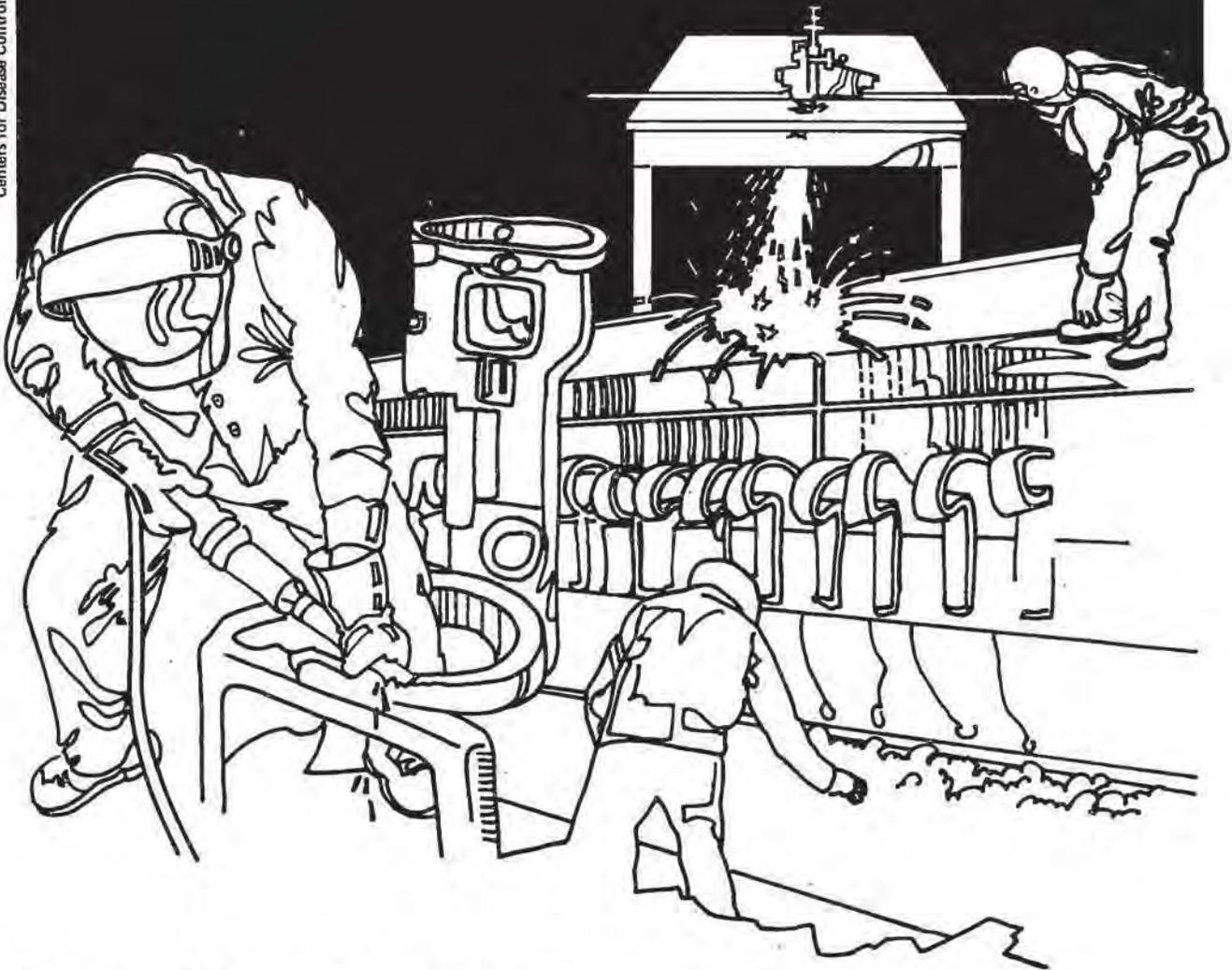


NIOSH



Health Hazard Evaluation Report

HETA 81-084-916
KUTZTOWN STATE COLLEGE
KUTZTOWN, 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.

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

HETA 81-084-916
July 1981
Kutztown State College
Kutztown, Pennsylvania

NIOSH INVESTIGATOR:
Walter J. Chrostek, IH

I. SUMMARY

On November 24, 1980, NIOSH received a request from the Dean of Administration, Kutztown State College, Kutztown, Pennsylvania for a health hazard evaluation at the Administration Building. The request stated that substances such as formaldehyde, fibrous glass, or asbestos, were possibly causing employees to experience dizziness, eye, nose and throat irritation, and respiratory problems which necessitated the evacuation of the building.

Between November 5th and December 15, 1980, three consultants visited the college, did environmental sampling, collected bulk samples, and interviewed employees. The consultants' findings seemed to implicate formaldehyde as being the agent, or one of the agents, responsible for the employees' symptoms. Air samples collected within desk drawers showed the highest levels of formaldehyde (ranging up to 0.9 ppm). Ambient air samples showed less than 0.12 ppm of formaldehyde.

On December 18, 1980, the NIOSH regional industrial hygienist collected 23 air samples for formaldehyde determinations in the false ceiling space and other areas not evaluated by the consultants. All of these samples were below the sampling and analytical limits of detection (less than 0.1 ppm). Three of five bulk insulation samples were positive for formaldehyde (albeit at low levels).

On January 12, 1980, NIOSH collected four additional air samples for formaldehyde determinations. Air concentrations ranged from 0.02 to 0.03 ppm. Bulk samples of furniture particle board showed formaldehyde concentrations of 0.29 and 0.58 mg/g of particle board (e.g., 0.29 mg/g equals three one-hundredths of 1%).

All of the air sample results indicate air concentrations of formaldehyde well below the OSHA standard of 3.0 ppm. However, NIOSH recognizes formaldehyde as a carcinogen and recommends that exposures be reduced to the lowest feasible levels. Reducing the formaldehyde levels to the lowest feasible level may also assist in ameliorating employee complaints. Recommendations for reducing air formaldehyde levels and employee complaints are included in the text of this report.

KEYWORDS: SIC 8221 (Colleges), formaldehyde, dizziness, eye, nose and throat irritation, respiratory irritation.

II. INTRODUCTION

On November 24, 1980, NIOSH received a request from the Dean of Administration, Kutztown State College, Kutztown, Pennsylvania, stating that substances such as formaldehyde, fibrous glass, or asbestos were suspected to be causing the employees to have dizziness, eye, nose and throat irritation, respiratory problems, and other symptoms which necessitated the evacuation of the Administration Building.

III. BACKGROUND

Kutztown State College is a Commonwealth of Pennsylvania institution. A three story administration building, with non-openable windows, was erected and occupied about five years ago. After occupancy, complaints about the air quality were received by management. As a consequence, several consultants conducted investigations and bulk samples of wall insulation were submitted by the Dean of Administration to the NIOSH regional office for formaldehyde analyses:

- 11/5/80 Pennsylvania State University occupational health personnel evaluated relative humidity and airborne dust, fungi, and fibrous glass levels. Employee interviews were conducted.
- 11/24/80 Bulk insulation samples were submitted by the college to the NIOSH regional office for formaldehyde analyses.
- 11/25/80 Spotts, Stevens, and McCoy, Inc. performed air sampling for formaldehyde.
- 12/15/80 Air Quality Services, Inc. performed air sampling and evaluated insulating materials, furniture, and furnishings for formaldehyde.

IV. EVALUATION METHODS

On December 18, 1980, the NIOSH regional industrial hygienist conducted air sampling for formaldehyde using chemically treated charcoal tubes and flow rates of 50 cc/min. Sample durations were about six hours. The samples were analyzed by NIOSH method P&CAM 318.¹ In addition, short-term samples (about 1 hour) were collected by midget impingers in series using distilled water and flow rates of 1.0 L/min. These samples were analyzed by NIOSH method P&CAM 125.² Since the sampling by the consultants had been done in the general work environment, much of the NIOSH sampling was done in the false ceiling space to determine if insulation could be the source of the formaldehyde.

On January 12, 1981, the NIOSH regional industrial hygienist revisited the college to discuss NIOSH findings. Additional samples for formaldehyde were collected by the impinger method (absorbent solution - 1% NaHSO₃ solution). Also, two samples of particle board (furniture constituent) and a piece of rug were collected for formaldehyde analyses.

No employee interviews were conducted as this had been done by the Penn State University industrial hygienist. Copies of the three consultants' reports were obtained and are summarized in the Findings Section of this report.

An interim report was sent to the college in February 1981.

V. EVALUATION CRITERIA

A. Environmental

The current U.S. Department of Labor, Occupational Safety and Health Administration (OSHA) standard for formaldehyde is 3.0 ppm for an 8-hour time weighted average exposure.³

In 1976, based upon irritant effects, NIOSH recommended that exposures to formaldehyde be limited to 1.0 ppm for any 30-minute sampling period.⁴ In 1981, based upon its carcinogenic potential, NIOSH recommended that occupational exposures be reduced to the lowest feasible level.⁶

B. Toxicological

Local--Formaldehyde gas may cause severe irritation to the mucous membranes of the respiratory tract and eyes. The aqueous solution splashed in the eyes may cause eye burns. Urticaria (hives) has been reported following inhalation of gas. Repeated exposure to formaldehyde may cause dermatitis either from irritation or allergy.⁶

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.⁶

The National Institute for Occupational Safety and Health recommends that formaldehyde be handled as a potential occupational carcinogen and that appropriate controls be used to reduce work 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.⁶

VI. FINDINGS

The reports of the three consultants, who conducted environmental investigations at the university, are summarized as follows:

Penn State University

Three air samples were collected on membrane filters and analyzed by emission spectroscopy and/or scanning electron microscopy. Analysis of these samples included an identification of individual elements made from representative particulates. Total particulates by one of the filters was 45,000 particles/M³. On another of these filters, airborne quantities of fungi were low and approximated levels found in households.

Psychrometric data was taken in various locations in the building. The relative humidity varied from 33 to 45%. Dry bulb temperatures varied from 73 to 76⁰F. These data do not indicate a problem from either air temperature or humidity.

Sixteen individuals were interviewed. A variety of health complaints were noted, most of which occurred shortly after the building was occupied. The possibility of eye irritations from fibrous glass, was suggested by a physician who had seen one of the individuals.

Spotts, Stevens, and McCoy

Ten general air samples for formaldehyde were collected using the midget impinger/sodium bisulfite method (NIOSH P&CAM 125). Air concentrations ranged from 0.07 to 0.12 ppm with a mean of 0.09 ppm.

Air Quality Services, Inc.

Seventeen air samples for formaldehyde were collected in various rooms using the impinger method (NIOSH P&CAM 125). Air concentrations ranged from 0.04 to 0.12 ppm with a mean of 0.07 ppm. Six samples taken in the Annex Building ranged from 0.03 to 0.04 ppm with a mean of 0.035 ppm.

Six air samples for formaldehyde were collected in wood credenzas and desks. Air concentrations ranged from 0.21 to 0.90 ppm with a mean of 0.5 ppm. One air sample collected in a metal desk indicated 0.06 ppm formaldehyde.

Seven bulk samples (drape, dust, wallboard, paint chips) analyzed for formaldehyde emissions ranged from none detected (N.D.) to 0.02 ug/M³ with a mean of 0.006 ug/M³. Four samples of drawer divider, closet shelf, paneling, and desk ranged from N.D. to 0.18 ug/M³ with a mean of 0.106 ug/M³. A carpet sample showed an emission of 0.06 ug/M³.

NIOSH

Three of the five bulk insulation samples submitted to NIOSH were analyzed as positive for formaldehyde, although interferences were present (Table 1). The concentrations of apparent formaldehyde ranged from 0.004 mg/g to 0.097 mg/g.

The 23 NIOSH air samples of December 18, 1980, all indicated air concentrations of formaldehyde less than the laboratory detectable limits (Table 2). The laboratory detectable limits, expressed as air concentrations were less than 0.04 ppm for most of the charcoal tubes and less than 0.10 ppm for most of the impinger samples. The laboratory detection limits, expressed as air concentrations, are dependent upon sample times (air volumes).

The four NIOSH air samples of January 27, 1981, were collected in rooms where excess furniture was stored. The air concentrations ranged from 0.02 to 0.03 ppm (Table 3).

Of the three NIOSH bulk samples of January 27, 1981, two were of furniture particle board and one was of hallway carpet. The formaldehyde analyses ranged from none detected (less than 0.015 mg/g) to 0.58 mg/g.

VII. CONCLUSIONS

The surveys of the three consultants and the NIOSH regional industrial hygienist seem to eliminate such agents as asbestos, fibrous glass, and lack of humidity as the causal factors for the employees symptoms. Formaldehyde was present throughout the building at levels generally less than 0.1 ppm. Three of the 54 general air samples were above 0.1 ppm, all being 0.12 ppm. These determinations indicate air levels well below the current OSHA standard of 3.0 ppm but NIOSH currently recommends that formaldehyde be handled as a potential occupational carcinogen and that occupational exposures be reduced to the lowest feasible levels. Since it has been reported⁽⁷⁾ that at 0.05 to 0.5 ppm there is eye irritation in an unacclimatized group, and at 0.13 - 0.45 ppm there are many complaints of temporary eye and upper respiratory tract irritation, the low levels of formaldehyde in the administration building may be a contributing factor to the employee's complaints.

The formaldehyde present may stem from resin systems used in furniture particle board and paneling. The carpet and drapes may also be a contributing source. These conclusions are deduced from the bulk sample analyses and air samples taken in drawers of the furniture. Bulk sample analyses and air samples taken in the false ceiling space indicate that insulating materials would not be a significant source of formaldehyde.

VIII. RECOMMENDATIONS

The following recommendations should assist in reducing formaldehyde levels and ameliorating employee complaints.

1. Steam clean the carpets.
2. Dry clean the drapes.
3. Make up (fresh) air and ventilation should be kept optimal per design specifications.

4. Hypersusceptible individuals might work in rooms without particle board furniture.
5. The formaldehyde levels will decrease with time. Continued air monitoring will document when air levels are reduced to non-detectable concentrations.

IX. AUTHORSHIP AND ACKNOWLEDGEMENTS

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X. DISTRIBUTION AND AVAILABILITY

Copies of this report are currently available upon request from NIOSH, Division of Technical Services, 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 at the Cincinnati address.

Copies of this report have been sent to:

1. Kutztown State College
2. Employee Representative
3. U.S. Department of Labor, OSHA, Region III
4. U.S. Department of Health and Human Services, NIOSH, Region III
5. Pennsylvania Department of Health
6. Pennsylvania Department of Environmental Resources

For the purpose of informing the approximately 100 "affected" employees, the employer shall promptly "post" for a period of 30 calendar-days, this report in a prominent place(s) near where employees work.

XI. REFERENCES

1. NIOSH Manual of Analytical Methods, Volume 6, (NIOSH) Publication #80-125, August 1980.
2. NIOSH Manual of Analytical Methods, Volume 1, (NIOSH) Publication #77-157A, April 1977.
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, CED, NIOSH, Publication #77-181, Revised June 1977.
6. NIOSH Current Intelligence Bulletin 34, Formaldehyde: Evidence of Carcinogenicity, April 15, 1981.
7. NIOSH Occupational Safety and Health Symposium 1979, Publication #80-139, June 1980.

TABLE 1
FORMALDEHYDE IN BULK INSULATION SAMPLES

KUTZTOWN STATE COLLEGE
KUTZTOWN, PENNSYLVANIA

November 24, 1980

Description	Apparent Formaldehyde		Comment*
	%	(mg/g)	
Pink Fibrous Glass	0.0097	0.097	Sample was colored noticeably before adding reagents. Much color, mostly purple. Probably mostly formaldehyde.
Brown Fibrous Glass	0.0013	0.013	Known to contain sulfide. Little color, mostly purple. Color mostly formaldehyde, but contained precipitate.
Black Fibrous Glass	0.0021	0.021	Sample was colored noticeably before adding reagents. Much color, doubtful if purple. Probably little, if any, formaldehyde.
Brown Insulation	0.0087	0.087	Sample was colored noticeably before adding reagents. Much color, some purple. Color increased faster than standards. Formaldehyde dubious.
Green Foam	0.0004	0.004	Little color, mostly purple. Probably mostly formaldehyde.

* Sodium bisulfite was added to each sample in test tube and a Teflon-lined screw cap was put on. The tube was sonicated for 15 minutes, let stand for 24 hours, sonicated again for 15 minutes, and the suspension filtered through a HA-type membrane filter. Analysis was done by NIOSH Method P&CAM 125. The qualitative observation during analysis showed that all colors were off from the color in the standard, indicating interferences as formaldehyde gives purple color.

TABLE 2

RESULTS OF AIR SAMPLES FOR FORMALDEHYDE

KUTZTOWN STATE COLLEGE
KUTZTOWN, PENNSYLVANIA

December 18, 1980

<u>Sample Time</u>	<u>Sample Method</u>	<u>Sample Location</u>	<u>Air Concentration</u>
0850-1548	Charcoal Tube	Room 302B - False Ceiling Space	None Detected*
0905-1548	"	" 315 - " " "	"
0912-1524	"	" 220 - " " "	"
0923-1533	"	" 230 - " " "	"
0927-1537	"	" 129 - " " "	"
0930-1538	"	" 130 - " " "	"
0935-1540	"	Post Office	"
0939-1538	"	Room 206 - Old Administration Bldg.	"
0947-1442	"	Boiler Room	"
0845-1018	Impinger	Room 302B - False Ceiling Space	"
0805-1015	"	" 315 " " "	"
0915-0930	"	" 220 " " "	"
1045-1145	"	Lunch Room - Table	"
1045-1145	"	Administration Lounge - Closet	"
1040-1150	"	Room 230 - False Ceiling Space	"
1200-1307	"	Print Shop - Cabinet	"
1210-1311	"	Room 220 - Ceiling	"
1215-1317	"	Second Floor - Outside Elevator	"
1335-1440	"	Boiler Room	"
1335-1450	"	Admission Office	"
1332-1450	"	Financial Aid CRT	"
1510-1610	"	Registrar	"
1520-1600	"	Penthouse	"

* Below Sampling and Analytical Limit of Detection:
 For most of the charcoal tube samples, less than 0.10 ppm.
 For most of the impinger samples, less than 0.04 ppm.

TABLE 3

RESULTS OF AIR SAMPLES FOR FORMALDEHYDE

KUTZTOWN STATE COLLEGE
KUTZTOWN, PENNSYLVANIA

January 27, 1981

<u>Sample Time</u>	<u>Sample Method</u>	<u>Sample Location</u>	<u>Formaldehyde Air Concentration (ppm)</u>
1103-1203	Impinger	Room 302 - On Desk	0.02
1106-1206	"	" 302 - In Credenza	0.03
1205-1323	"	" 206 - On Metal Desk	0.02
1213-1320	"	" 220	0.03

TABLE 4

ANALYSIS OF BULK SAMPLES FOR FORMALDEHYDE

KUTZTOWN STATE COLLEGE
KUTZTOWN, PENNSYLVANIA

January 27, 1981

<u>Description</u>	<u>Formaldehyde (mg/g)*</u>
Carpet, 3rd Floor Hallway	None Detected*
Panel Board (President's Office)	0.58
Panel Board (Room 302) Book Case	0.29

* Below laboratory limit of detection: 0.015 mg/g