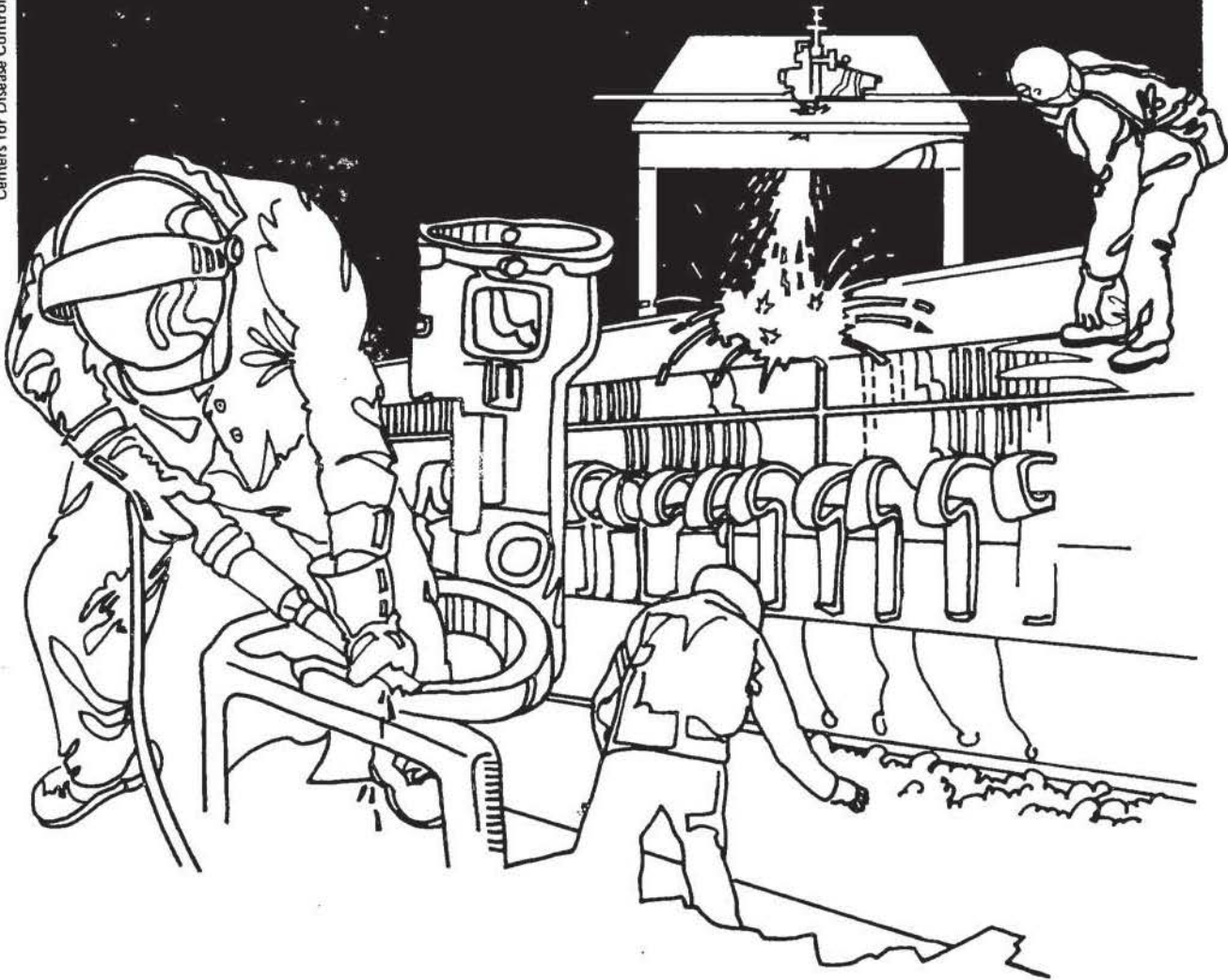


NIOSH



Health Hazard Evaluation Report

HETA 81-161-952
PUBLIC SCHOOL 397
BROOKLYN, 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.

HETA 81-161-952
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Public School 397
Brooklyn, New York

NIOSH INVESTIGATORS:
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I. SUMMARY

In January, 1981, the National Institute for Occupational Safety and Health (NIOSH) received a request from the United Federation of Teachers, Local 2, to perform a health hazard evaluation at Public School 397, Brooklyn, New York. The request concerned respiratory problems, eye irritation and frequent colds among the teachers and students at the school. The elementary school occupies a modern three story building which is supplied tempered air from a central source. The building's windows cannot be opened. The ground floor contains offices, a kitchen and a cafeteria. The second and third floors contain four large open carpeted classrooms, a few smaller auxiliary classrooms and a library. The student population is approximately 500. Fifty adults work in the building as teachers, administrators, clericals, and maintenance personnel.

NIOSH representatives visited the school on February 10, 1981, to tour the facility and interview various staff members. Environmental measurements of temperature, relative humidity, air movement, carbon monoxide, carbon dioxide, formaldehyde and organic vapors were made on March 31, 1981.

Employee interviews indicated widespread complaints among the teaching staff about lack of fresh air and respiratory irritation due to dust from the classroom carpets. The staff also reported that about twice a year exhaust fumes from the oil-fired heating system were inadvertently recirculated throughout the building. These episodes occasionally required temporary evacuation of the building.

All measured concentrations of carbon monoxide, carbon dioxide, formaldehyde and hydrocarbons were substantially below the NIOSH Recommended Standards and the Federal OSHA limits. Overall air supply was adequate; however, air movement at desk-top level was quite low. Relative humidity was slightly below the comfort level on the day of the survey.

NIOSH concludes that there is no significant health hazard from toxic substances in the public school building. Respiratory irritation among teachers and some students is likely due to dust from the classroom carpet. NIOSH makes the following recommendations:

1. Rugs and other floor coverings in the classroom areas should be vacuumed frequently (every second day) to prevent build-up of dirt.
2. The "fresh" air distributors in the classrooms should be fitted with louvers to better circulate air into the classroom.
3. The chimney on the roof should be extended to at least 20 feet above the roof to increase dispersion of the chimney's effluents.

KEYWORDS: SIC 8211 (Elementary and Secondary Schools); temperature, humidity, carbon monoxide, carbon dioxide, formaldehyde, stack effluents.

II. INTRODUCTION

In January, 1981, the National Institute for Occupational Safety and Health (NIOSH) received a request for a health hazard evaluation from the United Federation of Teachers, Local 2, to investigate environmental conditions at Public School 397, 490 Fenimore Street, Brooklyn, New York, 11203. The request claimed that teachers and students at the school suffered from respiratory problems, itching of the eyes, colds and asthma attacks. NIOSH representatives toured the facility and interviewed teachers on February 10, 1981. Evaluation of environmental conditions and measurements of potential contaminants were made on March 31, 1981.

III. BACKGROUND

Public School 397 began operations in September, 1975. This elementary school (grades 1 through 6) occupies a modern three story building. The first floor contains offices, a kitchen and a cafeteria. The second and third floors contain the classrooms. Each floor has two large (40' x 100') open carpeted classrooms, which house 3 or 4 classes each. Each floor also has 2 or 3 ordinary-sized classrooms for special education, such as science instruction. The school was designed for a student body of 350 to 400 students, and currently has an enrollment of about 500. Fifty adults work in the school as teachers, clericals, custodians, etc.. The building has a controlled atmosphere i.e., tempered air is supplied to the building by four air-handling systems. The windows of the building cannot be opened. The teaching staff have complained of the classrooms being too cold during the winters since the building was first occupied.

It is the practice in the open classrooms for the teachers and students to sit on the floor a great deal. The classrooms are carpeted so that teaching activities can take place on the floor. When the school was first opened, the carpets were vacuumed every day or every other day. Because of New York City's budget situation, regular vacuuming of the carpet now occurs every week or two. The carpet is shampooed once a year in the Summer when the building is not occupied. Over time, the carpet became dirty, and both teachers and students increasingly complained about odors and eye and nose irritation. The carpet in the open classrooms was replaced during the Christmas break, 1980, two months prior to the NIOSH evaluation. Complaints of irritation have largely subsided since that time.

The building has an oil-fired heating unit in the basement. The chimney stack for the heating unit is on the northwestern corner of the roof. The original height of the stack was about 6 feet. Occasionally, when the wind blows from the northwest during firing of the heating system, stack emissions blow from the stack into some of the four air handling system units located on the roof. The air handling system(s) then distribute the smoke into the school, forcing evacuation of the building. According to some of the teachers interviewed, this happens about twice a year. In 1980, the stack was fitted with a metal extension, raising the total height to about 12-14 feet above the roof, in an effort to minimize the infiltration of the smoke. An additional 10 foot extension of the stack is planned, but has been delayed because of budget restrictions.

IV. EVALUATION DESIGN AND METHODS

Administrative, teaching, and custodial staff were interviewed during the initial visit. They reported the information conveyed in the Background section of this report. During the follow-up visit, formaldehyde and organic vapors were measured because of the reported eye and nose irritation. Carbon monoxide and carbon dioxide were measured to evaluate the presence of contamination from the stack effluents.

Carbon monoxide, carbon dioxide and formaldehyde were measured in each of the four open classrooms by Draeger Direct Reading Detector Tubes. Hydrocarbons were sampled in the open classrooms by drawing air through tubes containing activated charcoal as the collection media. Typical sources of such hydrocarbons might be solvent or cleaning materials used in the building and combustion effluents drawn into the building from the chimney stack. One sample was collected in each open classroom using personal air sampling pumps at 2 liters per minute for approximately 5 1/2 hours each. Samples were desorbed with carbon disulfide, separated by gas chromatography and analyzed by mass spectrophotometry.

V. EVALUATION CRITERIA

The environmental evaluation criteria as related to airborne exposure to carbon monoxide, carbon dioxide, and formaldehyde are shown below. The criteria listed include the NIOSH Recommended Standards and the Federal Occupational Health Standards as promulgated by the Occupational Safety and Health Administration, U.S. Department of Labor (29 CFR 1910.1000). The NIOSH Recommended Standards are based on a 10 hour work day, 40 hour work week; they also include ceiling values, which are the maximum concentrations recommended for even short periods of time. The Federal Occupational Health Standards are based on an 8 hour work day, 40 hour work week:

<u>Substance</u>	NIOSH Recommended Standard (ppm) ^a		OSHA Federal Standard (ppm) ^a
	(TWA)[b]	(Ceiling Value)	
Carbon monoxide	35	200	50
Carbon dioxide	10,000	30,000 ^c	500
Formaldehyde	LFL ^d	LFL ^d	3

a. ppm = parts per million parts of air.

b. TWA = time-weighted average over the work day.

c. 10 minute ceiling.

d. NIOSH recommends that exposure be reduced to the lowest feasible limit⁴.

VI. RESULTS AND DISCUSSION

ENVIRONMENTAL

Direct reading detector tubes were used to measure airborne concentrations of carbon monoxide, carbon dioxide and formaldehyde in the open classrooms. Carbon monoxide was detected at only trace levels, indicating 1 or 2 parts per million parts of air (ppm). The "normal" concentration of carbon monoxide in an office situation is about 3 to 5 ppm. The levels of carbon monoxide in the second and third floor classrooms were lower than this level probably because smoking is not permitted on these floors. The carbon dioxide levels were 300 to 400 ppm, which is normal for occupied buildings. No formaldehyde could be detected; the limit of detection of the instrument used is 0.5 ppm.

No hydrocarbons could be detected on analysis of the samples collected on the charcoal tubes. The limit of detection for common hydrocarbons (such as toluene or cleaning solvents) is about 1 ppm.

On the day of the survey, the temperature at desk level in the open classrooms was 72 to 74°F. The outdoor temperature was in the mid 50°F range. Indoor relative humidity (RH) was 15 to 17%. The outdoor RH was 31%. The indoor temperature was within the comfort range(1). The indoor RH was slightly less than that considered comfortable - 20 to 25% RH minimum at 72°F(1).

VENTILATION

Air is supplied to the open classrooms through two rows of alternating intakes/return grills on the ceiling of each room, with an additional row of 10 return grills near the interior wall, for a total of 10 intakes and 20 returns per room. Air enters the room through 2' x 4' intake grills at an average velocity of about 150 linear feet per minute (LFM). The velocities ranged from about 50 LFM near the edges of the grills to a maximum of 280 LFM at the centers. With the 20% fresh air mix provided at the school, the measured ventilation rate would provide approximately 19 cubic feet per minute (CFM) per room occupant, assuming 125 occupants per room. This figure exceeds the 10 to 15 CFM per occupant which is recommended for school rooms by the American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.(2).

The arrangement of alternating intakes and returns limits the effectiveness of the air-moving system. There are 8 foot separations between the centers of the alternating intakes and returns. Incoming air is swept along the ceilings of the rooms from the intakes to the returns with very little being directed into the room. There was no measurable air movement 4 feet under the centers of the intake grills, 6 feet above the floor (limit of detection of the instrument used = 10 to 15 LFM). The temperature of the heated incoming air was 78 to 80°F, while the desk top temperature was 72°F. The arrangement of the air handling system not only wastes expensive tempered air, but also limits perceptible air movement, resulting in complaints of stuffiness or "no air".

VII. CONCLUSIONS

Sitting on the dirty rug was likely responsible for the complaints of itching eyes and upper respiratory tract irritation. The fact that the complaints have subsided since the rug was replaced tends to support this finding. The dirt and dust come from the daily traffic of approximately 5-10 teachers and 125 students per open classroom. Since activities involving sitting on the carpet occur as an integral component of teaching in these special classes, the carpet should be cleaned as necessary to avoid accumulation of dirt and dust.

Fresh air is ventilated into the classrooms at an adequate velocity and quantity. However, the arrangement of the distribution system prevents much of the fresh air from circulating down into the occupied space of the rooms (i.e. 6 feet and less from the floor). The air distribution system within the open classrooms should be altered to improve the distribution of the air flow.

There is no indication of ongoing contamination from the chimney stack effluents. Inspection of the stack indicates that the height above the roof level is still less than recommended levels(3). The stack should be extended to prevent entrainment of the chimney effluents into the building's air handling system.

The environmental conditions and health complaints at Public School 397 are indicative of those commonly associated with working in a "closed building". The occupants have no control over the environment of the building since the windows do not open and the air is centrally-supplied and tempered. On-going complaints can arise concerning environmental problems that cause discomfort, such as the dirty rug. A triggering event or condition (the effluent-filled classrooms) then causes an increased concern among the occupants about the general healthfulness of the building. The NIOSH environmental evaluation indicates that the building currently does not represent a health risk to its occupants. The new carpet should be properly maintained to prevent future discomfort among the teaching staff and students. The stack height should be increased to prevent any health risk from stack effluents. These measures should insure that the building will not represent a health risk in the future.

VIII. RECOMMENDATIONS

1. Rugs and other floor coverings in the open classroom areas should be vacuumed frequently (every second day) to prevent build-up of dirt.
2. The air distributors in the classrooms should be fitted with louvers to better circulate air into the classrooms.
3. The chimney on the northwest corner of the roof should be extended to at least 20 feet above the room to help the dispersion of the chimney's effluents(3).

IX. AUTHORSHIP AND ACKNOWLEDGEMENTS

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X. REFERENCES

1. ASHRAE Handbook and Product Directory - "1977 Fundamentals". American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., New York, 1977.
2. ASHRAE Handbook and Product Directory - "1978 Applications". American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., New York, 1978.
3. Recommendation based on communication with the U.S. Government Service Agency Engineers, April 1981.
4. NIOSH Current Intelligence Bulletin 34, FORMALDEHYDE: EVIDENCE OF CARCINOGENICITY, DHHS (NIOSH) Publication No. 81-111, April 15, 1981.

XI. DISTRIBUTION AND AVAILABILITY OF REPORT

For the purposes of informing affected employees, the employer shall promptly post a copy(s) of this report for 30 days in an prominent place(s) near where exposed employees work.

Copies of this report currently are 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 from 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 Publications Office at the Cincinnati address.

Copies of this report have been sent to:

1. Public School 397, Brooklyn, New York
2. United Federation of Teachers, Local 2, N.Y., N.Y.
3. U.S. Department of Labor, OSHA Region II Office, N.Y., N.Y.
4. U.S. Department of Health & Human Services, NIOSH Region II Office, N.Y., N.Y.
5. N.Y. State Department of Health, Albany, N.Y.