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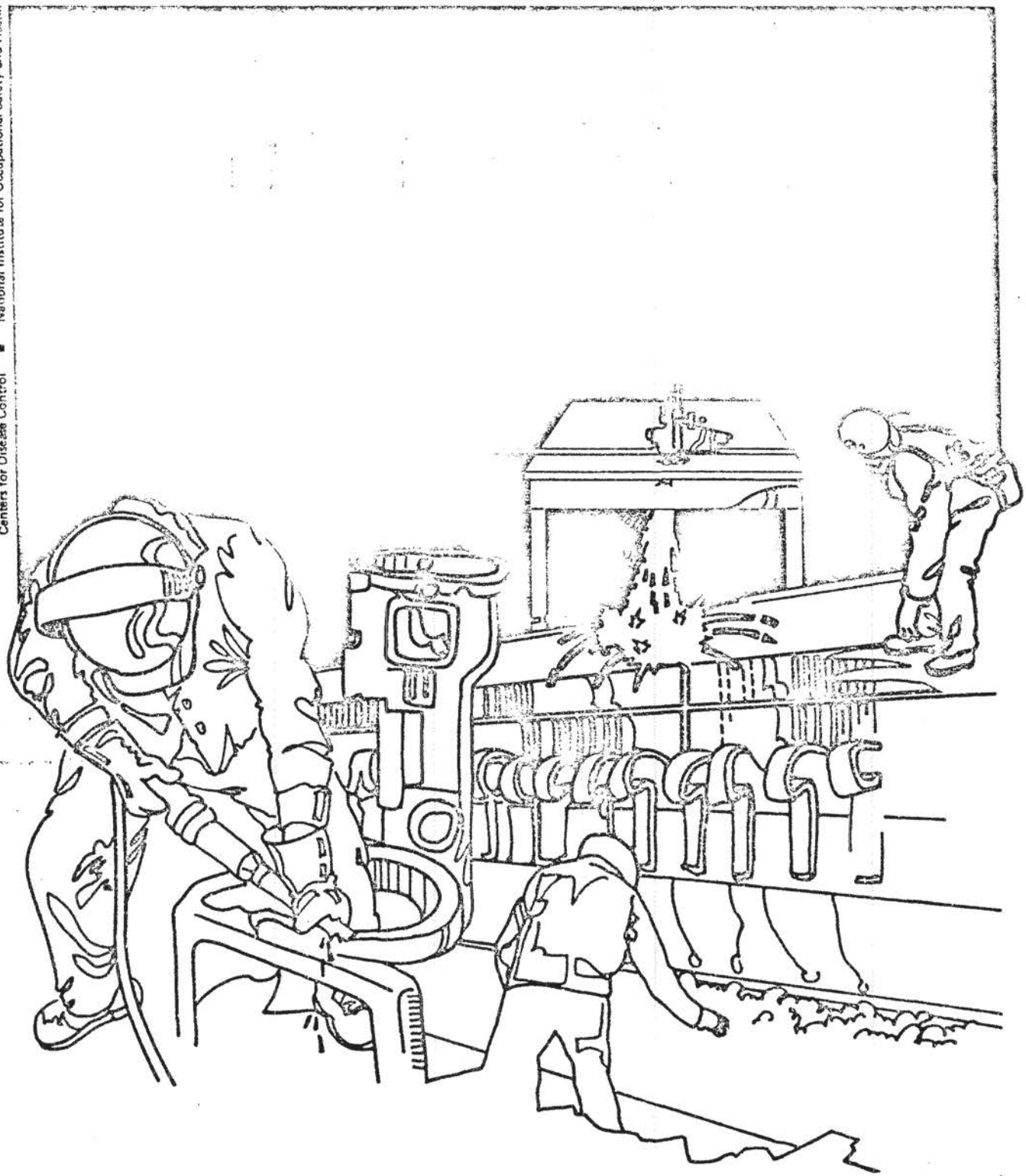

Health Hazard Evaluation Report

HETA 82-337-1163
NATIONAL PARK SERVICE
PATCHOGUE, NEW YORK

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.

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National Park Service
Patchogue, New York

NIOSH Investigators
Nicholas Fannick
David Marlow

I. SUMMARY

In June 1982, the National Institute for Occupational Safety and Health (NIOSH) received a request from the Regional Safety Manager, U. S. Department of the Interior, to re-evaluate formaldehyde concentrations in two houses in Watch Hill, Fire Island, New York. These houses are used by the National Park Service to house park rangers who work at the Fire Island National Seashore.

NIOSH representatives had performed similar surveys at the houses in 1981. Formaldehyde concentrations in the two houses (#1 and #3) ranged from 0.06 to 0.13 parts per million parts of air (ppm). At that time, NIOSH recommended that minors be removed from the houses and that occupancy be limited to the Summer months when natural ventilation and increased out-door activity would limit exposures. NIOSH further recommended that the urea-formaldehyde foam be removed from the two houses. The foam was removed from one of the houses with little effect on the formaldehyde levels (see HETA 81-241-970). The present request is to evaluate conditions after a lapse of over one year since the last survey was performed.

On July 7, 1982, NIOSH representatives surveyed the two houses for formaldehyde vapor using a direct reading CEA-555 analyzer. Formaldehyde concentrations were determined to be about 0.06 to 0.12 ppm in house #1 and 0.09 to 0.15 ppm in house #3, where the insulation had been removed. These levels are similar to the levels obtained in the previous surveys.

The limits for exposure to formaldehyde in an occupational setting really do not apply to a home situation, where individuals may be exposed to small concentrations for extended periods. On April 15, 1981, NIOSH recommended that formaldehyde be considered a potential occupational carcinogen and that exposures to formaldehyde be kept to a minimum. This limit also was meant to apply to occupational exposure and is difficult to relate to the situation which exists at Fire Island. However, it does point out that every effort should be made to limit exposure to formaldehyde.

NIOSH continues to recommend that occupancy of the two houses be restricted to adults and that the occupancy be restricted, as much as possible, to Summer months when increased natural ventilation and increased out-door activities would tend to reduce exposures to formaldehyde.

KEYWORDS: SIC 9512 (Land, mineral, wildlife and forest conservation), formaldehyde, private homes.

II. INTRODUCTION

In June 1982, the Regional Safety Manager of the United States Department of the Interior requested technical assistance from the National Institute for Occupational Safety and Health (NIOSH). The specific request was to re-evaluate the concentrations of formaldehyde vapor in two dwellings which the National Park Service has been using to house employees who work at the Fire Island National Seashore, New York.

The re-survey was performed on July 8, 1982.

III. BACKGROUND

The National Park Service administers the Fire Island National Seashore on Fire Island, which is located a few miles off the southern coast of Long Island, New York. Because access to Fire Island is limited by infrequent ferry service and transportation on the island is limited to dune buggies, horseback and walking, the National Park Service houses a number of their rangers in 12 houses in the Watch Hill community on the island. Two of these houses (#1 and #3) were insulated with foamed-in-place urea formaldehyde insulation in February 1977.

In February 1981, at the request of the Regional Safety Manager, NIOSH conducted a survey of formaldehyde concentrations in the two houses. Samples were collected on chromotropic impregnated charcoal tubes and analyzed using a modification of NIOSH's Method P&CAM 318 (ion chromatography). Concentrations were less than 0.08 parts per million parts of air (ppm) in house #1 and approximately 0.08 to 0.13 ppm in house #3.

Infant children of the rangers occupying the two houses at that time had symptoms (eye and respiratory tract irritation, frequent and prolonged colds) compatible with those of exposure to formaldehyde. These symptoms would subside following absences of one or two weeks from the houses. After the survey confirmed the presence of formaldehyde, the National Park Service elected to move the families to other houses in the area and to remove the urea formaldehyde insulation from house #3. A re-survey in house #3 was performed in May of 1981, a few weeks after the removal of the insulation and indicated that formaldehyde concentrations were essentially unchanged (See Table 1).

In October 1981, NIOSH determined that the sampling and analytical methods used in these surveys were affected by temperature and that the reported concentration should be considered as minimal values, and that actual concentrations might be as much as twice the reported values.

In March 1982, the National Park Service was advised of the availability of the CEA-555 formaldehyde analyzer, and the request for a re-survey was made by telephone soon after.

At the time of the 1982 re-survey, house #1 had been occupied by one ranger since December 1981, and house #3 was occupied by two rangers, one since March 1982 and one for three weeks. The only complaint among the occupants was made by the ranger occupying house #3 since March, who complained of occasional eye and throat irritation. This ranger has some environmental allergies and did not know if the symptoms were attributable to the formaldehyde exposure or to the allergies.

IV. EVALUATION DESIGN AND METHODS

For comparison, determinations of formaldehyde concentrations were made in the same locations as had been surveyed previously. In general, ventilation conditions were similar to those of the previous two surveys, when all doors and windows were closed. Windows were closed in the two bedrooms in house #3. Windows of the living room/dining area were closed, however, one of the two doors to the house were open, providing an open, screened area of approximately 2' x 3' for ventilation. A similar 2' X 3' screened opening provided ventilation to house #1.

The CEA-555 analyzer employs a "wet chemical" method of analysis. An air-borne contaminant is drawn into the analyzer, is mixed and reacts with a chemical solution, causing the solution to change color in proportion to the concentration of the contaminant. A light beam is passed through the darkened solution and the concentration of the contaminant is measured electronically. The process requires about five minutes for the reaction to occur, and therefore produces a slightly delayed determination of the concentration. With this instrumentation, the limit of detection for formaldehyde is approximately 0.02 ppm.

The CEA-555 analyzer was put in operation, allowed to stabilize, and "zeroed". The following procedure was used in each sampling location. The analyzer was run for about 5 minutes to purge the air from the previous sampling location. The digital readout of the formaldehyde concentration was observed for the next 5 to 15 minutes until the reading stabilized. The reading was considered to have stabilized when the concentration fluctuation was less than 0.02 ppm. The analyzer was then moved to a new sampling location. The analyzer was "zeroed" twice during the survey to insure correctness of the zero point. The zero reference is affected by relative humidity greater than 70%. The relative humidity was 80 to 90% at the time of the survey, which necessitated confirmation of the zero point and re-surveying of house #3 to confirm the validity of previous readings.

V. EVALUATION CRITERIA

In 1970, the Occupational Safety and Health Administration established a Permissible Exposure Limit to formaldehyde of 3 ppm, as a time weighted average (8 hours per day, for a 40 hour work week); with a 5 ppm ceiling and a 10 ppm peak, never to be exceeded[2].

In 1977, NIOSH recommended that exposure to formaldehyde be limited to 0.8 ppm, as a time weighted average (up to ten hours per day, for a 40 hour work week)[3].

These recommendations were established primarily to limit irritation from occupational exposures and do not apply to the situation which exists at Fire Island, where the rangers spend far longer than 40 hours per week in the houses. The effects of long term exposure to low concentrations of formaldehyde are not really known, and toxicological information about this type of exposure is just now being collected and analyzed. NIOSH considers that the standards for occupational exposure to formaldehyde are not relevant and do not apply in this situation. However, there are other limits, standards or recommendations which may apply to this case.

1. In April 1981, based on studies which indicated that formaldehyde induced nasal cancer in laboratory animals, NIOSH recommended that formaldehyde be handled as a potential occupational carcinogen and that exposures to formaldehyde should be minimized to the extent possible. Safe levels of exposure to carcinogens have not been demonstrated, but the probability of developing cancer should be reduced by decreasing exposure[3].

2. The American Industrial Hygiene Association and the nations of Sweden, Denmark the Netherlands, and West Germany have proposed or established an "in home" limit for exposure to formaldehyde of approximately 0.1 ppm[1]. These in home limits reflect the possibility that infants, elderly or ill persons may occupy the homes for prolonged periods, and may have adverse reactions to formaldehyde at low concentrations.

3. On February 22, 1982, the United States Consumer Product Safety Commission banned the use of urea-formaldehyde as an insulation material, contending that formaldehyde poses special dangers in the home where people, especially children and the elderly, are exposed to it over long periods of time[5].

4. It has been suggested that between 4% and 8% of the population could become sensitized to formaldehyde and experience increasingly severe and prolonged reactions to diminishing levels of the substance[6].

VI. RESULTS AND DISCUSSION

Table 1 lists the results of the survey of July 7, 1982 and the previous surveys. Concentrations of formaldehyde ranged from 0.06 to 0.09 ppm in the living room/dining areas of the two houses. Concentrations ranged from 0.09 to 0.15 ppm in the sleeping areas. The living room/dining areas of the houses received some general dilution ventilation through 2' x3' screened openings in the doors and in house #3 from a ceiling fan (outdoor

temperatures during the survey were 85 to 90°F). The windows in the bedrooms in house #3 were closed at the time of the survey (as in the previous surveys). The window in the bedroom in house #1 was partially open at the start of the measurement of formaldehyde concentrations. The formaldehyde concentrations in the homes have not changed significantly in the year and a half between the first and third surveys. The collection and analytical methods used in the 1981 surveys may have underreported the actual formaldehyde concentrations, but since the concentrations which exist in the houses is very low, the degree of hazard from exposure to formaldehyde is notsubstantially affected.

After removal of the insulation in house #3, staining of the construction beams and panelling was observed. Possibly, these materials are saturated with formaldehyde and now act as sources for the release of formaldehyde. It is not possible to predict how long formaldehyde will continue to be generated. "Urea formaldehyde foam insulation (UFFI) is inherently unstable and it can continue to release formaldehyde years after installation. When the foamed resin has set and the water evaporated, the breakdown of UFFI and the rate of formaldehyde release tends to decrease. However since the catalyst is still present in the dry foam, conditions of high humidity and elevated temperatures can initiate a marked increase in the rate of hydrolysis and formaldehyde release. As the formaldehyde gas escapes there can be further breakdown of UFFI due to an imbalance in chemical equilibrium."[7]

Since Fire Island is an area of high relative humidity as well as high summer temperatures, the release of formaldehyde vapor may continue for some time.

VII. RECOMMENDATIONS

NIOSH recommends the continuation of the following administrative controls as a method of limiting exposure to formaldehyde in these houses.

1. Occupancy of the houses should be limited to adults. Children should be excluded from the houses. This recommendation is partially based on the history of previous occupancy of the houses with young children, and partially on a report which claims that infants are particularly vunerable to the effects of formaldehyde exposure.[8]

2. Occupancy of the houses should be limited, as much as possible, to the Summer months, when general dilution ventilation or when window fans can provide flow-through ventilation, and when increased outdoor activities would tend to limit exposure times.

3. Individuals should be assigned to other quarters if they develop symptoms attributable to formaldehyde exposure such as chronic eye and/or throat irritation.

VIII. REFERENCES

1. National Academy of Sciences. Committee on Toxicology. Formaldehyde--an assessment of its health effects. Washington, D.C. March, 1980.

2. U. S. Department of Labor, Occupational Safety and Health Administration, OSHA Safety and Health Standards (20 CFR 1910) (Revised November 7, 1978)

3. National Institute for Occupational Safety and Health. Criteria for a recommended standard--occupational exposure to formaldehyde. Cincinnati, Ohio: National Institute for Occupational Safety and Health, 1977. DHEW (NIOSH) Publication No. 77-126).

4. National Institute for Occupational Safety and Health. Current intelligence bulletin 34--formaldehyde: evidence of carcinogenicity. Cincinnati, Ohio: National Institute for Occupational Safety and Health, 1981. DHHS (NIOSH) Publication No. 81-111.

5. U. S. Consumer Product Safety Commission. Washington, D.C. February, 1982.

6. Gunby, P. Fact or fiction about formaldehyde. JAMA, Vol 243, No. 17. May 2, 1980. pp 1697-1703.

7. Department of National Health and Welfare (Canada). Interim report of the national health and welfare advisory committee on urea formaldehyde foam insulation. Ottawa, Ont., Canada: December, 1980.

8. Woodbury, M. A. An assessment of the odor problems from UF foam insulations. Wisconsin Department of Health and Social Services. December 1, 1978.

IX. AUTHORSHIP AND ACKNOWLEDGEMENTS

Survey performed by:

Nicholas Fannick
Industrial Hygienist
NIOSH/Region II

David Marlow
Engineering Technician
NIOSH/IWSB

Report Prepared by:

Nicholas Fannick, MPH
Industrial Hygienist
NIOSH/Region II

Originating Office:

Hazard Evaluations and
Technical Assistance Branch

Division of Surveillance,
Hazard Evaluations, and
Field Studies.
Cincinnati, Ohio.

X. 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 Road, Springfield, Virginia 22161. Information concerning its availability through NTIS can be obtained from the NIOSH Publications Office at the Cincinnati address. Copies of this report have been sent to:

1. The National Park Service, Patchogue, N.Y.
2. Regional Safety Manager, U.S. Dept. of the Interior, Boston, Mass.
3. U.S. Dept. of Labor, OSHA, Region II, N.Y., N.Y.
4. U.S. Dept. of Health and Human Services, NIOSH, Region II, N.Y., N.Y.
5. N.Y. State Dept. of Health, Albany, N.Y.

For the purposes of informing affected employees, copies of this report shall be distributed to the employees occupying the two houses. As it is the policy of the National Park Service periodically to transfer employees to different housing quarters, the Park Service should inform new occupants of the findings of this evaluation.

TABLE 1

NATIONAL PARK SERVICE
Fire Island, N.Y.

HETA 82-337

Formaldehyde Concentrations

LOCATION	FORMALDEHYDE CONCENTRATIONS (ppm)		
	2/81	5/81	7/82
House #1			
living/dining area	0.06		0.06
master bedroom	0.05		0.12
House #3			
living/dining area	0.13	0.12	0.09
		0.07	
master bedroom	0.08	0.12	
bedroom A		0.13	0.12
bedroom B		0.06	0.15
Outdoors		ND	ND

ND = None Detected. Limit of detection is approximately 0.02 ppm .

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