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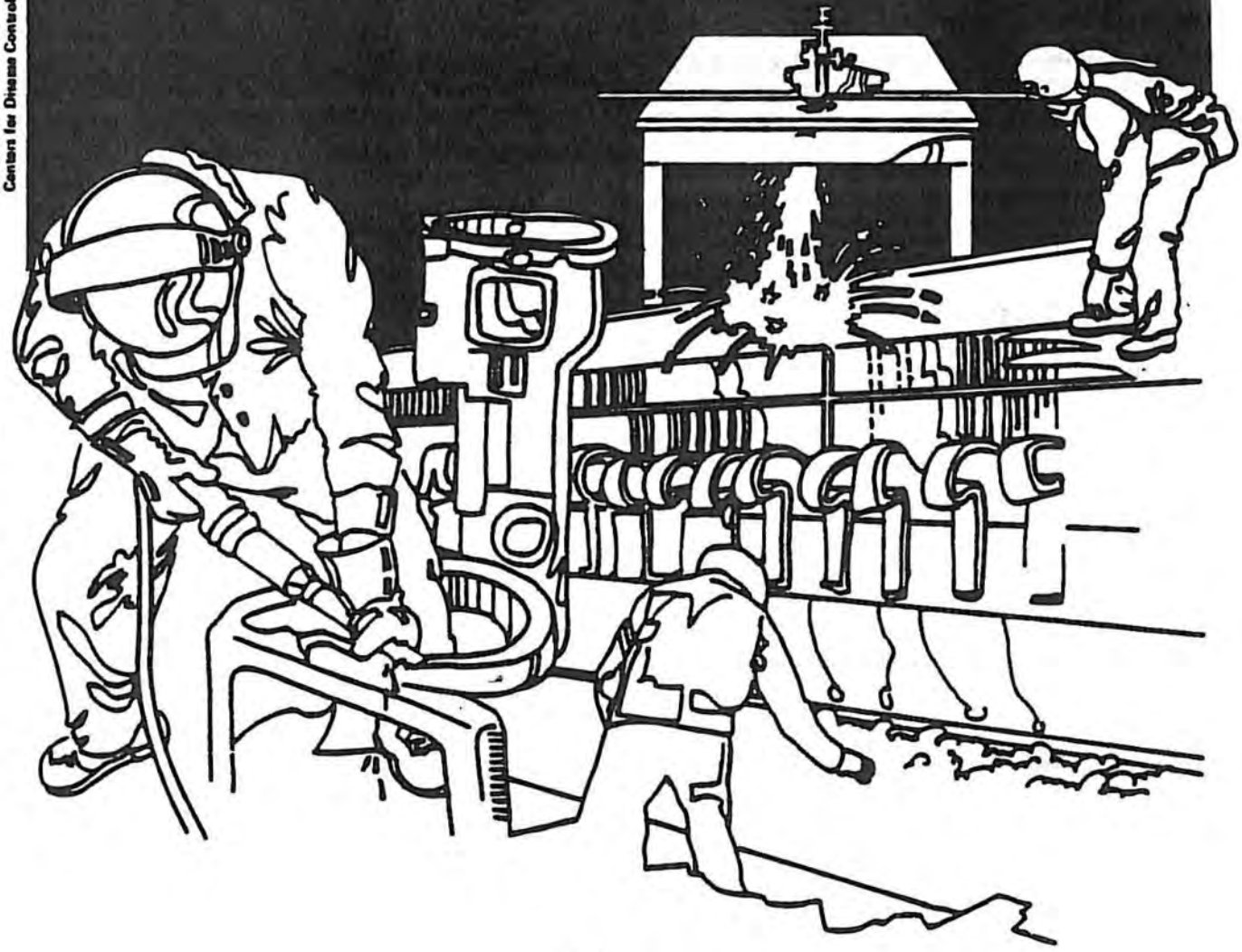

Health Hazard Evaluation Report

HETA 85-345-1665
COUNTY OF ALAMEDA
OAKLAND, CALIFORNIA

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.

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OAKLAND, CALIFORNIA

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1. SUMMARY

In May, 1985, the National Institute for Occupational Safety and Health (NIOSH) received a request to evaluate the air quality in the Data Processing Department of the Alameda County Administrative Building located in Oakland, California.

On May 16, 1985 an initial environmental survey was conducted at the Data Processing Department. A walk-through survey was conducted and several employees and supervisors were interviewed in addition to the building and plant maintenance supervisor. On June 14, 1985 a follow-up survey was conducted during which time air monitoring was performed for carbon monoxide (2-3 ppm), carbon dioxide (.01-.07%), and formaldehyde (none detected). No overexposures to any of these chemicals were measured. Ventilation measurements were conducted at ten air supply or exhaust vents, but these measurements did not meet design ventilation specifications. Temperature and relative humidity measurements were taken at various locations in the room. The air temperature measurements (dry bulb of 74°F and a relative humidity of 43 %) were within the ASHRAE recommended standard for indoor air quality (72-79°F, relative humidity 20-60 percent).

Interviews were conducted with about 20 workers to determine the extent of workers concerns about the ventilation system. Workers complained about cigarette smoke and the room air being stagnant, too cool, too hot, and damp during the winter.

Based on the walk-through survey, environmental air monitoring, and employee interviews, no overexposures to carbon monoxide, carbon dioxide, or formaldehyde were found. Workers' complaints appear to be closely related to an improperly balanced ventilation system and cigarette smoke. Recommendations are provided in Section VIII of the report.

KEYWORDS: SIC 9390 Local government (data processing room, indoor air pollution)

II. INTRODUCTION

In May 1985, the National Institute for Occupational Safety and Health (NIOSH) received a request for a health hazard evaluation from a representative of the Personnel Department, Occupational Health Services, County of Alameda, Oakland California. The representative requested NIOSH to evaluate an indoor air quality problem in the Data Processing Department.

On May 16, 1985 an initial environmental survey was conducted at the facility, and on June 14, 1985 a follow up environmental survey was conducted. Employee interviews were conducted during both of these surveys. Results of the environmental investigation were presented at the end of the follow-up survey along with recommendations for resolving the problem.

III. BACKGROUND

The Alameda County Data Processing office (Room 17) is located in the basement of the Administrative Building at 12th and Oak Streets, Oakland, California. The Data Processing Area occupies a large windowless room that was originally used for storage. The Room is an open bay (about 7000 square feet) in which 5-foot partitions are used to separate the office space. Thermostats are positioned at various locations or zones which are calibrated yearly. Approximately 70 to 80 programmers and clerical staff work an 8-hour day during the hours of 8:00 a.m.to 5:00 p.m. The staff was described as being a stable work force with little turnover.

Room 17 has a dedicated heating and air-conditioning system (variable air volume system) with a ceiling plenum. The fresh air intake and exhaust for this system are located side by side at street level at the corner of the building near a bus stop. Approximately 20 percent of the return air is outside air. Each of the air supply grills are reported to provide about "400" cubic feet per minute (cfm) of air which is filtered through a spun glass media. The filters are visually inspected daily, and they are turned exposing a clean part of the filter as needed, i.e. when there is a static pressure difference of 2 inches of water. In 1982, the ventilation system was found to have excessive pressure conditions with the supply and return air in the equipment room which caused the system to operate at 57 percent of the design capacity. A contractor was hired to correct the problem and balance the ventilation system; however, no report could be found regarding the completion of the work to evaluate air flow measurements at the air supply and exhaust grills.

Workers have complained to supervisors about the room air temperature being "stuffy in the morning, too cool or too hot," along with other symptoms such as "stuffy head, headaches, burning eyes and raspy throat". General air quality was reported by supervisors to be an ongoing problem, but there have been no complaints about any particular chemical odors. In April 1985,

personnel in the Department of Occupational Health Services attempted to evaluate workers general complaints about the room air quality. Temperature and relative humidity were evaluated and found to meet the American Society for Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) recommended standards. Air flow measurements were determined to be satisfactory, and the ventilation filters were inspected and found to be clean and without any indication of contamination. Based on these findings, the requestor was concerned that the ventilation intake duct may be capturing vehicle exhaust fumes which could be responsible for the workers' complaints.

IV. EVALUATION DESIGN AND METHODS

Chemical detector tubes were used to measure carbon monoxide (CO), carbon dioxide (CO_2), and formaldehye air concentrations in the Data Processing Room. Ventilation measurements were made at 10 air supply and exhaust grills. A flow hood, model CFM-83 which was calibrated one month earlier by the manufacturer, was used to perform these measurements. Also, a Bendix Psychrometer, model 566, was used to measure the dry and wet bulb temperatures in order to calculate the relative humidity.

Seventeen employees were interviewed at their desks to determine the extent of the workers' complaints about the general air quality.

V. EVALUATION CRITERIA

Building-Related Illness Episodes

Building-related illness episodes have been reported more frequently in recent years as buildings have been made more air-tight in order to conserve energy and to reduce air conditioning expenses. Modern high-rise office buildings are constructed primarily of steel, glass, and concrete, with large windows that cannot be opened, thus making the building totally dependent on mechanical systems for air conditioning. Contaminants may be present in 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 pinpointed.

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.

In 1981, the National Research Council (National Academy of Sciences) issued a report urging that a major national effort be mounted to study the subject of

indoor air pollution. 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. It is also a possible human carcinogen, based on its ability to produce nasal cancer in rats.

3. Sprayed-on insulation materials

Asbestos, fibrous glass, and mineral wool fibers have been used in some buildings in sprayed-on fireproofing insulation for walls, ceilings, and structural steel beams. Fibers and dust particles may be dislodged from the insulation 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 more important of which are: carbon monoxide, nitrogen dioxide, hydrogen cyanide, formaldehyde, hydrocarbons, ammonia, benzene, hydrogen sulfide, benzo(a)pyrene, 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. While cigarette smoking is the leading cause of lung cancer in the United States, currently available evidence is not sufficient to conclude that passive or involuntary smoking causes lung cancer in non-smokers.[1]

5. Microorganisms and allergens

Microorganisms have been spread through ventilation systems in buildings where air filters became wet and moldy, where pools of stagnant water accumulated under air conditioning cooling coils, and where decaying organic matter was 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 and telecopiers, from printing processes, and from certain cleaning compounds. Hydrocarbons can be irritants and, at high concentrations, are central nervous system depressants.

A. Air Contamination Evaluation Criteria

The primary sources of air contamination criteria generally consulted include: (1) NIOSH Criteria Documents and recommendations for occupational exposures, (2) the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLV's), (3) the U.S. Department of Labor (OSHA) federal occupational health standards, and (4) the indoor air quality standards developed by the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE). The first three sources provide environmental limits based on airborne concentrations of substances to which workers may be occupationally exposed in the workplace environment for 8 to 10 hours a day, 40 hours per week for a working lifetime without adverse health effects. The ASHRAE recommended standards are general air quality standards for indoor environments, and are applicable for the general population exposed for up to a 24 hour day of continuous exposure 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 consulted. 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. Several examples of common contaminants found in both industrial and non-industrial (indoor air) environments are shown below with their relevant environmental exposure criteria:

TABLE A

Contaminant	Concentration/Exposure Period 8-Hour TWA	Continuous	Source
Carbon monoxide	50	---	Cal-OSHA/ACGIH
(ppm)	35 (200[C])	---	NIOSH
	---	9	ASHRAE
Formaldehyde	3	---	Cal-OSHA
(ppm)	CA	---	NIOSH
	---	0.1	ASHRAE
Asbestos	2	---	Cal-OSHA
(fibers/cc)	(0.5- 2)[1]	---	ACGIH
Industrial	0.1, CA	---	NIOSH
Non-Indus.	0.01, CA	---	NIOSH
	---	CA	ASHRAE
Carbon dioxide	5,000	---	Cal-OSHA/ACGIH
ppm	10,000		NIOSH

NOTE: ppm = parts of contaminant (gas or vapor) per million parts of air, by volume
mg/m^3 = milligrams of contaminant per cubic meter of air
CA = lowest feasible level (suspect or confirmed carcinogen), use best control technology
C = short-term (15-30 min) or ceiling limit
1. The ACGIH TLV for asbestos varies depending on the type of fiber.

Other contaminants may be identified or suspect, dependent upon the particular situation and processes existing, and thus warrant further consideration.

B. 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.

Until recently, the ASHRAE Ventilation Standard 62-73 (1973) was utilized, but recommendations were based on studies performed before the more modern, air-tight office buildings became common. These older buildings permitted

more air infiltration through leaks in cracks and interstices, around windows and doors, and through floors and walls. Modern office buildings are usually much more airtight and permit less air infiltration. Due to the reduced infiltration, ASHRAE questioned whether the 1973 minimum ventilation values assure adequate outdoor air supply in modern, air-tight buildings.

Subsequently, ASHRAE has revised its standard and has published the new standard, ASHRAE 62-1981, "Ventilation for Acceptable Indoor Air Quality." The new standard 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. The new ASHRAE standard states that indoor air quality for "General Offices" shall be considered acceptable if the supply of outdoor air is sufficient to reduce carbon dioxide to less than 2500 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 rate recommended under the new standard is 5 cfm of outdoor air 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 20 cfm per person. Areas that are nonsmoking areas may be supplied at the lower rate (5 cfm/person), provided that the air is not recirculated from, or otherwise enters from, the smoking areas.(2)

The ASHRAE Standard 62-1981 also provides ventilation requirement guidelines for a wide variety of commercial, institutional, residential, and industrial facilities and should be consulted for application to the specific situation under evaluation.

VI. RESULTS AND DISCUSSION

On May 16, 1985 an initial environmental survey was conducted at the Data Processing Room to evaluate the general air quality. Management was concerned that the ventilation air intake which is located near the street may be collecting vehicle exhaust fumes which could be responsible for some of the workers health complaints. Even though the location of the air intake is at street level, it does not appear to collect vehicle (buses and automobiles) exhaust fumes based on the typical traffic patterns described to the investigator and the prevailing wind conditions. In order to confirm this, environmental air monitoring was done during a follow-up survey.

On June 14, 1985 environmental air monitoring was conducted for CO, CO_2, and formaldehyde at 6 locations inside the Data Processing Room. CO air concentrations ranged from 2-3 ppm and CO_2 air concentrations ranged from

500-700 ppm. Both of these air concentrations were well below the evaluation criteria listed in Table A. No formaldehyde was detected. The low air concentrations are a good indication that vehicle emissions were not being entrained into the ventilation system. Temperature measurements were taken at each of the air sampling locations. The dry bulb temperature ranged from 74 to 76°F, and the wet bulb temperature ranged from 59.5° to 60.5° F with a calculated relative humidity of 43 percent. The temperature and relative humidity measurements are within the recommended ASHRAE guidelines. It should be noted that some parts of the room appeared warmer, thus, some of the workers used small air fans to circulate the air through their area. Unfortunately, some of the fans blew directly onto the thermostats which could affect the proper operation of the thermostats.

In September, 1982 an inspection of the ventilation system revealed that there were several problems with supply air and return air fan systems. Ventilation measurements at 36 locations revealed that the system was not properly balanced and that it was operating at approximately 57 percent of its design specifications. The contractor recommended that these discrepancies be corrected which would allow for a balance at each box and outlet. Unfortunately, no documentation could be found regarding the repairs, nor could it be determined whether the ventilation system was properly balanced. Ventilation measurements were taken at 10 locations to determine whether the measured flow rates were similiar to the ventilation design rates, however, this proved to be unsuccessful because the ventilation system was operating on the economizer mode i.e. at about 75-80 percent of the expected rate thus no determination could be made.

Approximately 17 workers were randomly selected from the workforce and interviewed at their desks to determine if they had any complaints about the air quality. Of these, six workers (all had asthma or allergies) described one or more symptom which included: eye, nose, throat irritation, or cough which they believed were aggravated by cigarette smoke. It was reported that approximately six of the total staff smoke in the office. These individuals use Ecologizers at their desk to help control cigarette smoke from spreading through out the office area. Five workers complained about the air being either stagnant, too hot, or too cold; and seven employees who have worked along the 13th street side of the building generally complained about the air being damp during the winter. It should be noted that during the dates of this survey, workers did not generally have any complaints about the indoor air quality, except those workers who have difficulties with cigarette smoke.

VII. CONCLUSIONS

During the investigation, no chemical overexposures were measured, and the air temperature and relative humidity were within the ASHRAE standards. No conclusion could be made regarding the ventilation system

because it could not be ascertained if the system was balanced, and the system was operating on the economizer mode when ventilation measurements were made. Workers' complaints of eye, nose, and throat irritation appear to be related to the cigarette smoke.

VIII. RECOMMENDATIONS

1. It is recommended that ventilation system be properly balanced to meet design specifications.

2. It is recommended that workers be instructed not to direct the small fans toward the thermostats since this may affect the proper operation of the ventilation system.

3. It is recommended that relative humidity measurements be taken during the winter, particuliarly on the 13th street side of the building, to evaluate the dampness problem reported by workers.

4. It is recommended that a smoking/non-smoking policy be considered for workers in the Data Processing Room.

IX. REFERENCES

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X. AUTHORSHIP AND ACKNOWLEDGEMENTS

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