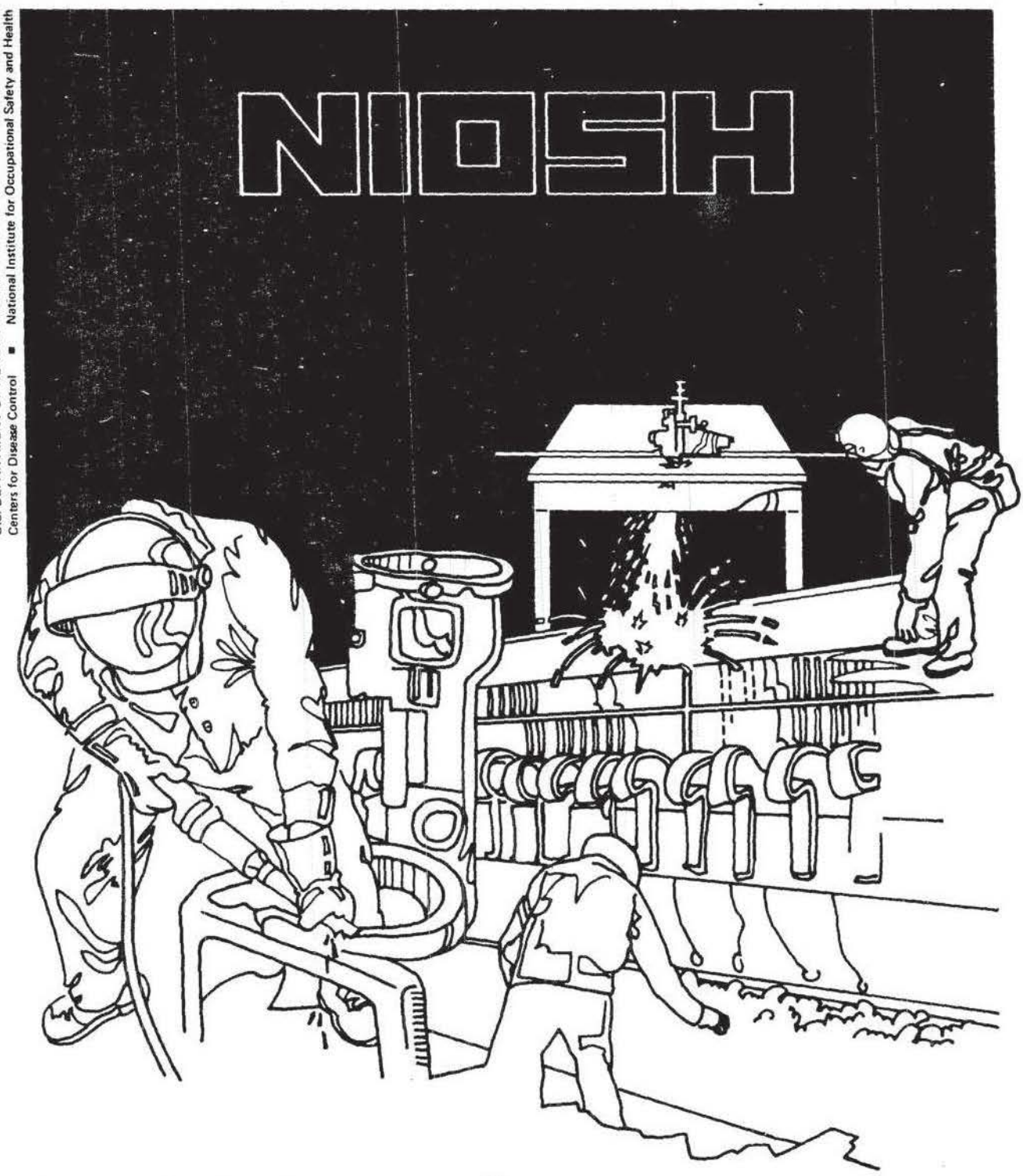
U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES ■ Public Health Service
Centers for Disease Control ■ National Institute for Occupational Safety and Health

NIOSH



Health Hazard Evaluation Report

HETA 84-430-1518
DMG INCORPORATED
PHILADELPHIA, PENNSYLVANIA

HETA 84-430-1518
OCTOBER 1984
DMG INCORPORATED
PHILADELPHIA, PENNSYLVANIA

NIOSH INVESTIGATOR:
Walter Chrostek

I. Summary

On July 3, 1984, the National Institute for Occupational Safety and Health (NIOSH) received a request to evaluate the occurrence of throat and eye irritation among workers exposed to particleboard which contained a formaldehyde type resin at DMG Incorporated, Philadelphia, Pennsylvania.

On July 31, 1984, an initial visit was made to DMG Incorporated. The Industrial Hygienist met with management and the representative of the employees and a walk through survey was made. Informal interviews were conducted with the employees regarding the adverse health effects they experienced due to exposure to the air contaminant. Two employees complained of nose bleeds. Other complaints included eye irritation and irritation of the throat.

On August 3, 1984, six environmental air samples were collected for formaldehyde. Concentrations ranged from 0.07 to 0.33 parts per million parts of air (ppm). The Occupational Safety and Health Administration (OSHA) standard is 3 ppm. NIOSH recommends that formaldehyde be handled as a potential occupational carcinogen and workers' exposure be reduced to a minimum by instituting appropriate controls.

On the basis of these results, it was determined that although the OSHA standard was not exceeded, there is a potential for certain susceptible individuals to be affected by the air concentrations of formaldehyde and appropriate recommendations to reduce exposures are made in Section VIII of this report.

KEYWORDS: SIC 2541 (Partitions, shelving and store fixtures); nose bleeds, throat and eye irritation , formaldehyde.

II. Introduction

On July 3, 1984, NIOSH received a request from the representative of the employees of DMG Incorporated, Philadelphia, Pennsylvania for a Health Hazard Evaluation to evaluate the adverse health effects experienced by the employees due the exposure to formaldehyde which was present in the particleboard used at the plant. The reported health effects include nose bleed and eye and throat irritation.

NIOSH personnel visited the plant on July 31, 1984 and an environmental air evaluation was made on August 3, 1984.

III. Background

DMG Incorporated assembles display cases from pre-cut particleboards. The stock of boards is stored along one side of the work area which is approximiately 40'X40' with a 30' ceiling.

The appropriate boards are inserted into slots and glued or wire nailed. The display case is then wiped down with mineral spirits.

This operation was formerly performed in an area with good general ventilation from open windows. The health complaints began when this operation was transferred to the present area where general ventilation is minimal as there are no windows. Floor air movement fans are used for the comfort of the employees.

IV. Environmental Design

Two general air and four personal air samples were collected on ORBO-22 solid sorbent tubes with personal air sampling pumps operating at 80 cubic centimeters (cc) per minute. The A and B sections were separated and analyzed by gas chromotography according to NIOSH Method P&CAM 354[1] with modifications. The limit of detection was 2.0 micrograms/sample for formaldehyde.

Informal interviews were conducted with the employees regarding the adverse health effects they experienced due to exposure to the air contaminant. Two employees complained of nose bleeds. Other complaints were of eye irritation and irritation of the throat.

V. Environmental Criteria

As a guide to the evaluation of the hazard posed by workplace exposures, NIOSH field staff employ environmental evaluation criteria for assessment of a number of chemcial and physical agents. These criteria are intended to suggest levels of exposure to which most workers may be exposed up to 10 hours per day, 40 hours per week for a working lifetime without experiencing adverse health effects. It is, however, important to note that not all workers will be protected from adverse health effects if: their exposures are maintained below these levels. A small percentage may experience adverse health effects because of individual susceptibility, pre-existing medical conditions, and/or a hypersensitivity (allergy).

In addition, some hazardous substances may act in combination with other workplace exposures, the general environment, or with medications or personal habits of the worker to produce health effects even if the occupational exposures are controlled at the level set by the evaluation criterion. These combined effects are often not considered in the evaluation criteria. Also, some substances are absorbed by dirct contact with the skin and mucous membranes, and thus potentially increase the overall exposures.

Evaluation criteria may change over the years as new information on the toxic effects of an agent becomes available.

The primary sources of environmental evaluation criteria for the workplace are: 1) NIOSH Criteria Documents and Recommendations, 2) the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLV's), and 3) the U.S. Department of Labor (OSHA) Occupational Standards. Often, the NIOSH recommendations and ACGIH TLV's are lower than the corresponding OSHA standards. Both NIOSH recommendations and ACGIH TLV's usually are based on more recent information than are the OSHA standards. The OSHA standards also may be required to take into account the feasibility of controlling exposures in various industries where the agents are used; the NIOSH-recommended standards, by contrast, are based primarily on concerns relating to the prevention of occupational disease. In evaluating the exposure levels and the recommendations for reducing these levels found in this report, it should be noted that industry is legally required to meet only those levels specified by an OSHA standard.

A time-weighted average (TWA) exposure refers to the average airborne concentration of a substance during a normal 8 to 10-hour workday Some substances have recommended short-term exposure limits or ceiling values which are intended to supplement the TWA exposures.

Criteria for Formaldehyde (ppm)*

OSHA[2]	NIOSH[3]	ACGIH[4]
3	LFL**	1***
5(acceptable ceiling)		
10(maximum ceiling, 30 minutes)		

* Denotes parts per million parts of air sampled.
** Denotes lowest feasible limit.
*** Denotes ceiling value, concentration that should not be exceeded even instantaneously.

VI. Formaldehyde Toxicity

The health effects of formaldehyde can result from acute or chronic exposure. The effects of acute exposure are primarily mucous membrane irritation. Symptoms first noted include eye and upper respiratory tract irritation (burning, tearing eyes; nose and throat irritation). These symptoms can occur as low as about 0.1 part per million (ppm)[3]. Dermatitis associated with formaldehyde vapor, solutions or formaldehyde-containing resins has been

documented [3,5]. Formaldehyde is a primary skin irritant but may also cause allergic dermatitis in concentrations below those likely to cause primary irritant effects.

Allergic effects include skin sensitization and possibly, asthma or asthma-like symptoms[6,7]. There is considerable evidence that formaldehyde can produce skin sensitization in man, especially in persons occupationally exposed through skin contact[8]. Eczematous contact dermatitis, when acute, is characterized by redness, swelling, vesiculation and oozing with itching. In the chronic form, affected areas of the skin may become dry, thickened, and fissured[9].

The National Research Council's Committee on Toxicology suggested that less than 20% of an exposed human population would react to formaldehyde concentrations below 0.25 ppm with slight irritation of the eyes, nose and throat and possibly a slight decrease in nasal mucous flow[5]. At present, there is no evidence of a threshold level for the irritant effects of formaldehye in human population.

A recent study conducted by the Chemical Industry Institute of Toxicolgy (CIIT) in which rats and mice exposed to formaldehyde vapors developed nasal cancer has raised concerns about its carcinogenic potential in humans.

The current OSHA standard for formaldehyde exposure is 3 ppm, as a time-weighted average (TWA) for an 8-hour workday. On the basis of the CIIT study findings ACGIH and NIOSH currently recommend that formaldehyde be treated as a potential human carcinogen. ACGIH currently proposed a TLV of 1 ppm as a ceiling limit[4]. NIOSH, however, recommends that exposures be reduced to the lowest feasible level[3].

VII. Results and Discussion

Detectable levels of formaldehyde were measured in all six samples, with concentrations ranging from 0.07 to 0.33 ppm (table). The highest levels were found in the general air samples, as the sampling was initiated one-half hour prior to the initiation of work. The higher levels can be accounted for due to the fact that the doors in the receiving department (adjacent to the area being evaluated) were closed and there was no dissipation by general air ventilation of the formaldehyde from the stored particleboard. The air levels were well within the current OSHA standard of 3 ppm which was primarily set to prevent irritation symptoms.

Complaints about health problems began shortly after relocation. Previously the work site was in an area where there were windows. At this location there are no windows, only floor air movement fans are used for the comfort of the employees.

The storage area of the pre-cut particleboard is a contributing factor to the higher than expected employee exposures to formaldehyde. This would also account for the higher levels in the general air samples. This is due to the overnight formaldehyde gassing into the work area without any air movement or exhaust ventilation.

VIII. Recommendations

1. Until such a time as the stock of particleboard is relocated, exhaust ventilate the work area. The exhaust ventilation should begin about one-half hour prior to the start of work and during the entire work shift.

2. Store the particleboard in an area outside the present work area that has general air or local exhaust ventilation. Only a minimal supply should be kept in the work area.

IX. References

1. NIOSH Manual of Analytical Methods, Vol. 7, August 1981, DHHS NIOSH Publication #82 100,.Cincinnati. Ohio

2. OSHA Safety and Health Standards 29 CFR 1910.1000, Table Z-2, Occupational Safety and Health Administration, Revised 1980

3. Current Intelligence Bulletin 34, Formaldehyde, Evidence of Carcinogenicity DHHS NIOSH Publication # 81 111, 1980, Cincinnati, Ohio

4. American Conference of Governmental Industrial Hygienist, Threshold Limit Values for Chemical Substances and Physical Agents in the Workroom Environment With Intended Changes for 1984-85. ACGIH, 1984, Cincinnati, Ohio

5. National Research Council Committee on Toxicology, Formaldehyde: An Assessment of Its Health Effects, Washington, D.C., National Academy of Sciences, 1980 (contract #N00014-79-C-0049).

6. Hendrick DJ, and Land DJ., Occupational Formalin Asthma. Br. J. Ind. Med. 34:11-19, 1977.

7. Hendrick DJ, and Lane DJ., Formalin Asthma in Hospital Staff. Br. Med. J. 1:607-608, 1975.

8. Health and Safety Executive, Toxicity Review; Formaldehyde, London, HMSO, 1981.

9. Fisher AA. Contact Dermatitis. 2nd Ed. Philadelphia: Lea & Febiger, 1973.

X. Authorship and Acknowledgements

Report prepared by: Walter J. Chrostek
Regional Industrial Hygienist

Originating office: Hazard Evaluations and Technical Assistance Branch
Division of Surveillance, Hazard Evaluation, and Field Studies

Report typed by: Mary Tomassini, Secretary

XI. Distribution and Availability of Report

Copies of this report are currently available upon request from NIOSH, Division of Standards Development and Technology Transfer, 4676 Columbia Parkway, Cincinnati, Ohio 45226. After 90 days, the report will be available through the National Technical Information Service (NTIS), 5285 Port Royal, Springfield, Virginia 22161. 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:

1. DMG Incorporated, Philadephia, Pennsylvania
2. Teamsters Local 837, Philadephia, Pennsylania
3. NIOSH ,Region III
4. OSHA, Region III

DMG Incorporated
Philadelphia, Pennsylvania

HETA 84 430

August 3, 1984

Formaldehyde Concentrations*

Operation	Time	Concentration	Remarks
Center of Room	07:27-14:39	0.33	General air
Back Area	07:30-14:47	0.33	General Air
KM	07:57-14:53	0.12	Operator's Exposure
DP	08:00-14:50	0.15	Operator's Exposure
BH	07:55-14:52	0.24	Operator's Exposure
ER	08:10-14:50	0.07	Operator's Exposure

*Denotes - Parts per million parts of air sampled.