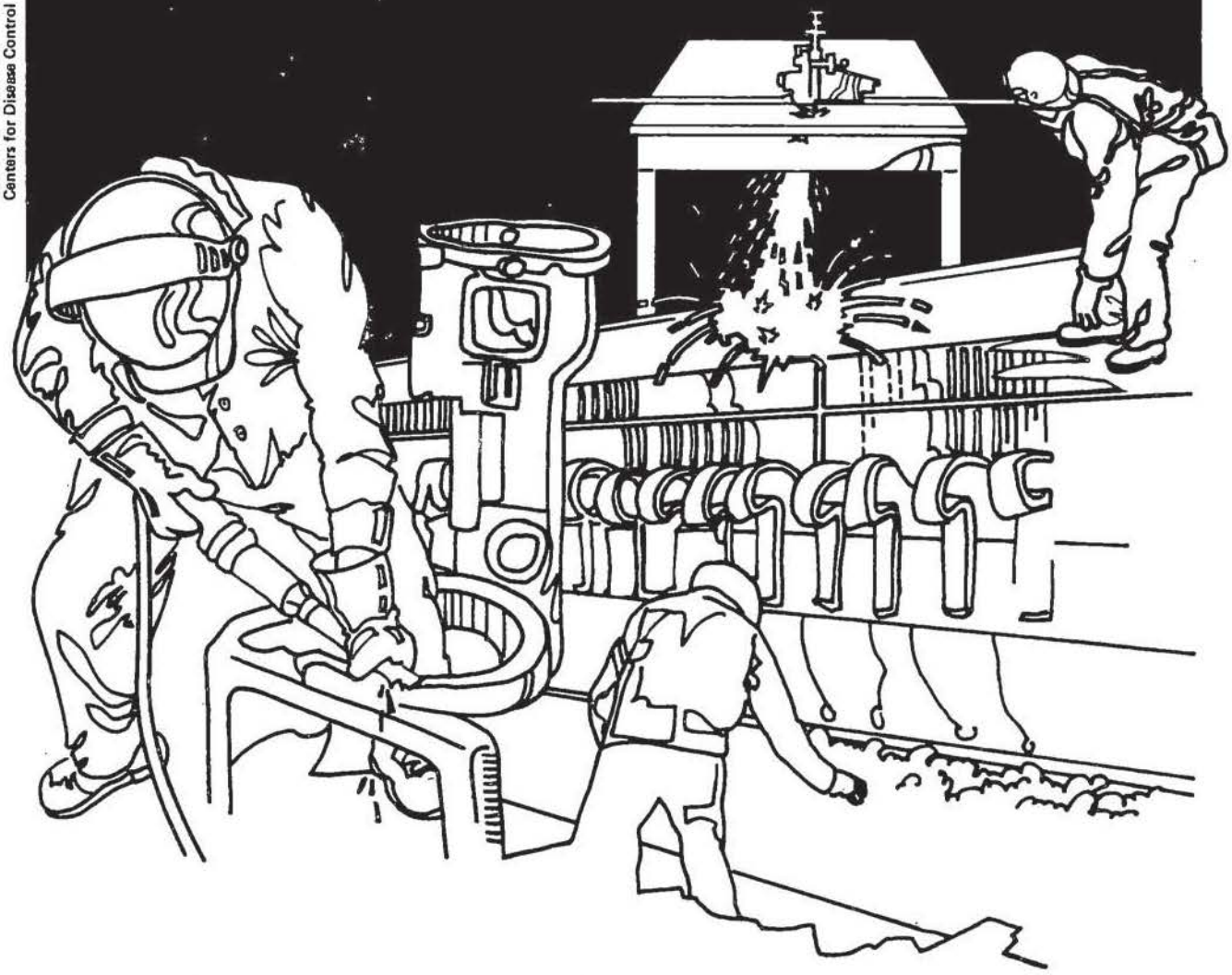
U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES ■ Public Health Service
Centers for Disease Control ■ National Institute for Occupational Safety and Health

NIOSH



Health Hazard Evaluation Report

HETA 81-098-941
LAB-CREST SCIENTIFIC GLASS COMPANY
SUBSIDIARY OF FISCHER & PORTER COMPANY
WARMINSTER, PENNSYLVANIA

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 81-098-941
August 1981
Lab-Crest Scientific Glass Company
Subsidiary of Fischer & Porter Company
Warminster, Pennsylvania

NIOSH Investigator:
Walter J. Chrostek

I. SUMMARY

On December 1, 1980, NIOSH received a request from the Director for Safety and Plant Protection of Fischer and Porter Company for a health hazard evaluation at their subsidiary, Lab-Crest Scientific Glass Company, Warminster, Pennsylvania. The request stated that two new ovens were installed for curing decals on glass tubes. Since these ovens were installed, the 5 employees are complaining of eye irritation and nasal problems.

Along with the request seven samples of the decals were submitted. These samples were sent to the NIOSH laboratory for analysis of their decomposition products. The major decomposition products of the decals were formaldehyde, acetaldehyde, propionaldehyde, n-butyraldehyde, n-valeraldehyde, styrene, and compounds of styrene.

On March 31, 1981, general and personal air sampling was conducted in the curing department of Lab-Crest Scientific Glass Company for aldehydes, formaldehyde and organic vapors. The aldehyde samples were analyzed for formaldehyde, acetaldehyde, propionaldehyde, n-butyraldehyde and n-valeraldehyde. The organic samples were analyzed for styrene and compounds of styrene.

Formaldehyde air concentrations ranged from 510-780 micrograms per cubic meter of air (Ug/M^3) sampled. The OSHA standard for formaldehyde is 3600 Ug/M^3. The former NIOSH recommended criteria based upon irritant effects was 1200 Ug/M^3, as a 30-minute ceiling exposure. However, based upon recent evidence of carcinogenicity as reported in the Current Intelligence Bulletin #34, NIOSH recommends that formaldehyde be handled as a potential occupational carcinogen, and that exposures be reduced to the lowest feasible limit.

Samples collected for acetaldehyde, propionaldehyde, n-butyraldehyde and n-valeraldehyde were also less than their respective limits of detection.

All samples collected for styrene and compounds of styrene were less than the limit of detection 1.0 microgram per samples (Ug/s).

On the basis of the data obtained in this investigation, NIOSH determined that a hazard from overexposure to styrene did not exist under present working conditions. NIOSH recommends that engineering controls and stringent work practices be employed to reduce occupational exposures to formaldehyde to the lowest feasible limit.

Keywords: SIC 3231 (Scientific glass products, made of purchased glass), formaldehyde, acetaldehyde, propionaldehyde, n-butyraldehyde, n-valeraldehyde, styrene, eye irritation, nasal problems.

II. INTRODUCTION

Under the Occupational Safety and Health Act of 1970, NIOSH investigates the toxic effects of substances found in the workplace. On December 1, 1980, a request was submitted by the Director for Safety and Plant Protection of Fischer and Porter for a health hazard evaluation at their subsidiary Lab-Crest Scientific Glass Company. Concern was expressed about the possible adverse health effects from exposure to decomposition products from plastic decals when baked in two new ovens.

Interim telephone discussions were conducted with management and union.

III. BACKGROUND

Lab-Crest Scientific Glass Company is engaged in making scientifically calibrated glass gauges. Purchased glass tubing is gas heated and drawn through calibrated rods. On these tubes is then affixed a decal with the proper gradation. These tubes are then placed in sand containing trays and inserted in a gas fired baking oven. The oven temperature is allowed to rise to 800°F and held for ten minutes at that point. The temperature then is raised to 1040°F and then the heat is shut off and allowed to cool. The oven is exhausted outdoors by forced mechanical ventilation.

IV. EVALUATION DESIGN

The 7 samples of the decal that were submitted on December 1, 1980 were sent to the NIOSH laboratory. Portions of each sample were heated separately in a tube furnace operating at 750°F. Air was passed over the heated samples to sweep away any volatiles generated and the effluent was then passed through charcoal tubes for sampling organics. The charcoal tubes were then desorbed with carbon disulfide or xylene (for low boiling components) and analyzed by gas chromotography. The analysis showed that the major decomposition products were formaldehyde, acetaldehyde, propionaldehyde, n-butyraldehyde, n-valeraldehyde, styrene and compounds of styrene.

General and personal air sampling was conducted on March 31, 1981.

A. Formaldehyde

Personal and general air samples on the operating ovens were collected utilizing specifically treated charcoal tubes and pumps operating at 50 cubic centimeters per minute. The A and B sections of the tube were analyzed by NIOSH Method P&CAM 318[1]. The limit of detection for the A section was 4 microgram of formaldehyde per sample (Ug/S) and for the B section 2Ug/S.

B. Aldehydes

Air samples were collected in the general work area and on the ovens in the midget impingers in series utilizing a 1 percent sodium bisulfite solution with pumps operating at 1 liter per minute. These samples were subsequently analyzed by NIOSH method No. P&CAM 125[2] for acetaldehyde, propionaldehyde, n-butyraldehyde, and n-valeraldehyde. The limit of detection for propionaldehyde was 7Ug/S. For all other aldehydes it is 2Ug/S.

C. Organic Vapors

Air samples were collected in charcoal tubes utilizing sampling pump operating at 100 cubic centimeters per minute adjacent to the samples collected for aldehydes and formaldehyde. These samples were analyzed by NIOSH method P&CAM No. S-30 for styrene and other organiz vapors. The limit of detection for styrene was 0.01 mg/sample

V. EVALUATION CRITERIA

Substance*	NIOSH	OSHA[3]
Formaldehyde	**LFL	3600
Styrene		420

*Denotes micrograms of contaminant per cubic meter of air samples (mg/M^3)
**Lowest feasible limit

VI. TOXICITY

A. Formaldehyde (4,5,6)

Local - Formaldehyde gas may cause severe irritation to the mucous membrances of the respiratory tract and eyes. The aqueous solution splashed in the eyes may cause eye burns. Urticaria has been reported following inhalation of gas. Repeated exposure to formaldehyde may cause dermatitis either from irritation or allergy.

Systemic - Systemic intoxication is unlikely to occur since intense irritation of upper respiratory passages compels workers to leave areas of exposure. If workers do inhale high concentrations of formaldehyde, coughing, difficulty in breathing, and pulmonary edema may occur. Ingestion, though usually not occurring in industrial experience, may cause severe irritation of the mouth, throat, and stomach.

The National Institute for Occupational Safety and Health (NIOSH) recommends that formaldehyde be handled as a potential occupational carcinogen and that appropriate controls be used to reduce worker exposure. These recommendations are based primarily on a Chemical Industry Institute of Toxicology (CIIT) study in which laboratory rats and mice exposed to formaldehyde vapor developed nasal cancer, and are supported by a New York University study where rats exposed to a mixture of formaldehyde and hydrochloric acid vapors developed nasal cancer. Formaldehyde has also been shown to be a mutagen in several short-term laboratory studies.

B. Aldehyde Compounds[5]

Aldehyde compounds are strongly irritating to the skin, eyes and respiratory tract. Acute exposure may result in pulmonary injuries such as edema, bronchitis and bronchopneumonia. Skin and pulmonary sensitization may develop in some individuals and result in contact dermatitis and, more rarely, asthmatic attacks.

C. Styrene

Local - Liquid and vapor are irritating to the eyes, nose, throat, and skin. The liquids are low-grade cutaneous irritants, and repeated contact may produce a dry, scaly, and fissured dermatitis.

Systemic - Acute exposure to high concentrations may produce irritation of the mucous membranes of the upper respiratory tract, nose, and mouth, followed by symptoms of narcosis, cramps, and death due to respiratory center parplysis. Effects of short-term exposure to styrene under laboratory conditions include prolonged reaction time and decreased manual dexterity.

VII. RESULTS AND DISCUSSION

A. Formaldehyde

Three atmospheric samples were collected. Two samples were collected on the baking ovens and one on the work table. Laboratory analysis of these samples showed atmospheric concentrations ranged from 510 to 780 micrograms per cubic meter of air. (Table 1).

B. Aldehydes

Three atmospheric air samples were collected for acetaldehyde, propionaldehyde, n-butyraldehyde, and n-valeraldehyde. Although these contaminants were present when the bulk samples were decomposed in the laboratory, the atmospheric air sampling results showed that the amounts in the work area were less than the lower limit of their detection, viz. 2 micrograms per sample.

C. Organic Vapors

Three atmospheric air samples were collected on charcoal tubes. Laboratory analysis of these tubes showed that the predominant peak was styrene. The concentrations of styrene vapor found was less than 1 microgram per sample which was the lower limit of detection.

The causative agents for the physical discomfort (eye irritation and nasal problems) may have been the decomposition products emitted from the paint in the newly purchased baking ovens. Since these ovens had been used many times before this evaluation was performed, the paint has been cured and these contaminants are no longer emitted.

During the environmental air sampling, the employees stated that they experienced no eye irritation or nasal problems.

VIII. AUTHORSHIP AND ACKNOWLEDGEMENTS

Report prepared by:

Walter J. Chrostek
Regional Industrial Hygienist
Project Leader, HETAB, NIOSH

Originating Office:

Hazard Evaluation and Technical Assistance Branch
Division of Surveillance, Hazard Evaluation and Field Studies
Cincinnati, OH

Report Typed By:

Deborah R. Ward
Secretary
NIOSH, Region III
Philadelphia, Pennsylvania

Acknowledgements

Laboratory Analysis:

Utah Biomedical Test Laboratory
Salt Lake City, UT

NIOSH Measurement Development Section
Cincinnati, Ohio

IX. DISTRIBUTION AND AVAILABILITY

Copies of this Determination Report are currently available upon request from NIOSH, Division of Technical Services, Information Resources and Dissemination Section, 4676 Columbia Parkway, Cincinnati, OH 45226. After 90 days, the report will be available through the National Technical Information Service (NTIS), Springfield, VA. 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. Lab-Crest Scientific Glass Company
2. Employee Representative
3. NIOSH, Region III
4. OSHA, Region III

For the purpose of informing the 5 employees of the results of the Lab-Crest Scientific Glass Company survey, the employer shall promptly "post" for a period of 30 calendar-days the Determination Report in a prominent place(s) near where employees work.

X. REFERENCES

1. NIOSH Manual of Analytical Methods, Vol. 6, (NIOSH) Publication #80-125, August 1980.
2. NIOSH Manual of Analytical Methods, Vol. 1, (NIOSH) Publication #77-157A&B.
3. U.S. Department of Labor, Occupational Safety and Health Administration, Federal Register, Vol. 39, No. 125, June 27, 1964, (Revised Nov. 7, 1978).
4. NIOSH Criteria for a Recommended Standard, Occupational Exposure to Formaldehyde, Publication #77-126, December 1976.
5. Occupational Diseases: A Guide to Their Recognition, USPHS, CDC, NIOSH, Publication #77-181, Revised June 1977.
6. NIOSH Current Intelligence Bulletin 34, April 15, 1981.

TABLE 1
HETA 81-098
Lab-Crest Scientific Glass Company
Subsidiary of Fischer & Porter Company
Warminster, Pennsylvania
March 31, 1981

Results of Personal and General Air Sampling for Formaldehyde

Sample No.	Location	Time	Airborne* Concentrations	Remarks
1	26HW34 Oven	9:45-14:37	550	Top of Oven
2	1101 Oven	9:50-14:32	780	Top of Oven
3	Operator	9:50-15:03	510	Operator's exposure

Evaluation Criteria

Substance	OSHA	NIOSH
Formaldehyde	3600	**1200 (for any 30 minute Sampling period)

*Denotes micrograms of contaminant per cubic meter of air sampled.
**Former NIOSH recommendation based upon irritant effects.