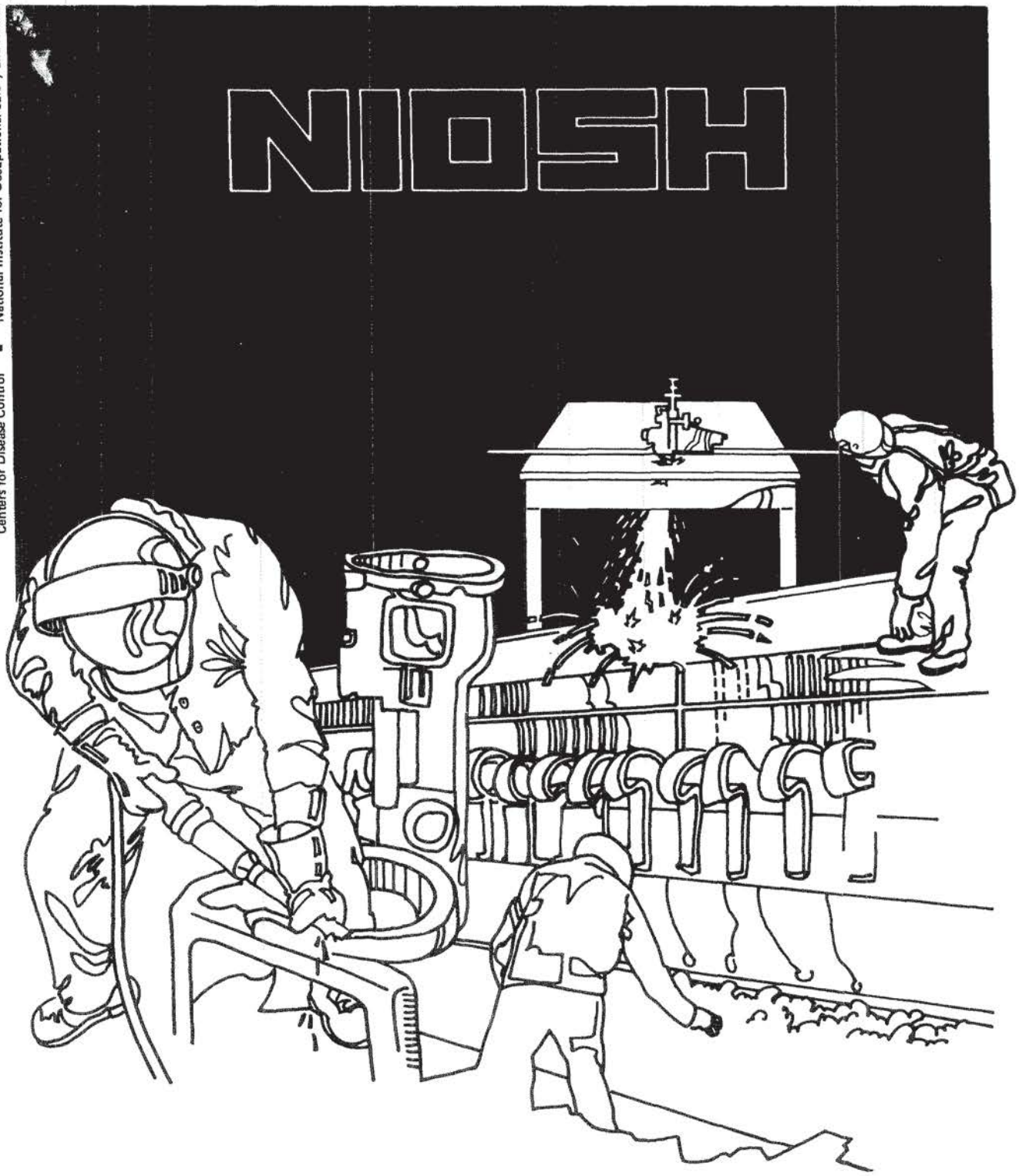
U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES ■ Public Health Service
Centers for Disease Control ■ National Institute for Occupational Safety and Health

NIOSH



Health Hazard Evaluation Report

HETA 81-054-1010
ENVIRONMENTAL PROTECTION AGENCY
SAN FRANCISCO, 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.

HETA 81-054-1010
December 1981
Environmental Protection Agency
San Francisco, California

NIOSH INVESTIGATORS:
Pierre L. Belanger, I.H.
Melvin T. Okawa, I.H.

I. SUMMARY

In February 1981, the National Institute for Occupational Safety and Health (NIOSH) received a request for a health hazard evaluation from a representative of the Environmental Protection Agency workers, Local No. 1 of the National Federation of Federal Employees. The requestor was concerned that employees working on the fifth and sixth floors at 215 Fremont Street, San Francisco, CA., may be exposed to street level vehicle exhausts entering the intake ventilation system located on the rooftop. It was reported that diesel fumes were smelled occasionally during the day. Several workers were reported to complain of headaches, stuffy nose and upper respiratory irritation. Also, there were complaints that an improperly operating ventilation system caused overheating or overcooling which prolonged workers colds and sore throats.

On April 9, 1981, NIOSH conducted an environmental survey. Air sampling was conducted at several locations on both floors for carbon dioxide, nitrogen dioxide, and sulfur dioxide using Drager® gas detector tubes. Carbon dioxide concentrations were below the limit of detection (less than 0.1 percent) of the detector tube, and no nitrogen dioxide and sulfur dioxide were detected. Peak carbon monoxide (CO) concentrations were measured at random intervals during the day. Peak CO concentrations ranged from 2.0 - 3.0 ppm (parts of a vapor or gas per million parts of air). These concentrations are well below the NIOSH recommended crtiteria (200 ppm ceiling) or the 35 ppm - 8 hour, time-weighted average. Six general area air samples were collected for formaldehyde, and no formaldehyde was detected.

Temperature measurements were taken at several locations on each floor to determine whether room temperatures were excessive. The average dry bulb temperature (72°F), wet bulb temperature (58°F) and calculated relative humidity (42 percent) were within the comfort control range (72-79°F, relative humidity 20-60 percent) recommended by the American Society of Heating, Refrigerating and Air-Conditioning Engineers. There were no health complaints aside from periodic discomfort due to overheating or overcooling.

Based on the environmental air sampling results during the date of this survey, overexposures to carbon monoxide, carbon dioxide, nitrogen dioxide, sulfur dioxide and formaldehyde did not exist. Also excessive temperatures due to overheating or overcooling and excessive relative humidity ranges were not measured on the day of this survey.

KEYWORDS: SIC 9999 (OFFICE WORKERS) diesel and gasoline fumes, carbon monoxide, nitrogen dioxide, sulfur dioxide, formaldehyde.

II. INTRODUCTION

On February 9, 1981, the National Institute for Occupational Safety and Health (NIOSH) received a request for a health hazard evaluation (HHE) from an authorized Environmental Protection Agency (EPA) representative, Local No. 1 of the National Federation of Federal Employees at San Francisco, California. The requestor was concerned that office workers on the fifth and sixth floors at 215 Fremont Street, San Francisco, California may be exposed to vehicle exhaust fumes entering the intake ventilation system located on the roof of the building. Also, there were complaints of either overheating or overcooling of the offices which prolonged colds or sore throats. Several workers reported complaints of headache, sore throat, or upper respiratory irritation.

III. BACKGROUND

The Environmental Protection Agency leases two floors of office space at 215 Fremont Street, San Francisco, California from Continental Development Corporation. Approximately 400 employees work an 8 hour day, 40 hour workweek.

Even though the EPA only occupies the fifth and sixth floors, it was alleged that the Pacific Telephone employees who work on the first four floors also had similar concerns as the EPA employees. Consequently, an authorized employee representative of the Communications Workers of America submitted a health hazard evaluation request (HHE 81-164) to investigate their work areas. Both studies were conducted simultaneously in order to characterize the general air quality for the entire building.

IV. HAZARD EVALUATION DESIGN

NIOSH conducted an environmental survey on April 9, 1981. Environmental air sampling was conducted at several locations on both floors for all possible vehicle exhaust fumes (carbon monoxide, carbon dioxide, nitrogen dioxide, sulfur dioxide and formaldehyde) which could emanate from gasoline and diesel exhaust systems. Several of the locations monitored were selected by the requestor based on previosuly reported complaints.

Dry and wet bulb temperature measurements were taken at several locations, and the respective relative humidity was calculated for each temperature reading.

A. Environmental Monitoring

Environmental area air sampling was conducted at the following locations: Fifth floor - water division, air division, director's office, room 517 - enforcement; Sixth floor - air section, hazardous material section, communications coordination section.

Carbon dioxide, nitrogen dioxide and sulfur dioxide was sampled at each location using direct reading Drager® gas detector tubes. Carbon monoxide air concentrations were measured using a direct reading instrument (Ecolyzer®). Formaldehyde air samples were collected using a sampling train consisting of a vacuum pump and a specially impregnated charcoal tube through which a known volume of air was drawn. NIOSH Physical and Chemical Analytical Method 318 was followed, with minor variations in the preparation and analysis of samples[1].

A Bendix psychrometer (Model 566) was used to measure dry and wet bulb temperatures from which the relative humidity was calculated.

B. Evaluation Criteria and Health Effects

Occupational exposure criteria have been developed to evaluate workers' exposure to chemical substances. Two sources of criteria were used to assess the workroom concentrations: (1) NIOSH Criteria for a Recommended Standard, and (2) Federal Occupational Safety and Health Administration (OSHA) Standards. These values represent concentrations to which it is believed that nearly all workers may be exposed for an 8 hour day, 40 hour week throughout a working lifetime without experiencing adverse health effects.

TABLE A

Substance	Time-Weighted Average (TWA)[a]	Ceiling Value
Carbon Monoxide (NIOSH)	35 ppm	200
Carbon Monoxide (OSHA)	50 ppm	-
Carbon Dioxide (NIOSH)	10,000 ppm	30,000 (10 min.)
Carbon Dioxide (OSHA)	5.000 ppm	-
Nitrogen Dioxide (NIOSH)	-	1 (15 min.)
Nitrogen Dioxide (OSHA)	5	-
Sulfur Dioxide (NIOSH)	0.5 ppm[b]	-
Sulfur Dioxide (OSHA)	5.0 ppm	-
Formaldehyde (NIOSH)	Lowest feasible limit	-
Formaldehyde (OSHA)	3	5

(a) TWA - NIOSH exposure is based on a workday up to 10 hours long, whereas OSHA Standards are based on an 8 hour workday.

(b) ppm - Parts of a vapor or gas per million parts of contaminated air by volume.

C. Toxicological Effects

Gasoline and Diesel Exhaust

Engine exhaust contains many different chemicals and materials, only some of which have been analyzed. A few of these chemicals are most likely to cause immediate irritation to people who may be inhaling them.

(1) Carbon monoxide (CO)

CO prevents the blood from carrying oxygen from the lungs to the tissues. There are small amounts of CO in most smokes (cigarettes, auto exhaust, etc.). CO causes headache and drowsiness at low levels. Diesel fumes contain smaller amounts of CO than gasoline combustion fumes, and CO is considered generally a less serious potential problem in diesel fumes.

(2) Carbon dioxide (CO_2)

CO_2 is a simple asphyxiant. Signs and symptoms of exposure, depending on the concentration present and duration of exposure may include headache, dizziness, restlessness or increased heart rate. "After several hours of exposure to 2 percent (20,000 ppm) subjects develop headache and dyspnea during mild exertion."[2]

(3) Formaldehydes and other aldehydes:

Formaldehyde is best known for its use by embalmers and morticians to preserve dead bodies and tissues. It has a sharp odor which can be smelled at very low levels (less than 1 part in a million parts of air, or 1 ppm). At levels between 1-5 ppm, formaldehyde makes the eyes water and sting. At 20 ppm, many people notice stinging or prickling in the throat and nose. Low levels -- 0.3 to 2.7 ppm -- have also been found to disturb sleep and to be irritating to a smaller number of people.(1)(2)(11) Formaldehyde has induced a rare form of nasal cancer in two test animals as reported in an ongoing study by the Chemical Industry Institute of Toxicology. Formaldehyde has also been shown to be a mutagen in several test systems.

Other aldehydes -- such as acrolein -- also cause irritation to the nose, throat, eyes and lungs at even lower levels of air concentrations.

(4) Nitrogen dioxide (NO_2)

NO_2 is well known as the gas which makes smog over large cities like Los Angeles turn yellow or yellow brown. This gas also causes irritation of the nose, throat, and lungs at low levels (5 ppm). It may cause cough and phelgm (mucous) which persist at these levels. At higher levels, 50 ppm or more NO_2 will cause serious swelling in the lungs, and in some cases permanent lung damage.(2)

(5) Sulfur dioxide (SO_2)

SO_2 causes symptoms of irritation similar to those caused by NO_2 and formaldehydes.

V. RESULTS AND DISCUSSION

Environmental air sampling was conducted for diesel and gas fumes generated by street traffic vehicles or from bus traffic passing through the East Bay Transit facility located across the street. Several workers reportedly complained of periodic headaches, stuffy nose or upper respiratory irritation. Also, several workers complained of what they perceived to be overheating or overcooling of the offices which resulted in prolonged colds and sore throats.

Random inquiries were made of personnel (12-15 employees) working in the offices sampled for vehicle exhaust fumes. None of these employees complained of any symptoms reported in the HHE request form; however, several employees reported that they periodically smelled diesel fumes whenever inversion conditions occurred. Diesel fume odors were periodically smelled in the late afternoon as commuter traffic increased. Workers mentioned that the air conditioning appeared to be working properly on the day of our investigation, i.e., the offices were not perceived to be too hot or too cold.

No sulfur dioxide or nitrogen dioxide was detected on any of the gas detector tubes. Carbon dioxide concentrations were below the limit of detection (less than 0.1 percent) of the gas detector tube. Carbon monoxide peak measurements were taken at various intervals of the day. The concentrations ranged from 2.0 - 3.0 ppm (parts of a vapor or gas per million parts of air). These concentrations were well below the NIOSH recommended criteria and OSHA standard listed in Table A.

Six area air samples were collected for formaldehyde; however, none was detected on either section of the impregnated charcoal tube. The analytical limit of detection was four and two micrograms for the front and backup section of the charcoal tube respectively.

It should be mentioned that the environmental air sampling results collected from the first four floors (Pacific Telephone Survey HHE 81-164) were very similar to the results collected during this study.[3]

Temperature measurements (dry and wet bulb) were taken in the later afternoon at several locations on the fifth and sixth floors. Also, the relative humidity was calculated from these two measurements. The fifth floor was measured to have an average dry bulb temperature of 72 degrees F, wet bulb temperature of 58 degrees F and a relative humidity of 40 percent. The sixth floor was measured to have approximately the same temperatures and relative humidity. These temperatures and relative humidity are within the comfort control range (dry bulb temperature range 72 to 79 degrees F and a relative humidity range - 20-60 percent) recommended by the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)[4]. It should be mentioned that ASHRAE recommends a ventilation rate for general offices of 15 cubic feet per minute per occupant.

VI. CONCLUSIONS

Based on the environmental air concentrations measured during this survey, no overexposures to diesel or gasoline exhaust fumes (carbon monoxide, carbon dioxide, nitrogen dioxide, sulfur dioxide or formaldehyde) were measured. Also, no excessive temperatures were measured and relative humidity was calculated to be within the comfort range.

VII. REFERENCES

1. NIOSH Manual of Analytical Methods, HEW Publication No. (NIOSH) 80-125.

2. Proctor, Nick H. and Hughes, James, Chemical Hazards of the Workplace, (1978), J. B. Lippincott Company.

3. Belanger, P. L. and Okawa, M. T.: A study of the Pacific Telephone workers environment for vehicle exhaust fumes, NIOSH Hazard Evaluation and Technical Assistance Report No. 81-164, October 1981

4. ASHRAE Handbook and Product Directory, 1977 Fundamentals, ASHRAE Inc., New York, 1980.

5. Criteria for a Recommended Standard: Occupational Exposure to Formaldehyde, DHEW (NIOSH) Publication No. 77-126, Cincinnati, U. S. Department of Health, Education and Welfare, PHS NIOSH, 1977.

6. Health Hazard Determination: White Pass and Yukon Railroad, DHEW (NIOSH) Publication No. 74-1-160, Cincinnati, U. S. Department of Health, Education and Welfare, PHS, NIOSH 1974.

7. Criteria for a Recommended Standard: Occupational Exposure to Carbon Monoxide, DHEW (NIOSH) Publication No. 73-11000.

8. Criteria for a Recommended Standard: Occupational Exposure to Carbon Dioxide, DHEW (NIOSH) Publication No. 76-194.

9. Criteria for a Recommended Standard: Occupational Exposure to Nitrogen Dioxide DHEW (NIOSH) Publication No. 76-149.

10. Criteria for a Recommended Standard: Occupational Exposure to Sulfur Dioxide, DHEW (NIOSH) Publication No. 74-111.

11. Formaldehyde: Evidence of Carcinogenicity, NIOSH Current Intelligence Bulletin, No. 34, April 15, 1981, DHHS (NIOSH) Publication No. 81-111.

VIII. AUTHORSHIP AND ACKNOWLEDGEMENTS

Report Prepared By:

Pierre L. Belanger
Industrial Hygienist
NIOSH - Region IX
San Francisco, California

Environmental Assistance:

Melvin T. Okawa
Regional Program Consultant
NIOSH - Region IX
San Francisco, California

Analytical Laboratory Service:

Utah Biomedical Test Laboratory
Salt Lake City, Utah

Report Typed By:

Dorothy Gollnast
NIOSH - Region IX

DISTRIBUTION AND AVAILABILITY OF REPORT

Copies of this Determination Report are currently available upon request from NIOSH, Division of Standards Development and Technology Transfer, 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), 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. U. S. Environmental Protection Agency, Local No. 1 of the National Federation of Federal Employees.
2. U. S. Environmental Protection Agency - Region IX
3. U. S. Department of Labor - Region IX
4. U. S. Department of Health and Human Services

DEPARTMENT OF HEALTH AND HUMAN SERVICES
PUBLIC HEALTH SERVICE
CENTERS FOR DISEASE CONTROL
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH
ROBERT A. TAFT LABORATORIES
4676 COLUMBIA PARKWAY, CINCINNATI, OHIO 45226

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE, $300

Third Class Mail

POSTAGE AND FEES PAID
U.S. DEPARTMENT OF HHS
HHS 396