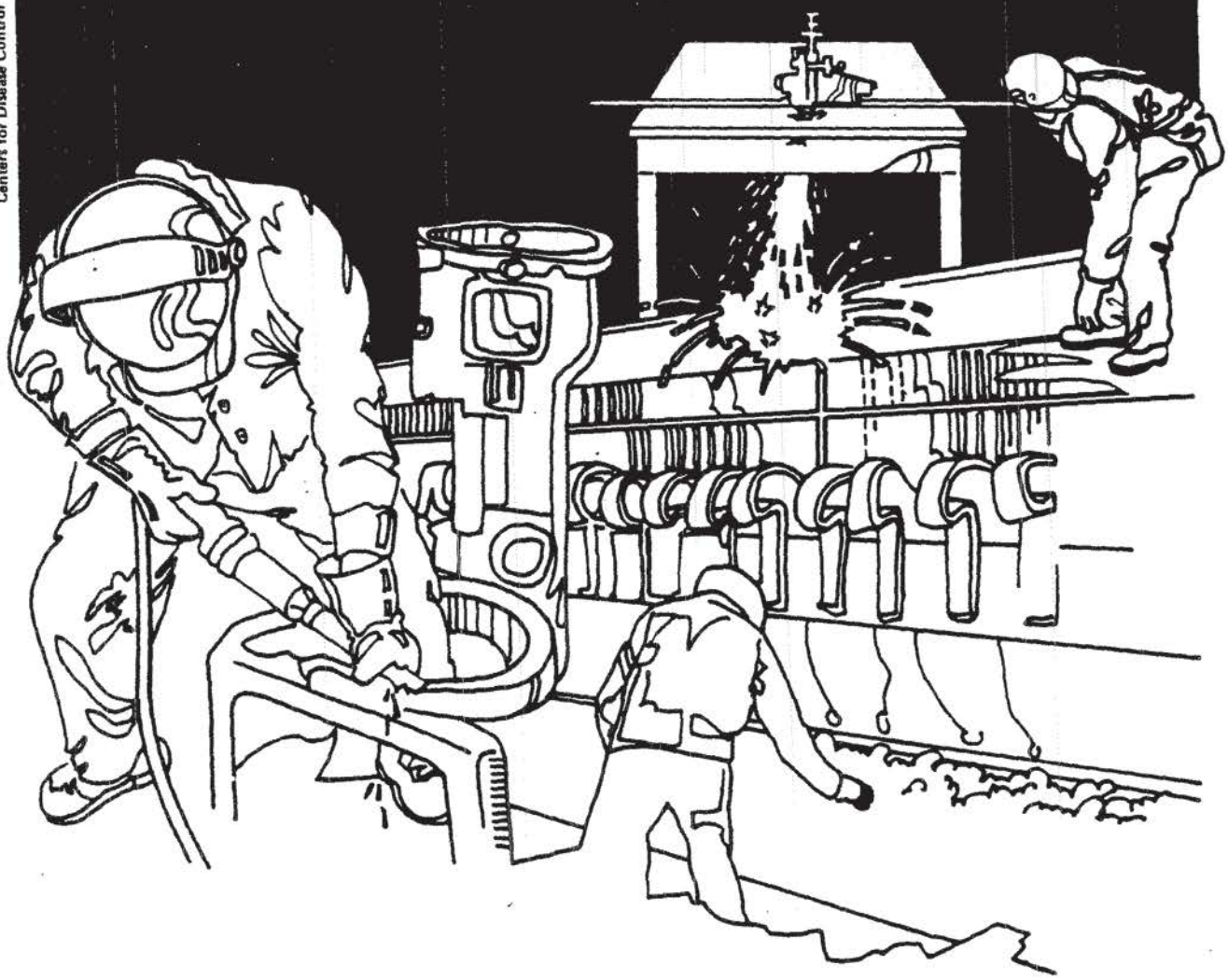
U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES ■ Public Health Service
Centers for Disease Control ■ National Institute for Occupational Safety and Health

NIOSH



Health Hazard Evaluation Report

HETA 84-337-1611
FEDERAL BUILDING
DALLAS, TEXAS

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 84-337-1611
JULY 1985
FEDERAL BUILDING
DALLAS, TEXAS

NIOSH INVESTIGATORS:
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I. SUMMARY

In May, 1984, the National Institute for Occupational Safety and Health (NIOSH) received a request to investigate possible causes of eye and upper respiratory irritation among employees on the second and eighth floors of the Federal Building, 555 Griffin Street, Dallas, Texas.

Over the next several months, NIOSH investigators reviewed the results of a medical questionnaire administered to employees by U.S. Department of Labor, Occupational Safety and Health Administration (OSHA) staff, held discussions, made environmental measurements for formaldehyde, carbon monoxide and carbon dioxide, and evaluated the heating, ventilation and air conditioning (HVAC) system. The most common symptoms being experienced by the six employees reporting health difficulties were eye irritation, coughing and sneezing. Four of the six had a history of asthma, hay fever or sinus conditions. No formaldehyde and minimal levels of carbon monoxide (0-4 ppm) were found. While the fresh air supplied to the floors appeared to be adequate, carbon dioxide concentrations in some work areas approached twice background levels and generally increased during the workday. This would indicate a potentially inadequate distribution of fresh air to these areas. Several maintenance and/or operational problems with the HVAC system were also identified which could have contributed to this problem.

Based on the results of this evaluation, NIOSH identified no specific hazard responsible for the employees's health complaints. However, certain symptoms experienced by employees may have been exacerbated by deficits identified in the HVAC system. Recommendations for alleviating these problems are included in Section VI of this report.

KEYWORDS: SIC 9651, closed building syndrome, eye irritation, upper respiratory irritation, ventilations.

II. Introduction

In May 1984, the National Institute for Occupational Safety and Health (NIOSH) received a request from the U.S. Department of Labor, Occupational Safety and Health Administration (OSHA) to conduct a Health Hazard Evaluation (HHE) at the Federal Building, 555 Griffin Street, Dallas, Texas. The request concerned reported eye and upper respiratory irritation by several Department of Labor employees performing duties at various locations within the building.

III. METHODS OF EVALUATION

A walk-through visit was made on May 30, 1984, to familiarize the investigator with the existing heating, ventilation and air conditioning (HVAC) system, as well as applicable and affected work areas. OSHA staff had administered a questionnaire to employees on the concerned floors and had identified six (6) employees who believed they were experiencing health related problems associated with their work area. An additional employee on the eighth floor was eventually also considered. Discussions were conducted with the majority of the supervisors of employees reported to be experiencing health problems. Followup visits were made on June 15, June 26, and July 23, 1984 to monitor for possible sources of environmental contaminants and evaluate the performance of the HVAC system. By the use of detector tubes, environmental measurements were made for carbon monoxide, carbon dioxide and formaldehyde.

IV. EVALUATION CRITERIA

A. Air Contaminants

The primary sources of environmental criteria for the workplace area 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. 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 lifetime without experiencing adverse health effects. It is, however, important to note that not all workers will be protected from adverse health effects, even if their exposures are maintained below these levels. A small percentage may experience adverse health effects because of individual susceptibility, pre-existing medical conditions, and/or 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 workers to product health effects even if the occupational exposures are controlled at the level set by the evaluation criteria. These combined effects are often not considered in the evaluation criteria.

For indoor environments, the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) have developed general air quality standards which are applicable for the general population continuously exposed for up to a 24 hour day without known toxic effects. Indoor air should not contain concentrations of contaminants known to impair health, or to cause discomfort to a substantial majority of the occupants. Ambient air quality standards/guidelines available from federal, state, or local authorities should be utilized. If the air is thought to contain any other contaminants, reference to OSHA, ACGIH, and NIOSH recommendations should be made. For application to the general population, the concentration of these contaminants should not exceed 1/10 of the limits which are used in industry.

B. Building Related Illness Episodes

Building-related illness episodes have been reported more frequently in recent years as buildings have been made more air-tight to conserve energy and reduce air conditioning costs. Thus, buildings have been more dependent on mechanical systems to provide treated air to the occupants. Contaminants may be present in the make-up air, or may be introduced from indoor activities, furnishings, building materials, surface coatings,

and air handling systems and treatment components. Symptoms often reported are eye, nose, and throat irritation, headache, fatigue, and sinus congestion. Occasionally, upper respiratory irritation and skin rashes are reported. In some cases, the cause of the symptoms has been ascribed to an airborne contaminant, such as formaldehyde, tobacco smoke, or insulation particles, but most commonly a single cause cannot be identified.

Imbalance or malfunction of the air conditioning system is commonly identified, and in the absence of other theories of causation, illnesses are usually attributed to inadequate ventilation, heating/cooling, or humidification. Some of the major types of contaminants found in indoor air are:

1. Products of combustion

   Carbon monoxide and nitrogen dioxide are often considered the most important toxic products of the combustion of fossil fuels and other organic materials. Gas stoves may be a significant source of these pollutants. Carbon monoxide is an asphyxiant and nitrogen dioxide a pulmonary irritant.

2. Formaldehyde

   Formaldehyde and other aldehydes may be released from foam plastics, carbonless paper, particle board, plywood and textile fabrics. Formaldehyde is an irritant to the eyes, nose, mouth and throat.

3. Sprayed-on insulation materials

   Asbestos, fibrous glass, and mineral wool fibers have been used in some buildings as fireproofing insulation for walls, ceilings, and structural steel beams. Fibers and dust particles may be dislodged and become airborne. Asbestos fibers can cause pulmonary disease and cancer. Mineral wool and fibrous glass particles are irritants.

4. Tobacco smoke

Tobacco smoke contains several hundred toxic substances, the most important of which are: carbon monoxide, nitrogen dioxide, hydrogen cyanide, formaldehyde, hydrocarbons, ammonia, tars, and nicotine. Tobacco smoke can irritate the respiratory system and, in allergic or asthmatic persons, often results in eye and nasal irritation, coughing, wheezing, sneezing, headache, and other related sinus problems. People who wear contact lenses often complain of burning, itching, and tearing eyes when exposed to cigarette smoke.

5. Microorganisms and allergens

Microorganisms have been spread through ventilation systems in buildings where air filters become wet and moldy, where stagnant water has accumulated under air conditioning cooling coils, and where decaying organic matter is found near air conditioning intakes. Health effects may be infections, irritation or allergic symptoms.

6. Hydrocarbon vapors

Hydrocarbon vapors are released from dispersants and toners used in photocopying machines, fresh paint, glue and many cleaning compounds. Hydrocarbons can be irritants, and at high concentrations, are central nervous system depressants.

C. Ventilation Evaluation Criteria

Neither NIOSH nor OSHA has developed ventilation criteria for general offices. Criteria often used by design engineers are the guidelines published by ASHRAE.

ASHRAE 61-1981, "Ventilation for Acceptable Indoor Air Quality," provides guidelines for minimum ventilation values to assure adequate outdoor air supply in modern, air-tight buildings. It is based on an occupant density of 7 persons per 1000 ft^2 of

floor area, and recommends higher ventilation rates for areas where smoking is permitted. Indoor air quality for "general offices" is considered acceptable if the supply of outdoor air is sufficient to reduce carbon dioxide levels to less than 2500 parts per million (ppm) and to control contaminants, such as various gases, vapors, microorganisms, smoke, and other particulate matter so that concentrations known to impair health or cause discomfort to occupants are not exceeded. However, the threshold levels for health effects from these exposures are poorly documented. For "general offices" where smoking is not permitted the recommended input of outdoor air is 5 cubic feet per minute (cfm) per person. Higher ventilation rates are recommended for spaces where smoking is permitted because tobacco smoke is one of the most difficult contaminants to control at the source. When smoking is allowed, the amount of outdoor air provided should be 20cfm per person.

V. RESULTS AND DISCUSSION

None of the six employees experiencing health difficulties were smokers; however, two-thirds indicated they had asthma, hay fever or sinus conditions. Eye irritation, coughing and sneezing were the most common symptoms reported. The length of time they had been located on the second floor ranged from 2 1/2 - 9 years. Recent changes in the work area included recarpeting and constructing closed offices and a library in an area which had previously been a large open space. Measurements made on both the second and eighth floors indicated non-detectable levels of formaldehyde and minimal levels of carbon monoxide (0-4ppm).

Calculations of the fresh air intake on the roof indicated that approximately 22,470 cubic feet per minute (cfm) of outside air was being supplied to the building. The supply of outside air to the eighth floor fan room (3,060 cfm) and the second floor fan room (2,601 cfm), both should have been adequate based on occupancy. Although not found at hazardous concentrations, airborne levels of carbon dioxide (CO_2) were found to approach twice background levels in some areas

and generally increased during the course of the workday. CO_2 levels are often used as a rough indicator of the adequacy of outside air supplied to an area. Levels above twice background would indicate insufficient outside air to an area. When the CO_2 measurements in the morning are approximately those found outside, but are elevated by the close of the workday, then the 24 hour intake of outside air is probably sufficient, but the supply is most likely inadequate during working hours. CO_2 found in office space is normally that generated by human respiration and from tobacco smoke. Other observations made during the investigation, included:

1. At approximately 9:45 a.m. on July 23, the fresh air intake fan on the roof was not operating to supply make-up air into the building. Shortly, thereafter, the fan was turned on.

2. The outside air fan filter was overly dirty, indicating the need for maintenance.

3. On the second floor, column 25, the mixing box dampers were in the full, open position. This allowed air in the area to be drawn into the mixing box and combined with conditioned air supplied from the fan room. As a result the air delivered to the workspace would be less cool and contain less makeup air than under normal operating conditions when only conditioned air was provided.

4. Several ceiling tiles were missing. Since the space above the drop ceiling serves as the return air plenum for the HVAC system, missing tiles can allow nuisance particulates to settle out in the work area.

5. While no specific hazards were identified as responsible for the health complaints reported by the employees, remodeling in the area and the several maintenance and/or operational problems identified above could have resulted in an imbalance in the fresh air distribution in some areas which may have contributed to the symptoms experienced by the employees.

VI. RECOMMENDATIONS

1. A preventive maintenance program should insure that all filters in the system, and particularly those at the fresh air intake, are routinely inspected and cleaned, or replaced.

2. Missing ceiling tiles should be replaced to maintain the effectiveness of the HVAC system.

3. The fresh air and recirculating fans should be turned on 1-2 hours before the beginning of the workday.

4. The HVAC distribution system on the second floor should be evaluated to insure proper balance.

5. The damper settings for the second floor mixing boxes should be checked and corrected if necessary.

VII. References

1. U.S. Department of Health and Human Services. The health consequences of smoking: cancer 1982, a report of the Surgeon General. Washington, D.C.: U.S. Department of Health and Human Services, 1982.

2. American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. ASHRAE standard 62-1982, ventilation for acceptable indoor air quality. Atlanta, Georgia: ASHRAE, 1981.

VIII. AUTHORSHIP AND ACKNOWLEDGMENTS

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IX. 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 regarding its availability through NTIS can be obtained from NIOSH Publications Office at the Cincinnati address.

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

Copies of this report have been sent to:

1. OSHA, Region VI

2. NIOSH, Region VI