. Contact of the skin with the liquid may cause dermatitis.

Xylene

Excessive xylene exposure may result in headache, fatigue, lassitude, irritability and gastrointestinal disturbances such as nausea and loss of appetite as the most common symptoms. These symptoms are quite similar to those of toluene although more pronounced. It is believed no significant chronic injury will result from continued occupational exposures at 100 ppm or less.

Wood Dust

An increased incidence of carcinoma of the nasal cavity and accessory sinuses has been reported for furniture industry workers in Great Britain although the associated dust levels are unknown.[6] The dust levels associated with this increased cancer risk may have been very high since the carcinogenic agent is believed to have been present during the 1920-1940 time period. This period would coincide with an increase in mechanization of the industry with less advance of environmental controls.

A study conducted in a Czechoslovakian furniture factory resulted in dividing wood dusts into three levels of toxicity: (1) low - oak, beech, maple, ash; (2) high - pine, larch, mahogany; and (3) allergenic - yew, mansonia.[7,8] The limits recommended for these three groups were 10, 5, and 1 mg/M^3. Other diseases which have been associated with exposure to wood dusts are dermatitis from mechanical or chemical irritation and respiratory disease.

Since the level of exposure necessary to cause serious disease is not well defined, it would seem prudent to maintain levels of wood dust at as low a level as possible. The ACGIH has adopted a provisional limit of of 5.0 mg/M^3 for non-allergenic species in view of the present lack of basic knowledge concerning wood dust toxicity.

2. Environmental Standards for Substances Evaluated

Environmental standards intended to protect the health of workers have been recommended by several sources. These standards are established at levels designed to protect workers occupationally exposed to a substance on an 8-hour per day, 40-hour per week basis over a normal working lifetime. For this study the recommended standards from three sources are presented:

a. Federal Standards - the standard enforced by the Department of Labor as found in the Federal Register, Vol. 37, Section 1910.93, October 18, 1972.

b. Threshold Limit Value (TLV) - as found in TLVs for Chemical Substances and Physical agents in the Workroom Environment with Intended Changes for 1973, ACGIH.

c. Recommended standard developed in the applicable NIOSH Criteria Document.

Source	Substance	8-Hour Time-Weighted-Average (ppm)[a]
Federal Standard	Normal-butyl acetate	150
	Methyl isobutyl Ketone	100
	Toluene	200
	Xylene	100
TLV (ACGIH)	Normal-butyl acetate	150
	Methyl isobutyl ketone	100
	Toluene	100
	Xylene	100
	Wood Dust (non-allergenic)	5 mg/M^3[b] total
NIOSH Criteria Document	Toluene	100

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a - parts per million of vapor per million parts of contaminated air by volume

b - approximate milligrams of particulate per cubic meter of air at 25°C and 760 mm Hg.

E. Evaluation Results and Discussion

1. Plant Inspection

A tour of the areas involved in the request was conducted on January 15, 1974 accompanied by representatives of the employer and employees. It was observed that the plant was operating under a high negative pressure since opening outside doors was very difficult and high velocity winds were blowing through outside doors which were open. One outside door which was closed during the initial tour on January 14, 1974 was open during the environmental sampling on January 16, 1974 which could account for lower values for the environmental samples collected at Spray Booth #7. The roundtable shapers were observed and, although ventilated, the effectiveness of this ventilation was limited due to the long travel of the cutting heads and the relatively remote positioning of the exhaust ducts.

2. Organic Vapor Sampling Results

Three long term area samples were obtained in the general vicinity of the workers on whom personal samples were being obtained. These charcoal tubes were analyzed using mass spectrographic techniques to identify the organic compounds which had been collected. By this procedure a number of organics were identified: acetone, normal butyl acetate, cellosolve acetate, diacetone alcohol, ethyl acetate, ethyl ether, isopropyl alcohol, methyl isobutyl ketone, toluene, and xylene. Normal butyl acetate, methyl isobutyl ketone, toluene, and xylene were of sufficient concentration to be quantitated by gas chromatographic methods on all the personal samples while the other substances were 3% or less of the applicable Federal Standard.

The results for the four major substances determined by charcoal tube measurements for individual tubes are presented in Table I while the results expressed on a shift basis are shown in Table II. Compared to Federal Standards shown as the bottom entries in the Tables it can be seen the individual and shift results are far less than the Standards. Since these substances possess similar toxicological properties, it is desirable to examine the combined exposure of the mixture. This combined exposure was determined using the method explained in the Federal Register, Volume 37, Section 1910.93 (d)(2)(i), October 18, 1972. This equivalent exposure is expressed as a decimal with a number greater than 1.0 indicating a result exceeding the combined standard. The results for the combined standards are shown in the right hand column of Tables I and II with all results considerably less than 1.0.

3. Dust Sampling Results

Table III contains the results of sampling for total wood dust and respirable wood dust in the breathing zones of the roundtable shaper operators. The total dust samples are at very similar levels for the shapers and above the TLV recommended by the ACGIH of 5 mg/M^3 for nonallergenic wood dust. The respirable dust samples on the other hand are very much lower than the total dust samples. These results indicate the dust evolved at the shapers is predominantly larger than respirable size and would be trapped in the upper respiratory tract of the operator with little penetrating to the lungs of exposed employees. However, if allergenic wood dusts are encountered upper respiratory tract absorption could be a problem.

4. Employee Interviews

Of the twelve color patchers and spray booth operators interviewed, seven workers complained of one or more past symptoms which might be related to exposure to substances during normal work duties. However, on the day of evaluation only one worker had a complaint possibly related to his work which was a slight sore throat. The roundtable

shaper operators were interviewed and did not have any complaints on the day of evaluation. There were some past symptoms related which could have been due to dust exposure. Some symptoms described by color patchers were related to times when the insides of cabinets were being sprayed and the spray mist consequently was reflected toward them.

Conclusions

In view of the results of (1) air sampling, (2) employee interviews, and (3) review of criteria relating to toxicity of substances of the evaluation, normal butyl acetate, methyl isobutyl ketone, toluene, and xylene, were not believed to be toxic to color patchers and spray booth operators, while the exposure to wood dust is judged to be potentially toxic to the roundtable shaper operators at the concentrations measured.

Recommendations

1. An approved organic vapor respirator (Bureau of Mines Schedule 23B) should be furnished to color patchers for use during work which may cause symptoms in exposed workers, such as spraying the interiors of cabinets.

2. The high negative pressure in this plant indicates that insufficient makeup air is being provided in the plant. The ventilation system should be studied and corrections made to provide adquate makeup air for proper operation of the ventilation system(s).

3. The roundtable shaper exhaust system should be improved to control wood dust exposure of operators to 5 mg/M^3 or less.

V. REFERENCES

1. White, W. D., Taylor, D. B., Mauer, P. A. and R. E. Kupel, A Convenient Optimized Method for the Analysis of Selected Solvent Vapors in the Industrial Atmosphere. Am. Ind. Hyg. Assoc. J., Vol. 31, March - April, 1970.

2. Documentation of the Threshold Limit Values, American Conference of Governmental Industrial Hygienists, 3rd Ed., Cincinnati, Ohio, 1971.

3. Hygienic Guide Series, American Industrial Hygiene Association, 14125 Prevost, Detroit, Michigan.

4. Patty, F. A., Industrial Hygiene and Toxicology, Second Revised Edition, Three Volumes. Interscience Publishers, New York, 1967.

5. Encyclopedia of Occupational Health and Safety, International Labor Office, McGraw-Hill Book Co., New York, 1971.

V. REFERENCES (cont.)

6. Acheson, E. D., Cowdell, R. H., Hadfield, E., Macbeth, R. G.: Brit. Med. J. 2, 587 (1968).

7. Michaels, L.: Can. Med. Assn. J. 96, 1150 (1967).

8. Haslean, L., Kadec, K.: Pracoon. Lekar. 16, 276 (1964); (English Abs).

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TABLE I - PERSONAL CHARCOAL TUBE SAMPLING RESULTS

January 15-16, 1974

Location	Job	Concentration - ppm				Equivalent Exposure $\frac{C_1}{L_1} + \frac{C_2}{L_2} \cdots \frac{Cn}{Ln}$
		n-butyl Acetate	MIBK	Toluene	Xylene	
Trim Patch	Color Patcher 1	7	2	2	<1	.09
"	Color Patcher 2	14	3	3	<1	.13
"	Color Patcher 3	10	2	2	<2	.10
"	Color Patcher 4	11	3	2	<2	.12
"	Color Patcher 4	7	1	1	<1	.07
"	Color Patcher 5	5	1	<1	<1	.06
"	Color Patcher 1	8	2	1	<1	.08
"	Color Patcher 2	6	1	1	<1	.06
"	Color Patcher 3	9	1	2	<1	.09
"	Color Patcher 4	12	<2	<3	<2	.12
"	Color Patcher 5	7	<2	<3	<2	.09
"	Color Patcher 3	15	3	<3	<2	.16
"	Color Patcher 1	4	<2	<2	<2	.07
"	Color Patcher 2	13	2	<3	<2	.12
"	Color Patcher 5	4	1	<1	<1	.05
"	Color Patcher 1	3	<1	<1	<1	.05
"	Color Patcher 3	9	1	2	<1	.08
"	Color Patcher 2	6	1	1	<1	.06
"	Color Patcher 4	4	<1	<1	<1	.05
Spray Booth #7 Shade Booth	Sprayer 1	45	10	8	5	.44
	Sprayer 2	13	2	2	<2	.12
Spray Booth #7 Shade Booth	Sprayer 1	29	8	6	3	.31
	Sprayer 2	6	<3	<3	<2	.11
Spray Booth #7	Sprayer 3	15	6	4	<3	.20
Spray Booth #1 Dept. 12	Sprayer 4	14	11	7	4	.28
	Sprayer 5	9	6	4	2	.17
Spray Booth #7	Sprayer 3	8	5	3	1	.13
Spray Booth #1 Shade Booth	Sprayer 4	14	11	7	4	.28
	Sprayer 2	12	2	2	<1	.11
Spray Booth #7	Sprayer 1	37	9	7	4	.37
Federal Standard		150	100	200	100	1.00

TABLE II - SHIFT TIME-WEIGHTED AVERAGE EXPOSURES OF PERSONAL SAMPLES

January 15-16, 1974

Location	Job	Concentration - ppm				Equivalent Exposure $\frac{C_1}{L_1} + \frac{C_2}{L_2} \cdots \frac{Cn}{Ln}$
		n-butyl acetate	MIBK	Toluene	Xylene	
Trim Patch	Color Patcher 1	1	2	6	2	.07
"	Color Patcher 2	1	2	9	2	.10
"	Color Patcher 3	<2	2	10	2	.10
"	Color Patcher 4	<1	2	7	2	.09
"	Color Patcher 5	<1	<2	5	2	.07
Spray booth # 7	Sprayer 1	4	7	38	9	.39
Shade Booth	Sprayer 2	<2	2	11	2	.11
Spray booth #7	Sprayer 3	2	3	10	5	.14
Spray booth #1	Sprayer 4	4	7	14	11	.28
Dept. 12	Sprayer 5	2	4	9	6	.17
Federal Standard		150	100	200	100	1.00

TABLE III - PERSONAL SAMPLING RESULTS FOR WOOD DUST

January 15-16, 1974

Location	Job	Dust Concentration mg/M^3	Type	ACGIH - TLV-1973 mg/M^3
Rye Round Table	Shaper Operator	8.6	Total	5
Onsrud Table	Shaper Operator	8.9	Total	5
Rye Round Table	Shaper Operator	0.02	Respirable	-
Onsrud Table	Shaper Operator	0.40	Respirable	-