U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES ■ Public Health Service
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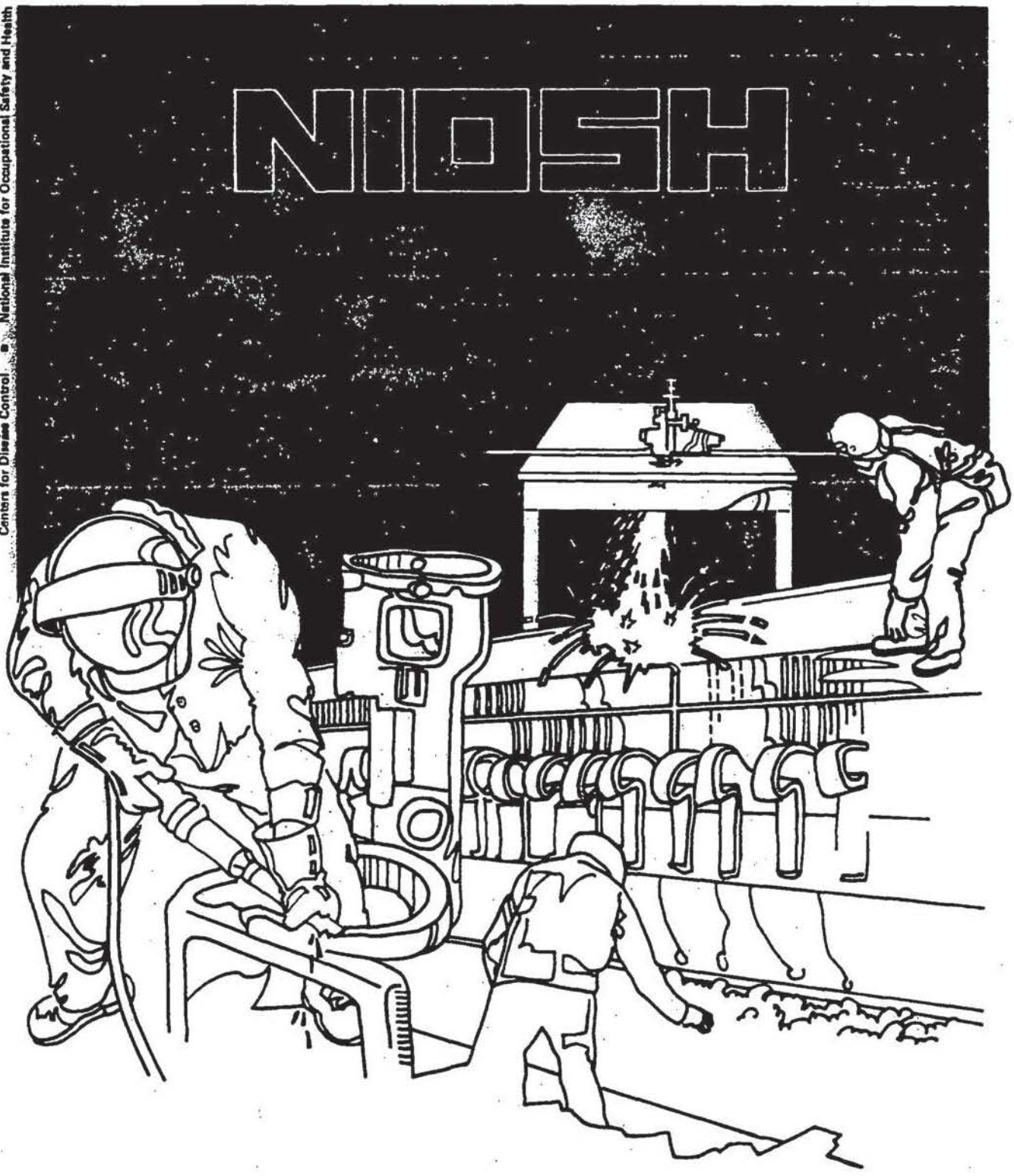
NIOSH



Health Hazard Evaluation Report

HETA 81-436-1074
ELLIS FISCHEL STATE CANCER HOSPITAL
COLUMBIA, MISSOURI

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.

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Ellis Fischel State Cancer Hospital
Columbia, Missouri

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I. SUMMARY

In July 1981, the National Institute for Occupational Safety and Health (NIOSH) received a request from the Director of the Department of Maxillofacial Rehabilitation to evaluate exposures to acetic acid vapor in the Maxillofacial Rehabilitation Laboratory, Ellis Fischel State Cancer Hospital, Columbia, Missouri. At the time of the study, one operator and one assistant were employed at the laboratory in the construction of maxillofacial prostheses. The process involves the use of a silicone elastomer that releases acetic acid during curing.

On December 15, 1981, NIOSH investigators conducted industrial hygiene sampling. Six personal breathing zone air samples were collected on charcoal tubes and analyzed for acetic acid by gas chromatography. Eight measurements for acetic acid exposure were also taken in the operator's breathing zone using direct-reading colorimetric detector tubes.

Fifteen-minute average exposures to acetic acid were found to be about 4 parts per million (ppm) for the operator according to the charcoal tube analysis. However, possible analytical problems as revealed by the analyses of spiked samples indicate that these results may be suspect. The colorimetric measurements for acetic acid in the operator's breathing zone ranged from 4 to 30 ppm, with a mean of 16 ppm.

The American Conference of Governmental Industrial Hygienists (ACGIH) recommends that exposure to acetic acid vapor not exceed 15 ppm during any 15-minute sampling period in order to prevent undue irritant effects. Irritant effects have been reported to occur at levels below 10 ppm.

The operator reported that he frequently experienced eye and nose irritation during prosthetics fabrication.

Based on these results, NIOSH concluded that eye and nose irritation due to exposure to acetic acid vapor occurs during prosthetics fabrication. Recommendations for avoiding overexposure are included in section VII of this report.

KEYWORDS: SIC 806 (Hospitals), acetic acid, silicone, maxillofacial prostheses.

II. INTRODUCTION

In July 1981, NIOSH received a request for a health hazard evaluation at the Ellis Fischel State Cancer Hospital in Columbia, Missouri. The request was submitted by the Director of the Department of Maxillofacial Rehabilitation who asked NIOSH to evaluate laboratory exposures to airborne acetic acid released during the use of a silicone polymer in the construction of maxillofacial prostheses.

III. BACKGROUND

Silicone elastomers have recently replaced polyvinyl chloride (PVC) plastisols for the fabrication of facial prostheses at the Ellis Fischel facility. The major product used during this process, "Silastic, Medical Adhesive Type A" is manufactured by Dow Corning Corporation. The product is marketed in two ounce tubes with the enclosed instructions for use stating that the material is nontoxic and essentially nonreactive to surrounding tissues, upon curing. No solvents or plasticizers are used in the material since polymerization occurs at room temperature upon contact with air moisture. The instructions also report that, "while curing, approximately 6.4% acetic acid is evolved", from the elastomer.

The operator begins by pouring a small amount of the uncured elastomer on a flat plate to which he gradually adds and stirs various pigments until the color of the mixture matches that of the patient's face. This process generally requires about 15 minutes. The silicone is then placed into the previously constructed mold for several hours until cured. The operator generally conducts prosthetic fabrication a few times per month.

IV. METHODS AND MATERIALS

NIOSH collected personal breathing zone air samples on December 15, 1981, to evaluate lab workers exposure to acetic acid vapors. Samples were taken on the operator and his assistant during the process. One set of samples was taken during the construction of a nose and one set was taken while fabricating an orbital prosthesis. Six samples were collected on charcoal tubes and analysed by gas chromatography according to NIOSH Method No. S-169. The samples were drawn by calibrated personal sampling pumps operating at 1.0 liters per minute for 15 minutes. Two charcoal tube samples were spiked with 1.0 milligrams (mg) of acetic acid and submitted to the laboratory along with the other samples in order to check the accuracy of the analytical method.

Acetic acid measurements also were taken in the operator's breathing zone using direct-reading colorimetric detector tubes while he was mixing the silicone materials.

V. EVALUATION CRITERIA

Acetic acid vapor has a direct irritant effect on the eyes, nose, throat, and lungs. Inhalation of concentrated vapors may cause serious nose and throat injury. At high exposures injury to the lungs is manifested by the development of pulmonary edema and bronchopneumonia. Repeated high exposures may cause irritation and darkening of the skin, erosion of teeth, and chronic inflammation of the nose, throat, and bronchi. Irritant effects have been reported to occur at levels below 10 ppm.

The American Conference of Govermental Industrial Hygienists (ACGIH) recommends that exposures to acetic acid not exceed 15 parts per million (ppm) during any 15-minute sampling period in order to prevent undue irritant effects.

VI. RESULTS

Personal breathing zone concentrations of acetic acid ranged from 0.5 to 4.8 ppm as determined by the charcoal tube analysis (Table I). The operator was exposed to an average concentration of 4 ppm. However, analysis of the spike samples (1.0 mg acetic acid) indicated a potential deficiency in the analytical method. One sample was found to contain 0.98 mg, but the other contained only 0.50 mg. Further work is needed to determine the cause of the analytical problem. It is possible that acetic acid concentrations may actually be higher than reported in Table I.

Direct colorimetric measurements taken during prosthetic fabrication indicated that consistently higher concentrations of acetic acid was present in the operators breathing zone. Levels ranged from 4 to 30 ppm with a mean of 16 ppm. In general, colorimetric detector tubes are only accurate to within $\pm$ 25%. These particular tubes are not NIOSH - certified.

Eye and nose irritation was clearly evident when the material was brought close to one's breathing zone.

VII. CONCLUSION/RECOMMENDATIONS

Relatively small amounts of acetic acid are emitted when using the Silastic product, such that no significant accumulation of irritating vapors would be expected in the laboratory. However, due to the operator's necessity to work within a very close distance of the emissions, eye and nose irritation has been experienced by him.

A small fan located on or near the work desk is probably all that is needed to direct acetic acid vapor away from the operator's face where the vapors would be diluted to well below irritating levels within the general area. In the event that future plans ever call for an increase in the amount of facial prosthetic work that is done at Ellis Fischel, it might be prudent to install a laboratory - type exhaust hood where such work could be conducted with more efficient control of contaminants.

VIII. AUTHORSHIP AND ACKNOWLEDGEMENTS

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IX. 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. Ellis Fischel State Cancer Hospital.
2. U.S. Department of Labor, Region VII.
3. NIOSH, Region VII

TABLE I

Personal Breathing Zone Concentrations of Acetic Acid Vapors
Ellis Fischel State Cancer Hospital
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December 15, 1981

JOB	PROSTHESIS	SAMPLING TIME	CONCENTRATION (ppm)
		NIOSH Method No. S-169	
operator	nose	10:45-11:00	4.8
assistant	nose	10:45-11:00	0.5
operator	orbital area	11:33-11:51	3.3
assistant	orbital area	11:33-11:51	0.9
		Direct Colorimetric Measurements	
operator	nose	10:47	4
operator	nose	10:50	30
operator	nose	10:53	12
operator	nose	10:55	25
operator	nose	10:58	8
operator	nose	11:00	15
operator	orbital area	11:37	25
operator	orbital area	11:40	12