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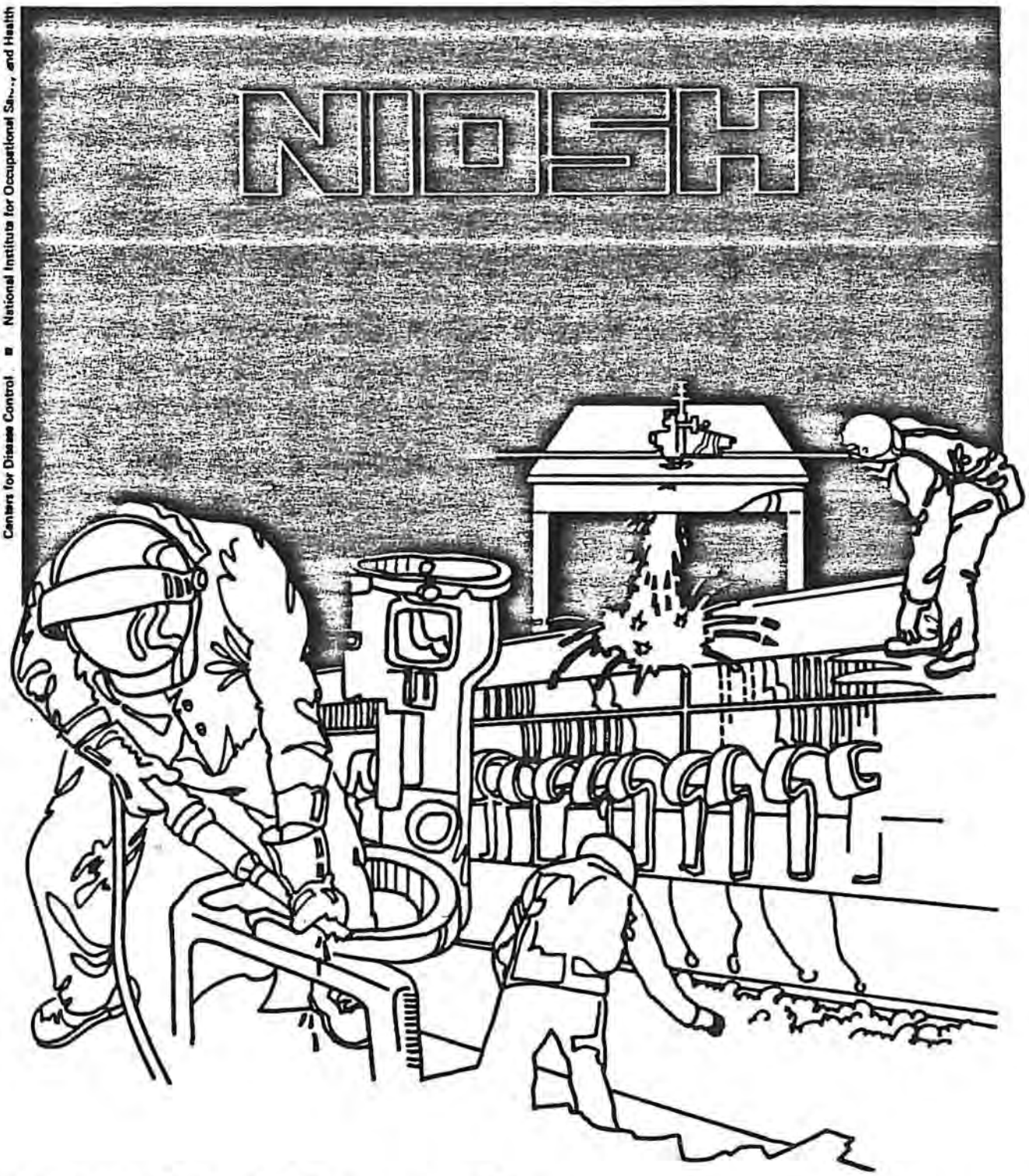

Health Hazard Evaluation Report

HETA 82-176-1236
U.S. CUSTOMS SERVICE
PATROL DIVISION OFFICE
TREASURE ISLAND
SAN FRANCISCO, CALIFORNIA

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.

Mention of company names or products does not constitute endorsement by the National Institute for Occupational Safety and Health.

HETA 82-176-1236
DECEMBER 1982
U.S. CUSTOMS SERVICE
PATROL DIVISION OFFICE
TREASURE ISLAND
SAN FRANCISCO, CALIFORNIA

NIOSH INVESTIGATORS:
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I. SUMMARY

On March 15, 1982, the National Institute for Occupational Safety and Health (NIOSH) was requested by the National Treasury Employees Union Chapter 165 at the U.S. Customs Service Patrol Division Office at Treasure Island, San Francisco, California, to evaluate possible excess exposure to formaldehyde after multiple complaints of eye and upper respiratory irritation, headache and fatigue among office workers and patrol officers in the Patrol Division Office.

On April 21, 1982, NIOSH conducted an initial environmental and medical survey at the U.S. Customs office. Seven formaldehyde area air samples were collected using Chromosorb tubes; however, no formaldehyde was detected. On July 21, 1982, a follow-up environmental survey was conducted and five formaldehyde area air samples were collected. Formaldehyde was detected in all samples, and the concentration ranged from 0.15 - 0.23 ppm (parts of a vapor or gas per million parts of contaminated air) based on one hour-sampling periods. Since formaldehyde is recognized as a potential occupational carcinogen, NIOSH recommends that exposure be reduced to the lowest feasible limit.

Interviews with eight workers revealed a pattern of eye and upper respiratory irritation, cough, chest tightness, headache, nausea and fatigue consistent with exposures to low levels of formaldehyde.

Based on environmental and medical results, NIOSH concluded that there was a health hazard from low-level exposure to formaldehyde at the U.S. Customs Service Patrol Division Office. Recommendations to control this hazard are found in Section VIII of this report.

KEYWORDS: SIC 9999 (Office Workers), formaldehyde, eye irritation, upper respiratory irritation, sensitization.

II. INTRODUCTION

In March, 1982 the National Institute for Occupational Safety and Health (NIOSH) received a request for a health hazard evaluation from the National Treasury Employees Union, Chapter 165, at the U.S. Customs Patrol Division Office, (Treasure Island) San Francisco, California. NIOSH was requested to investigate the cause of workers complaints of upper respiratory irritation, headache and fatigue while working in the Patrol Division Office.

On April 21, 1982, NIOSH conducted an initial environmental and medical survey of the Patrol Division Office. Airborne formadehyde samples were collected and employee interviews were conducted. On July 21, 1982, a follow-up environmental survey was conducted, and additional formaldehyde air samples were collected. The environmental air sampling results were telephoned to the appropriate individuals as soon as they become available. The medical findings were discussed with the workers and supervisor at the end of the initial survey.

III. BACKGROUND

In August, 1980, the U.S. Customs Service Patrol Division, San Francisco District moved its offices and staff to the present location in a trailer complex on Treasure Island, San Francisco, California. Within a month, several employees noted an unusual odor in the trailer building, and began to complain of eye irritation, cough, chest tightness, nose and throat irritation, headache, fatigue and other symptoms. On June 5, 1981, the Coast Guard Industrial Hygienist at Mare Island collected three formadehyde air samples. The formaldehyde air concentrations were measured to be 3, 5 and 19 ppb (parts of a vapor or gas per billion parts of air) which was well below the Federal Occupational Safety and Health Administration (OSHA) Standard of 2 ppm (parts of a vapor or gas per million parts of air). Samples of the wood paneling were analyzed and found to contain 0.01 percent formaldehyde which is normally used in glue. It should be noted that another source of formaldehyde is the synthetic carpets. A follow-up written report by the industrial hygienist stated that the formaldehyde concentrations measured would not be detrimental to the employees health; however, he recommended 5 to 10 air changes per hour in the building.

On June 10, 1982, ENTEK Corporation was contracted to test, evaluate and prepare a report with recommendations regarding the five air conditioning units located in three private offices and the women's locker room. At the time of their investigation, the ventilation consisted of open doors and windows and some small space fans for circulation. The air-conditioning units were not being used because of the excessive noise. Numerous recommendations were made to improve the air distribution capabilities of the present air conditioning system.

Individual workers were seen by a number of physicians in the community, and in several cases were told that their complaints were related to ventilation problems in the trailer. In December of 1981, all eight employees in the building were examined by a Public Health Service physician, who noted that:

> "All eight patients complained of headaches after working for a few hours in the office building. Five of these also had symptoms referrable to the upper airways. Seven complained of fatigue and two had skin problems. Four of these patients smoke. On physical examination....no common medical abnormalities could be identified. Despite several medical complaints in common, no consistent medical abnormalities could be identified in any organ system."

No suggestions were offered for a possible etiology or of possible ways of investigating this apparent problem. Memoranda concerning the problem were forwarded from the San Francisco District Patrol Director to the District Director's office for the Department of the Treasury, and evaluations were conducted by Department representatives without identification of the cause of the problem. As a result of this, NIOSH was requested to undertake an evaluation in March of 1982.

Eight employees of the patrol Division spend most of their workday within the trailer building. Of these, two workers are clerical and the others are patrol officers. Work for all these employees involves administrative and technical tasks, seated at desks, and with frequent movement from office to office within the building. Complaints were particularly high regarding two of the smaller offices in the back of the trailer.

IV. EVALUATION DESIGN AND METHODS

A. Environmental

Several sampling techniques were used to evaluate formaldehyde air concentrations. Area air samples were collected using a sampling train (calibrated vacuum pump and appropriate collecting medium) through which a known volume of air is passed. On April 21, 1982 Chromosorb tubes were used to collect formaldehyde vapors. The tubes were subsequently analyzed according to NIOSH Physical and Chemical Analytical Method (P&CAM) number 354[1] (modified) using a Hewlett-Packard 5711A gas chromatograph with a flame ionization detector. The formaldehyde limit of detection was five micrograms per sample. On July 21, 1982, another method consisting of a one percent sodium bisulfite impinger solutions was used to collect analyzed by NIOSH P&CAM method number 125[2]. The analytical limit of detection was two micrograms per sample.

B. Medical

Eight employees were interviewed by questionnaire for the following symptoms: eye irritation, cought, chest tightness, headache, nausea shortness of breath, sore throat, odor, fatigue, frequent body aches, congested nose and sneezing. Backache and frequent urination were questioned to provide an internal control for non-formaldehyde related complaints. Workers were asked about the temporal pattern of their

symptoms, whether they had taken sick leave in the past year as a result of these symptoms, whether they smoke, and if they have a history of allergies prior to their work in this trailer. The results of the questionnaire were evaluated for their consistency internally, and with regard to the known symptoms of formaldehyde irritation and sensitization.

V. EVALUATION CRITERIA AND HEALTH EFFECTS

A. Environmental

Occupational exposure criteria have been developed to evaluate worker's exposure to chemical substances. The criteria are based on the best available information from industrial experience from experimental human and animal studies, and when possible from a combination of the three. These values below represent concentrations to which it is believed that nearly all workers may be exposed for an 8-10 hour day, 40-hour work week throughout a lifetime without experiencing adverse health effects.

Three sources of criteria generally used to evaluate the workroom concentrations of air contaminants: (1) NIOSH criteria for recommended standards; (2) recommended Threshold Limit Values (TLV's) and their supporting documentation as set forth by the American Conference of Governmental Industrial Hygienists (ACGIH), 1981; and (3) Federal-Occupational Safety and Health Administration (FED-OSHA) standards.

TABLE A

Permissible Exposure Limit - ppm[1]

	NIOSH	ACGIH TLV	FED-OSHA
Formaldehyde	Lowest feasible limit.	2(c)[2]	5(c)[2] 10(c)[3] (30 min)

1) ppm - parts of a vapor or gas per million parts of contaminated air.

2) $(c)^2$ - The maximum concentration of an airborne contaminant to which an employee can be exposed at any time.

3) $(c)^3$ - The maximum concentration of an airborne contaminant to which an employee can be exposed during a 30 minute duration.

B. Toxicological

Formaldehyde gas may cause severe irritation to the mucous membranes of the respiratory tract and eyes. Repeated exposure to formaldehyde may cause dermatitis (skin rash) either from irritation or allergic reaction. Some persons become sensitized (allergic) to formaldehyde and subsequently develop eye and respiratory tract irritation at much lower levels than non-sensitized individuals. (3) In two recent studies, intense irritation of the eye, nose and throat was reported at levels range from 0.13-0.45 ppm, and headache as well as irritation at levels from 0.25 to 1.39 ppm. (4,5)

Formaldehyde has recently been found to cause nasal cancer in exposed laboratory animals. (6) The TLV for formaldehyde is 2 ppm ceiling concentration. NIOSH recommends use of engineering controls and work practices to limit worker exposure to the lowest feasible limit.

VI. RESULTS AND DISCUSSION

A. Environmental

Based on the employees health complaints, it was suspected that formaldehyde off-gassing from the wall paneling glue and the synthetic carpets, along with inadequate ventilation may have been responsible for worker's symptoms. Ventilation on the first day of our survey consisted of open doors and windows. The window air conditioning units were not used because they were too noisy. On April 21, 1982, seven formaldehyde area air samples were collected from the offices. Four-hour (12 liter) air samples were collected; however, no formaldehyde was detected. It should be noted that the NIOSH investigators experienced eye irritation when they entered one of the private offices. It was suspected that the relatively hot weather on the day of the survey may have contributed further to the formaldehyde off-gassing. Since no airborne formaldehyde was detected using a relatively new sampling method (Chromosorb tube), it was decided to re-evaluate the work environment using impinger solutions which are more sensitive. On July 21, 1982, five sets of impinger samples were used to detect formaldehyde vapors (Table I). The airborne concentrations ranged from 0.09-0.19 ppm based on one-hour (60 liter) air samples. Indoor temperature measurements were taken during the follow-up survey with a psychrometer. The dry bulb temperature (69°F), wet bulb temperature 58.5°F) and calculated relative humidity (58 percent) were within the comfort control range (72-79°F, relative humidity 20-60 percent) recommended by the American Society of Heating, Refrigerating and Air Conditioning Engineers. The NIOSH Investigator did not experience eye irritation on the follow-up survey as he did during the initial survey; however, the indoor building temperature was perceived as being considerably cooler (about 10°F).

It should be noted that of the ventilation recommendations made by ENTEK Corporation for improving the air distribution had not been implemented at the time of this report. It is believed that the ventilation changes will alleviate the hot stagnant air and the build-up of low level formaldehyde concentrations which are believed to be responsible for the employees health complaints.

B. Medical

Eight employees (age range 27-49 years) were interviewed on May 13, 1982. Symptoms reported are summarized below, including the two control questions regarding backache and frequent urination. Without exception, all workers reported that their symptoms were much worse by the end of the workday, and cleared completely or almost completely during vacations. Six of the eight employees had taken sick leave time because of the symptoms reported. Three of the workers had a prior history of allergies, and four were cigarette smokers; there was no apparent correlation between smoking or atopic history and the symptoms reported.

FREQUENCY OF SYMPTOMS REPORT

BY PATROL DIVISION EMPLOYEES

SYMPTOM	FREQUENCY OF COMPLAINTS (n=8)
Headache	8
Fatigue	7
Eye Irritation	6
Congested Nose	6
Dry/Itchy/Sore Throat	6
Persistent Cough	5
Nausea	5
Notice Unusual Ordor	4
Frequent Sneezing	4
Chest Tightness	3
Frequent Body Aches	2
Shortness of Breath	1
Backache	1
Frequent Urination	0

VII. DISCUSSION AND CONCLUSIONS

The pattern of complaints in the medical interviews were highly consistent with low level formaldehyde irritation and possible sensitization. This was further strengthened by the temporal pattern, in which all workers' symptoms improved during their vacation and worsened after several hours exposure. It is noteworthy that although several previous physicians had concluded that workers at this site were manifesting symptoms of a work-related health problem, a physician who saw all of the employees and commented upon the common pattern of their complaints did not pursue the matter, evidently because of the lack of physical findings. It should be emphasized that in cases of formaldehyde-induced irritation or sensitization, it is quite possible that no physical changes will be seen on physical examination except in extreme cases.

VIII. RECOMMENDATION

It is suggested that the recommendations cited in the ENTEK Corporation study, dated June 23, 1981, be implemented as soon as possible to improve the air distribution of the present air conditioning system.

REFERENCES

1) NIOSH Manual of Analytical Methods, Volume No. 7, HEW Publication No. (NIOSH) 82-100.

2) NIOSH Manual of Analytical Methods, Volume No. 1, HEW Publication No. (NIOSH) 77-157A.

3) NIOSH: Occupation Diseases - A Guide to Their Recognition, DHHS (NIOSH) Publication No. 77-181, June 1977, pp 153-154.

4) Bourne H. Seferian S. Formaldehyde in Wrinkle-proff Apparel Processes. Industrial Medicine and Surgery 1959; 28:232-3.

5) Kerfoot E, Mooney T. Formaldehyde and paraformaldehyde study in funeral homes. American Industrial Hygiene Association Journal 1975; 36:533-7.

6) Formaldehyde: Evidence of Carcinogenicity, NIOSH Current Intelligence Bulletin, No. 34, DHHS (NIOSH) Publication No. 81-111, April 15, 1981.

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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, 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, Publication Office, at the Cincinnati address.

1. National Treasury Employees Union, Chapter 165, U.S. Customs Service Patrol Division Office, San Francisco, California.
2. Regional Commissioner of U.S. Customs Service, San Francisco, California.
3. U.S. Department of Labor - Region IX
4. NIOSH - Region IX.

For the purpose of informing the 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.

TABLE I

SUMMARY OF AREA AIR SAMPLES

COLLECTED FOR FORMALDEHYDE VAPORS

U.S. CUSTOMS SERVICE PATROL DIVISION OFFICE

TREASURE ISLAND

SAN FRANCISCO, CALIFORNIA

JULY 21, 1982

SAMPLE NO.	LOCATION	SAMPLE PERIOD	SAMPLE VOLUME (LITERS)	FORMALDEHYDE CONCENTRATION (ppm)[1]
1 & 1A	Secretaries Desk	0908-1008	60	0.19
2 & 2A	Air Branch Office	0908-1008	60	0.14
3 & 3A	Marine Branch Office	0908-1008	60	0.18
4 & 4A	Air Supervisors Office	0915-1015	60	0.12
5 & 5A	Senior Supervisor Office	0921-1021	60	0.09

(1) ppm - parts of a vapor or gas per million part of contaminated air.

DEPARTMENT OF HEALTH AND HUMAN SERVICES
PUBLIC HEALTH SERVICE
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