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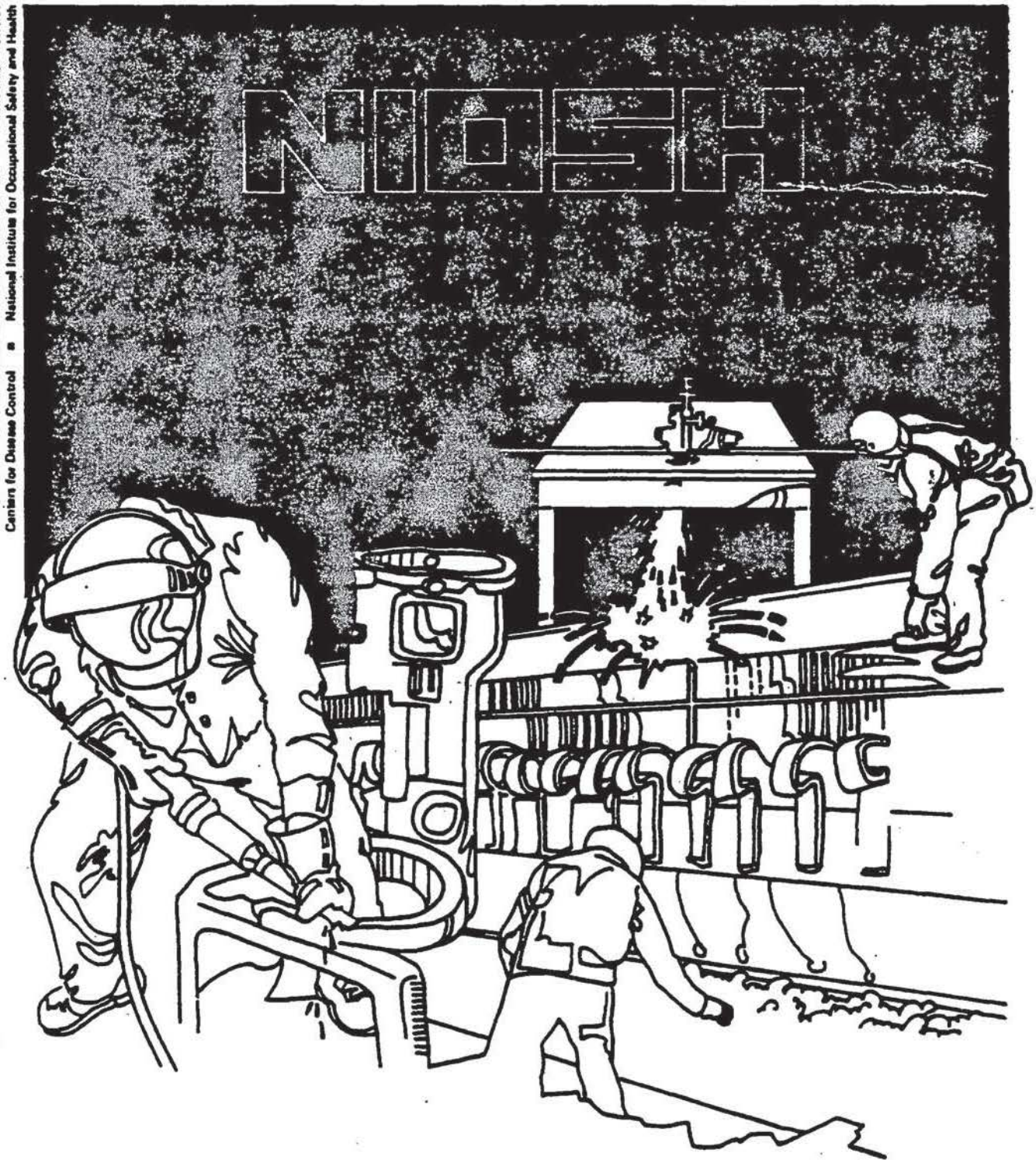

Health Hazard Evaluation Report

HETA 85-020-1587
DEPARTMENT OF THE INTERIOR
SAN FRANCISCO BAY NATIONAL
WILDLIFE REFUGE
NEWARK, 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.

HETA 85-020-1587
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DEPARTMENT OF THE INTERIOR
SAN FRANCISCO BAY NATIONAL
WILDLIFE REFUGE
NEWARK, CALIFORNIA

NIOSH INVESTIGATOR:
Pierre L. Belanger, IH.

I. SUMMARY

In October 1984, the National Institute for Occupational Safety and Health (NIOSH) received a request to evaluate indoor air quality at the the San Francisco Bay National Wildlife Refuge in Newark, California. The manager of the facility was concerned that an employee working at the headquarters and visitor center may be exposed to indoor air contaminants. One worker reported smelling unusual odors, having sinus irritation, and a general feeling of respiratory discomfort.

On November 17, 1984, an initial environmental survey was conducted at the Wildlife headquarters and visitor center. On December 11, 1984 a follow up environmental survey was conducted to evaluate formaldehyde air concentrations. Four environmental air samples were collected during the day. The air concentrations ranged from none detected to 0.02 parts of a vapor or gas per million parts of contaminated air by volume (ppm) which is consistent with what is called background levels.

Based on the environmental air sampling results, the NIOSH investigator concluded that a health hazard did not exist at the National Wildlife Refuge headquarters and visitor center. Recommendations are provided in Section VIII of this report to assure that formaldehyde exposures do not occur when formalin is used by the biologists.

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

II. INTRODUCTION

In November, 1984 the National Institute for Occupational Safety and Health (NIOSH) received a request for a health hazard evaluation from the Manager of the San Francisco Bay National Wildlife Refuge in Newark, California. NIOSH was requested to investigate whether the office staff at the headquarters/visitors information center were being exposed to indoor air pollution as a result of off-gassing from the plastic furniture, the wood paneling and the synthetic carpet. The manager was concerned whether one workers symptoms (sinus irritation, feeling of lassitude, and general feelings of respiratory discomfort) could be related to indoor air pollution.

On November 17, 1984, NIOSH conducted an initial environmental survey of the center. On December 11, 1984 a follow up environmental survey was conducted to evaluate formaldehyde air concentrations in the office areas. Environmental air sampling results were telephoned to the manager as soon as they became available.

III. BACKGROUND

The headquarters and visitors center of the Wildlife Refuge was built in 1978-79. Approximately 16 workers (5 female and 11 male) are assigned to the center, however, only six employees work in the office full time. Also, there are three volunteers who work part-time in the visitors information center. Employees generally work eight hours a day five days a week during the hours of 8:00 am to 5:00 pm.

The center is an 8000 square feet cathedral ceiling design. The building is constructed of pilings and laminated beams; the interior is finished with treated plywood, the walls are insulated with batting, and nylon carpeting is used throughout the office areas. The building uses a hot water, forced air heating and ventilation system (HVS). The thermostat regulates the air temperature at 68°F during the hours of 7:00 am to 3:00 pm.

The wildlife refuge center is open seven days a week except for the office areas. The center is built on a hillside and consists of four levels of which office areas occupy two levels and the visitors center occupies two. The biologists' office and I&R area are located on the first level; the administrative area, library, three offices, bathrooms and the HVS are located on the second level, and the visitor information center is located on the third and fourth level. It should be noted that the first and second level are not physically separated by a wall.

The only chemical reportedly used in the office area (lab) is formalin which evolves formaldehyde gas. The biologists periodically use formalin for preserving some of the wildlife samples collected at the

refuge. The preserved specimens are kept in a cabinet in the biologists office. At the time of the survey, formalin and other chemicals which may be used in the field were being stored in a safe outside the biologists' office in order to control undesirable chemical odors.

IV. ENVIRONMENTAL DESIGN METHOD

Two air sampling techniques were used to evaluate formaldehyde air concentrations. Area air samples were collected using a sampling train (calibrated vacuum pump) and a one percent sodium bisulfite impinger solution through which a known volume of air was passed. A second method was used in an attempt to characterize the long term formaldehyde air concentrations. This method utilized a passive dosimeter (filter) which was hung a specified height from the ceiling and exposed to the ambient air for seven days. It should be noted that the second method is not a valid NIOSH sampling method due to sampling efficiency of the filter when the filter becomes dry, thus this data should be carefully scrutinized. The impinger solution and filters were each analyzed by NIOSH Physical and Chemical Analytical method (P&CAM) number 125 (1).

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 life time 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 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 at 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 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 8-10-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 exposure.

TABLE A

Permissible Exposure Limit-ppm[1]

CHEMICAL	NIOSH	ACGIH-TLV	FED-OSHA
Formaldehyde	Lowest Feasible limit	2(C)[2]	5(C)[2] 10(C)[3]

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

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 and other aldehydes may be released from a number of different sources including diesel exhaust, the foam plastics,

carbonless paper, particle board, plywood, and textile fabrics to mention a few. Formaldehyde is an irritant to the eyes, nose, mouth, and throat. 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.(2) 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. (3,4)

Formaldehyde has recently been found to cause nasal cancer in exposed laboratory animals. (5) The ACGIH 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

Based on the health hazard evaluation request and initial telephone conversation with the requestor, there was concern that employees may be exposed to indoor air pollution. An initial walk through survey revealed that the problem is more likely to be related to the formalin used by the biologists in the laboratory. A slight formaldehyde odor was smelled by the industrial hygienist upon entering the biologists' office; however, this odor did not permeate the other adjacent areas. It was reported that the formalin solution was used occasionally by the biologists to preserve specimens collected at the refuge. The preserved specimens are kept in a cabinet inside the biologists office. Four environmental air samples (Table 1) were collected from the first and second levels of the facility during the follow up survey. Each of the air samples were collected for about four hours. The sampling period was staggered so that samples could be collected during the whole work day. Low levels of formaldehyde were measured which ranged in concentration from none detected to 0.03 ppm. These air concentrations are consistent with what is called background concentrations which may range from 0.01 to 0.04 ppm. Additionally, the odors detected in the biologists office are consistent with the air concentrations measured on the date of this survey. The highest air concentration, as anticipated, was measured in the biologists office where the specimens are stored. The long term passive dosimeters measured air concentrations ranging from 0.01 to 0.02 (Table II) which is consistent with the impinger air sample results reported above.

Six employees were interviewed to determine whether they were experiencing any symptoms of exposure to formaldehyde. Of the six

persons interviewed, two workers reported respiratory irritation (cough), particuliarly during the spring and summer months, but these workers also reported having mild allergies. The only other symptoms reported by one worker included occasionally smelling an unusual odor, feelings of lassitude, sinus irritation, and a general feeling of respiratory discomfort.

VII. CONCLUSION

Based on the formaldehyde air concentrations measured during the dates of this survey, a health hazard did not exist at the San Francisco National Wildlife Refuge. The formaldehyde odors detected in the biologists' office and the environmental air sampling results are consistent with background levels.

VIII RECOMMENDATIONS

1. It is recommended that the formalin solution used by the biologists for preserving the wildlife samples be well controlled to prevent vapors from permeating the general office areas. If the solution is to be used frequently, than consideration should be given to using the chemical under a laboratory hood.

2. The formalin solution along with other chemicals used in the laboratory should be stored in a proper storage cabinet to contain chemical odors. Consideration might be given to storing the preserved specimens in a ventilated cabinet to control the formaldehyde vapors.

IX. REFERENCES

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

2. NIOSH: Occupational Diseases- A Guide to Their Recognition, DHHS (NIOSH) Publication No. 77-181, June 1977, pp 153-4.

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

4. Kerfoot E. and Mooney T., Formaldehyde and paraformaldehyde study in funeral homes. American Industrial Hygiene Association Journal 75; 36:533-7.

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

X. AUTHORSHIP AND ACKNOWLEDGEMENTS

Report Prepared By;	Pierre L. Belanger Industrial Hygienist NIOSH-Region IX San Francisco, California
Analytical Laboratory Support	California State Department of Health. Berkeley, California

XI. DISTRIBUTION AND AVAILABILITY

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 Road, Springfield, Virginia, 22151. Information regarding its availability through NTIS can be obtained from the NIOSH Publication Office at the Cincinnati address.

Copies of this report have been sent to:

1. San Francisco Bay National Wildlife Refuge, Newark, California.
2. U.S. Department of Labor-Region IX.
3. 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
USING IMPINGER SOLUTION

SAN FRANCISCO BAY NATIONAL WILDLIFE REFUGE-
VISITORS INFORMATION CENTER.

NEWARK, CALIFORNIA
DECEMBER 11, 1984

Sample No.	LOCATION	SAMPLE PERIOD	SAMPLE VOLUME (LITERS)	FORMALDEHYDE Concentration (ppm)[1]
F-1	Second level; On top of file cabinet next to Secretary's desk	0826-1246	260	0.02
F-2	First level; Biologists office next to cabinet where specimens are kept	0829-1302	303	0.03
F-3	First level; open office on filing cabinet; I & R Section	0831-1009 & 1247-1547	240	0.01
F-4	Second level; Project leaders desk	0930-1335	245	None Detected

1. ppm-Parts of a vapor or gas per million parts of contaminated air by volume.

TABLE II

SUMMARY OF AREA AIR SAMPLES
COLLECTED FOR FORMALDEHYDE VAPORS
USING PASSIVE DOSIMETERS*

SAN FRANCISCO BAY NATIONAL WILDLIFE REFUGE-
VISITORS INFORMATION CENTER.

NEWARK, CALIFORNIA
DECEMBER 11, 1984

Sample No.	LOCATION	SAMPLE PERIOD	SAMPLE VOLUME (LITERS)	FORMALDEHYDE Concentration (ppm)[1]
F-10	Second level; Project leaders office	Seven days	--	0.01
F-11	Second level; Biologists office	Seven days	--	0.02
F-12	Second level; Library	Seven days	--	0.01

1. ppm-Parts of a vapor or gas per million parts of contaminated air by volume.

* It should be noted that NIOSH does not consider the use of passive dosimeters as a valid sampling method due to the problems with the filter collection efficiency. Thus this data should be carefully scrutinized when this sampling method is being used to monitor formaldehyde air concentrations.