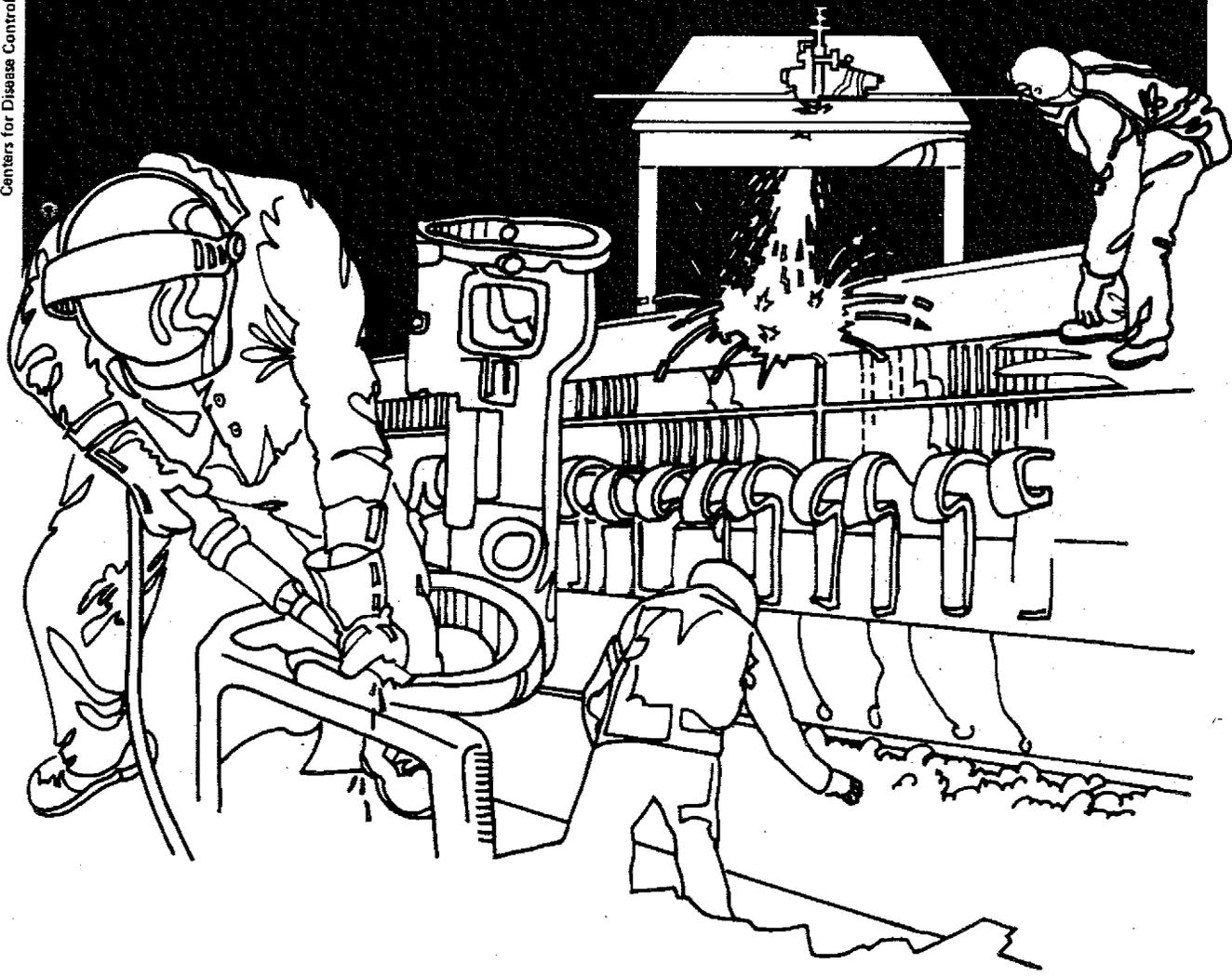


# NIOSH



## Health Hazard Evaluation Report

HETA 83-430-1451  
A&H SUNLIGHT LETTERING AND TROPHY  
GLENWOOD SPRINGS, COLORADO

## PREFACE

The Hazard Evaluations and Technical Assistance Branch of NIOSH conducts field investigations of possible health hazards in the workplace. These investigations are conducted under the authority of Section 20(a)(6) of the Occupational Safety and Health Act of 1970, 29 U.S.C. 669(a)(6) which authorizes the Secretary of Health and Human Services, following a written request from 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 Hazard Evaluations and Technical Assistance Branch also provides, upon request, medical, nursing, and industrial hygiene technical and consultative assistance (TA) to Federal, state, and local agencies; labor; industry and other groups or individuals to control occupational health hazards and to prevent related trauma and disease.

HETA 83-430-1451  
April 1984  
A&H SUNLIGHT LETTERING and TROPHY  
GLENWOOD SPRINGS, COLORADO

NIOSH INVESTIGATORS:  
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## I. SUMMARY

In November, 1983, the National Institute of Occupational Safety and Health (NIOSH) received a request to evaluate occupational exposures of workers to chemicals at A & H Trophy, Glenwood Springs, Colorado. This facility performs silk screen printing on shirts, jackets and similar items.

On November 14, 1983, NIOSH performed an environmental investigation at A & H Trophy. This evaluation consisted of environmental breathing zone and general room air sampling for perchloroethylene, methylene chloride, 1-1-1 trichloroethane, xylene, and petroleum naphtha. Interviews and pulmonary function testing were performed on the three employees and two owners.

A total of eight air samples were taken, four on workers, and four general area samples in the work area. Four time weighted average (TWA) air concentrations of perchloroethylene ranged from 21 to 24 mg/M<sup>3</sup>, methylene chloride from 106 to 174 mg/M<sup>3</sup>, 1-1-1 trichloroethane from 3 to 46 mg/M<sup>3</sup>, xylene from 7 to 8 mg/M<sup>3</sup> and petroleum naphtha from 16 to 24 mg/M<sup>3</sup>. All these values were below the evaluation criteria. Evaluation criteria was not exceeded when the solvent concentrations were added according to the threshold limit values for mixtures. The National Institute of Occupational Safety and Health Current Intelligence Bulletin, #20, states that perchloroethylene should be treated as a carcinogen due to its ability to cause cancer in experimental animals. Pulmonary function testing indicated that the three workers and two owners had excellent lung function. All parameters such as forced expiratory volume during the first second of expiration FEV<sub>1</sub>, the forced vital capacity (FVC), the ratio of the two, FEV<sub>1</sub>/FVC and the mid-maximum expiratory flow (MMEF) were either above or well within the normal values.

On the basis of the environmental data, employee interviews, and the carcinogenic potential of perchloroethylene, NIOSH concluded that a potential health hazard exists to workers at A & H Trophy, Glenwood Springs, Colorado. Recommendations that can further assist in reducing environmental exposures are included in this report.

KEYWORDS: SIC 7399 (Silk screen designing), Methylene chloride, perchloroethylene, 1-1-1-trichloroethane, xylene, petroleum naphtha, pulmonary function.

## II. INTRODUCTION

The National Institute of Occupational Safety and Health (NIOSH) received a request in August 1983 to evaluate exposures to various solvents at A & H Trophy, Glenwood Springs, Colorado. An environmental evaluation and pulmonary function study was conducted on November 14, 1983. The pulmonary function data was explained to the two owners of A & H Trophy and to the three workers on November 14. Management and employees were sent a letter containing all environmental data on January 4, 1984.

## III. BACKGROUND

The workers at A & H Trophy were concerned about possible overexposures to solvents during silk screen printing on fabric shirts and jackets. Both workers were seen by their private physician who recommended that the establishment be evaluated for solvent exposure since both workers were experiencing symptoms such as headaches, scratchy throats and finger paresthesias.

## IV. ENVIRONMENTAL DESIGN AND METHODS

Four breathing zone and four general room air samples were collected on Organic Vapor Charcoal sampling tubes using vacuum pumps operated at 50 cc/minute. These air samples were analyzed according to NIOSH P&CAM # 127. Pulmonary function tests were performed with a spirometer connected to a computer that provided immediate results of FEV<sub>1</sub>, FVC, FEV<sub>1</sub>/FVC and MMEF.

## V. EVALUATION CRITERIA

### A. Environmental

As a guide to the evaluation of the hazards posed by workplace exposures, NIOSH field staff employ environmental evaluation criteria for assessment of a number of chemical 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, a pre-existing medical condition, 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 direct contact with the skin and mucous membranes, and thus potentially increase the overall exposure. Finally, evaluation criteria may change over the years as new information on the toxic effects of an agent become 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 health 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 air-borne 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 where there are recognized toxic effects from high short-term exposures.

	Permissible Exposure Limits 8-Hour Time-Weighted Exposure Basis
Perchloroethylene	335 mg/M <sup>3</sup> (OSHA) (NIOSH) (ACGIH)
Methylene Chloride	360 mg/M <sup>3</sup> (ACGIH) 1734 mg/M <sup>3</sup> (OSHA)
1,1,1 Trichloroethane	1900 mg/M <sup>3</sup> (OSHA) (NIOSH) (ACGIH)
Xylene	435 mg/M <sup>3</sup> (OSHA) (NIOSH) (ACGIH)
Petroleum Naphtha	*350

mg/M<sup>3</sup> = milligrams of substance per cubic meter of air.

\* = no standard or criteria has been established; this value is for stoddard solvent which is a type of petroleum naphtha.

## B. Toxicological

Perchloroethylene - Perchloroethylene is a widely used solvent with particular use as a drycleaning agent, a degreaser, and a chemical fumigant. Repeated contact may cause a dry, scaly and fissured dermatitis. High exposures may produce eye and nose irritation. Acute exposures may cause CNS depression and liver damage. Overexposure may cause dizziness, headaches, increased perspiration, fatigue and slowing of mental ability. Medical surveillance should include the skin with liver and kidney function.<sup>1</sup> The National Institute for Occupational Safety and Health (NIOSH), Current Intelligence Bulletin #20 states that perchloroethylene should be treated as a carcinogen due to its ability to cause cancer in experimental animals.

Methylene Chloride - Methylene chloride is an irritant, it depresses the central nervous system and can elevate carboxyhemoglobin levels. The signs and symptoms of exposure include: irritation of eyes and respiratory tract, headache, dizziness, nausea and vomiting. Maintaining exposures below  $360 \text{ mg/M}^3$  should eliminate metabolic injury.<sup>2</sup>

1-1-1-trichloroethane can affect the body if it is inhaled or if it comes in contact with the eyes or skin. It can also affect the body if ingested. Acute exposure affects include: headache, dizziness, drowsiness, unconsciousness, irregular heart beat, and death. Eye contact usually causes irritation. Chronic exposures may cause skin irritation. Reproductive abnormalities have been noted in animals chronically exposed to high concentration.<sup>3</sup>

Xylene overexposures may cause headache, nausea, gastrointestinal disturbances, and dizziness. Eye, nose, throat and skin irritation are also common complaints when workers are exposed to xylene.<sup>4</sup>

Petroleum Naphtha - The petroleum distillate used in the printing industry and the one in use at this facility includes the distillate that distills between 95 degrees and 175 degrees Centigrade. These are chiefly aliphatic hydrocarbons chiefly of C<sub>7</sub> - C<sub>10</sub> series. The composition may vary widely since anyone of several fractions within this boiling range may be used.

Depression of the central nervous system is one of the symptoms of exposure. Prolonged exposure causes irritation to mucous membranes, skin irritation, and defatting dermatitis. Liver and kidney damage can occur if excessive exposure is long term.

This product should be used under well ventilated conditions. If airborne concentrations are high (excess of  $1000 \text{ mg/M}^3$ , the action level or one-half the TLV or OSHA standard), local exhaust ventilation should be used. For short exposure a respirator may be used.<sup>5</sup>

## VI. ENVIRONMENTAL RESULTS

### A. Environmental

Four breathing zone and four general room air samples were collected and analyzed for perchloroethylene, methylene chloride, 1-1-1-trichloroethane, xylene, and petroleum naphtha. Time weighted average values for perchloroethylene ranged from 21 to 24  $\text{mg/M}^3$ , methylene chloride from 106 to 174  $\text{mg/M}^3$ , 1-1-1-trichloroethane from 3 to 46  $\text{mg/M}^3$ , xylene from 7 to 8  $\text{mg/M}^3$  and petroleum naphtha from 16 to 24  $\text{mg/M}^3$ . These values are all within the evaluation criteria. The workers who performed the silkscreen printing complained of irritated eyes and respiratory systems. They also complained of headaches. All symptoms disappeared when they were removed from exposures.

B. Medical

Pulmonary Function - No abnormalities were noted in the pulmonary function of the two owners and the three workers. Forced vital capacity, forced expiratory volume in one second, and the ratio of these two were normal in all subjects.

VII. DISCUSSION AND CONCLUSIONS

During this survey production of silk screen shirts and jackets was far below the normal output. There is no local exhaust ventilation in the facility and during peak production, air concentrations of all the organic solvents would be much higher which may account for the medical symptoms experienced. The workers who did the silk screen printing both verified this observation.

VIII. RECOMMENDATIONS

1. Local exhaust ventilation should be installed at the point where the silk screen paint is applied. Respiratory protection should be worn until this can be accomplished.
2. Workers should be given annual physical exams with emphasis on eyes, respiratory system and liver function.
3. A good safety inspection with emphasis on fire prevention should be done by insurance carrier or the fire department.
4. Workers should wear protective gloves and goggles when mixing and applying these solvents and paints.

IX. REFERENCES

1. Occupational Diseases: A Guide to Their Recognition, Department of Health, Education and Welfare (NIOSH) Publication No. 77-181, Revised Edition, June 1977.
2. Occupational Health Guidelines for Chemical Hazards, Department of Health and Human Services Publication (NIOSH) No. 81-123, January 1981.
3. Ibid.
4. Health and Safety in Printmaking: A Manual for Printmakers, Alberta Labour, January 1978.
5. Criteria for a Recommended Standard. Occupational Exposure to Xylene. HEW Publication No. (NIOSH) 75-168, 1976.

X. AUTHORSHIP AND ACKNOWLEDGMENTS

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XI. DISTRIBUTION AND AVAILABILITY

Copies of this report are currently available upon request from NIOSH, Division of Standards Development and Technology Transfer, Information Resources 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:

1. A & H Sunlight Lettering & Trophy.
2. U.S. Department of Labor/OSHA - Region VIII.
3. NIOSH - Region VIII.
4. Colorado Department of Health.

For the purpose of informing 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.

BREATHING ZONE AND GENERAL ROOM AIR CONCENTRATIONS  
 OF PERCHLOROETHYLENE, METHYLENE CHLORIDE,  
 1-1-1 TRICHLOROETHANE, XYLENES AND PETROLEUM NAPHTHA

A & H Sunlight Lettering & Trophy  
 Glenwood, Colorado

November 14, 1983

SAMPLE IDENTIFICATION	SAMPLE TIME	PERCHLOROETHYLENE	METHYLENE CHLORIDE	1-1-1 TRICHLOROETHANE	XYLENE	PN	COMBINED EXPOSURE INDEX
worker #1	8:37-4:04	21	112	46	7	16	0.47
worker #2	8:41-4:10	34	174	3	8	24	0.69
area	8:55-4:12	22	106	3	7	21	0.45
area	8:55-4:14	24	112	4	7	18	0.46
EVALUATION CRITERIA		335	350	1900	435	350*	1.0
LABORATORY LIMIT OF DETECTION		.01	.01	.01	.01	.1	

\* No standard exists, however, the standard for stoddard solvent, a common petroleum naphtha cleaning solvent is 350mg/M<sup>3</sup>

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