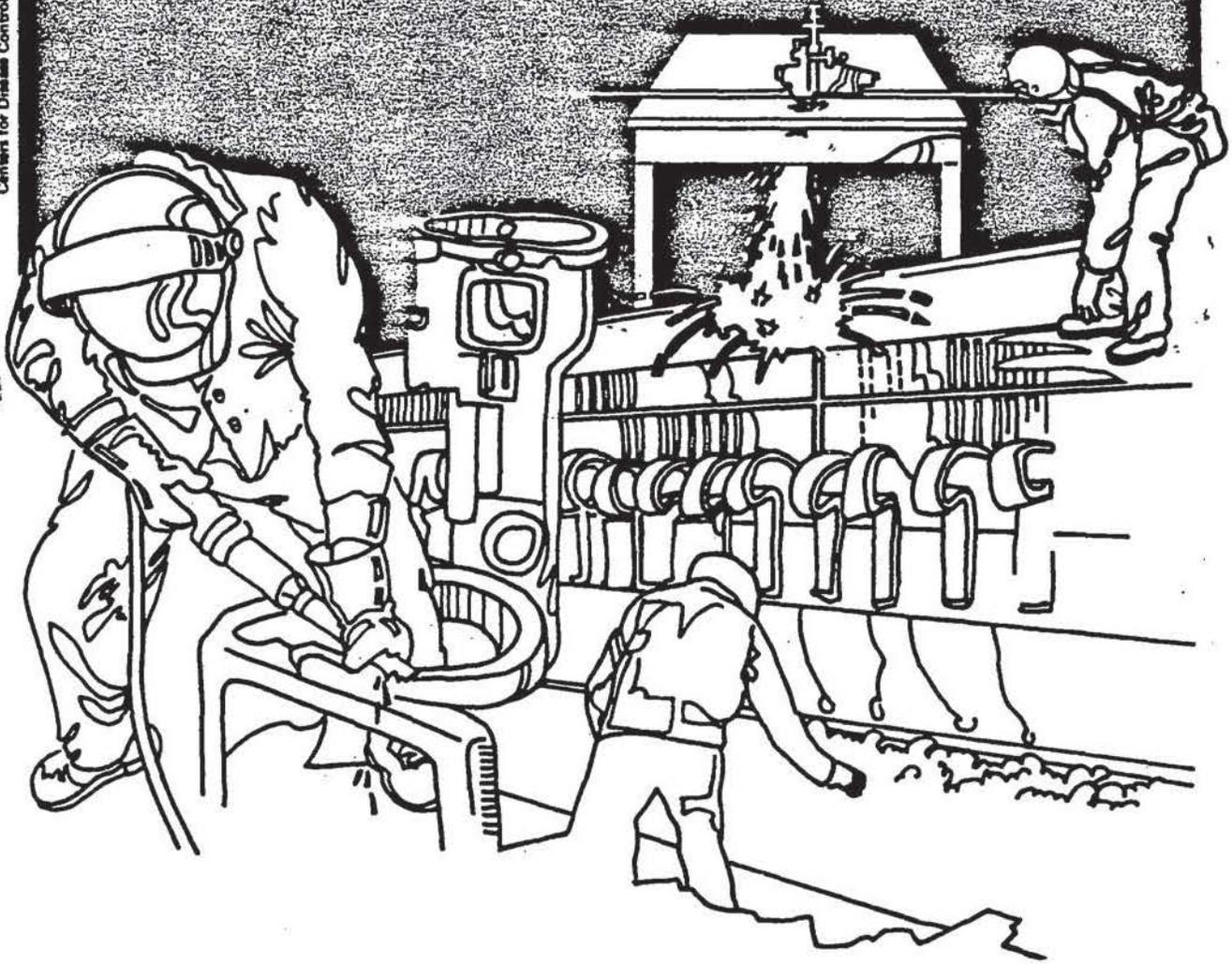


# NIOOSH



## Health Hazard Evaluation Report

HETA 81-397-1084  
RIDGE CENTRAL MEDICAL BUILDING  
EVANSTON, ILLINOIS

## 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 81-397-1084  
APRIL 1982  
Ridge Central Medical Building  
Evanston, Illinois

NIOSH Investigator:  
William J. Daniels

I. SUMMARY

In July 1981, the National Institute for Occupational Safety and Health (NIOSH) received a request from an employer representative to conduct a health hazard evaluation of the Ridge-Central Medical Building, Evanston, Illinois. The requestor was concerned with employee complaints of headaches, burning eyes, chest pain, and difficulty concentrating, possibly related to the air quality in the lower level of the building.

In July 1981, NIOSH investigators conducted an initial survey, followed by additional environmental surveys in July and August 1981. During these surveys, detector tube and long term air samples were collected. In addition, measurements were taken of the ventilation system in two locations identified as problem areas.

Measurements taken with detector tubes revealed no detectable levels of carbon monoxide, formaldehyde, ozone, or carbon dioxide. Analysis of the area air samples revealed no significant levels of any contaminants detectable by gas chromatography/mass spectrometry. Measurements of the ventilation system in the reception and records offices indicated that the air supply for these offices was within the levels for recirculated air recommended by the American Society of Heating, Refrigeration, and Air-conditioning Engineers (ASHRAE).

Based on data obtained during this investigation, NIOSH was unable to identify any specific cause for the reported adverse health effects. Recommendations for further evaluation of the existing ventilation system are incorporated in Section VIII of this report.

KEY WORDS: SIC 8011, Office building, general ventilation

## II. INTRODUCTION

On July 16, 1981 a representative of the Ridge-Central Medical Building, Evanston, Illinois, requested a NIOSH health hazard evaluation of the building. The requestor was concerned with the air quality in the basement offices of the building as a result of employee complaints of headaches, difficulty concentrating, chest pains, burning eyes, and a feeling of inadequate air circulation.

On July 15, 1981 NIOSH investigators conducted a site visit to the facility following a telephone request for technical assistance. Detector tube samples were taken to determine the airborne levels of carbon monoxide, ozone, formaldehyde, and carbon dioxide. On July 28, 1981 detector tube measurements were repeated and general area air samples were collected to determine the presence of any additional contaminants. On August 24, 1981 a final environmental survey was conducted during which detector tube measurements were repeated and the ventilation system was evaluated. Letters of September 3 and December 23, 1981, were sent to the requestor as notification of preliminary survey findings.

## III. BACKGROUND

The Ridge-Central Medical Building is a bi-level structure utilized for medical offices. In May 1980, the basement was remodeled to house two medical groups and one dental group. The medical group submitting the request consisted of 2 physicians, each working one-half day shifts, and a support staff consisting of 4 full-time and 1 part-time employees.

The entrance to the basement offices of the building is located to the rear of the building, adjacent to the parking area. The entire building is supplied by one central ventilation system. Recent changes in the system included the transfer of a fresh air intake from the rear of the building onto the roof of the building.

Over the past year, employees had periodically complained of headaches, difficulty concentrating, chest pain, burning eyes, and a feeling of inadequate air circulation. These symptoms were reported to occur sporadically, and appeared to be associated most often with the afternoons of warm days. The reception and records offices were identified as the areas where most of the complaints originated. No routine use of chemical substances was noted in these areas.

## IV. MATERIALS AND METHODS

Detector tube samples were collected according to manufacturers' instructions using a Drager hand pump and the following Drager tubes: Carbon Monoxide 5/c, Formaldehyde 5/a, Ozone .05/a, Carbon Dioxide 0.1%/a. These measurements were taken in the receptionists office and in the hallway immediately outside of the office. These substances were selected for evaluation due to their ability to produce the reported adverse health effects.

Two area samples were collected in the receptionist's office using battery powered pumps operating at 1.5 liters per minute (lpm) attached via tygon tubing to the collection media which consisted of a charcoal or porous polymer tube. These samples were analyzed by gas chromatography-mass spectrometry for identifiable contaminants.

Ventilation measurements were taken of the air supply system for the reception and records offices using a Kurz Series 400 air velocity meter. In addition, air flow patterns were characterized by use of smoke tubes.

## V. EVALUATION CRITERIA

### A. Potential Exposures

A number of sources recommend maximum airborne levels of substances representing conditions under which it is believed that nearly all workers may be repeatedly exposed without adverse effect. Because of a wide variation in individual susceptibility, however, a small percentage of workers may experience effects at levels at or below these limits: a smaller percentage may be more seriously affected by aggravation of a pre-existing condition or by a hypersensitivity reaction<sup>1</sup>. A listing of the substances evaluated in this survey, their corresponding environmental criteria and the major health effects from acute exposure is as follows:<sup>2</sup>

#### 1. Carbon Monoxide (CO)

CO is a colorless, odorless, tasteless gas usually occurring as a by-product of incomplete combustion of carbonaceous materials, with the major source of atmospheric CO being gasoline powered internal combustion engines. CO combines with hemoglobin which reduces the blood's ability to carry oxygen. The typical signs and symptoms of acute CO poisoning are headache, dizziness, drowsiness, nausea, vomiting, and at high levels collapse, coma, and death. The NIOSH recommended environmental limit is 35 parts per million (ppm) on a time weighted average basis (TWA) for a 10 hour workday, 40 hour workweek, with ceiling concentrations not to exceed 200 ppm for a 15 minute period. These levels should limit carboxyhemoglobin formation to 5% in a nonsmoker engaged in sedentary activity. Smokers may have a higher carboxyhemoglobin level than nonsmokers (usually 5 - 10%).

#### 2. Formaldehyde

Formaldehyde is used in the manufacture of textiles, dyes, inks, urea-formaldehyde foam insulation, resins used to manufacture plywood, fiberboard and particle board, and in the paper and furniture industries. Concentrations ranging from 0.1 to 5 ppm have produced burning of the eyes and general irritation of the upper respiratory tract. Levels ranging from 10 to 20 ppm may produce coughing, tightening of the chest, and a sense of pressure in the head. The NIOSH recommended environmental limit is 1 ppm for any 30 minute sampling period, although based on recent evidence of carcinogenicity in animals, NIOSH recommends that occupational exposure be reduced to the lowest feasible limit.

#### 3. Ozone

Ozone is a gas naturally occurring in the atmosphere as a result of solar radiation and electrical storms, but can also be formed by equipment emitting electrical arcs or discharges. Ozone is irritating to the eyes and all mucous membranes, and can produce the following symptoms: dryness of upper respiratory passages, irritation of mucous membranes of nose and throat, choking, coughing, and severe fatigue. The current OSHA standard for Ozone is 0.1 ppm as an 8-hour TWA.

#### 4. Carbon Dioxide (CO<sub>2</sub>)

CO<sub>2</sub> is a colorless gas and is a by-product of many processes, including human respiration. CO<sub>2</sub> is a simple asphyxiant, and its concentration in the blood can affect the rate of breathing. Concentrations of 5% (500 ppm) can produce shortness of breath and headache. The current OSHA standard is 5,000 ppm as an 8-hour TWA.

#### B. Ventilation

The American Society of Heating, Refrigeration, and Air-conditioning Engineers (ASHRAE) recommends a minimum air supply of 0.75 to 2.0 cubic feet of air per minute per square foot (cfm/f<sup>2</sup>) of office floor space. In addition, this air should include a minimum of 15% make-up or outdoor air.<sup>3</sup>

### VI. RESULTS

Results of the indicator tube surveys revealed no detectable levels of any of the substances evaluated. The sensitivity range of these tubes was as follows: carbon monoxide - 5 to 150 ppm, formaldehyde - 0.5 to 10 ppm, ozone - 0.05 to 1.4 ppm, carbon dioxide - 0.1 to 1.2 % by volume CO<sub>2</sub>.

Analysis of the area samples indicated no detectable levels of contaminants on the porous polymer tube, but very small peaks were detected on the charcoal tube sample. The only compounds which could be identified at barely detectable levels with mass spectrometry were 1,1,1-trichloroethane, benzene, methyl isobutyl ketone, toluene, and xylene. However, benzene and methyl isobutyl ketone were also observed on the blank charcoal tube, and therefore, their presence or absence in the air cannot be positively confirmed. In addition, the possibility exists that some of the other substances could have resulted from contamination during tube manufacture or the analysis. In summary, these air concentrations are extremely low (unquantifiable) for all of the identified substances, and there is little likelihood that any adverse health effects could be expected.

The volume of air supplied to the reception and records offices was determined to be approximately 240 and 250 cubic feet of air per minute (cfm), respectively. Based on the ASHRAE recommendation, the air supply to the receptionist office should range between 104 and 278 cfm/f<sup>2</sup>, and 98 and 262 cfm/f<sup>2</sup> for the records office. Therefore, provided that the appropriate percentage of outdoor air is supplied, it appears that these levels are sufficient. In addition, the use of smoke tubes indicated that air flowed freely from the offices and into the hall where the return air duct was located.

### VII. DISCUSSION AND CONCLUSIONS

During the three survey visits, no airborne substance could be identified which would be responsible for the health effects noted by the employees. In addition, examination of the ventilation system indicated that air supply to the offices was sufficient at the time of the survey. Although instances of inadequate air circulation were not noted during the survey, these occurrences could possibly arise from either mechanical or operational problems

## VIII. RECOMMENDATIONS

In order to alleviate the possibility of future problems with the ventilation system and to provide for employee comfort, it is recommended that the existing ventilation system be professionally examined for possible operational or mechanical problems. This examination should consider factors such as proper system balance, the addition of an adequate supply of fresh make-up air (at least 15% of the total air supplied to the offices) and fluctuations in temperature and humidity throughout the building.

## IX. REFERENCES

1. Threshold Limit Values for Chemical Substances and Physical Agents in the Workroom Environment with Intended Changes for 1980, American Conference of Governmental Industrial Hygienists, 1980.
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3. ASHRAE Applications, Chapter 3 "Commercial and Public Buildings, American Society of Heating, Refrigeration, and Air-conditioning Engineers, New York, 1974.

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## XI. DISTRIBUTION AND AVAILABILITY OF DETERMINATION REPORT

Copies of this Determination Report are currently available upon request from NIOSH, Division of Standard Development and Technology Transfer, 4676 Columbia Parkway, Cincinnati, Ohio 45226. After 90 days the report will be available through the National Technical Information Services (NTIS), Springfield, Virginia. Information regarding its availability through NTIS can be obtained from NIOSH publications office at the Cincinnati address. Copies of this report have been sent to the following:

- A. Ridge-Central Medical Building
- B. U. S. Department of Labor, OSHA - Region V
- C. NIOSH Regional Offices/Divisions

For the purpose of informing the affected employees, copies of the report should be posted in a prominent place accessible to the employees, for a period of 30 calendar days.



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