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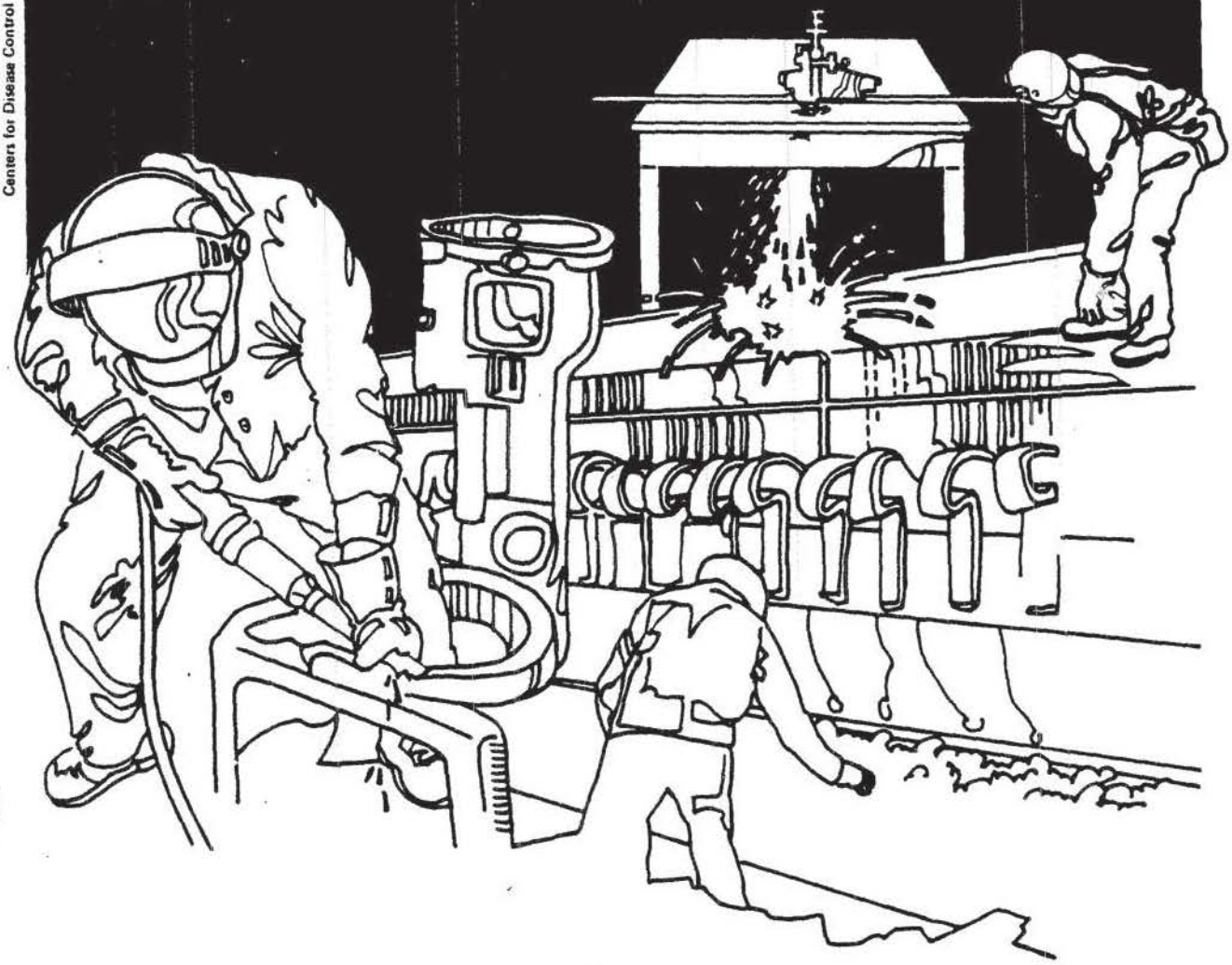

Health Hazard Evaluation Report

HETA 85-002-1551
SALOMON BROTHERS
NEW YORK, 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.

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I. SUMMARY

On September, 1984, the National Institute for Occupational Safety and Health (NIOSH) received a request for a Health Hazard Evaluation from the Medical Department of Salomon Brothers, Inc., 1 New York Plaza, New York City, N.Y. 10004. The request concerned conditions on the 40th floor trading floor, where many employees were concerned about intermittent headaches and eye, nose and sinus irritation. The work population of the 40th floor trading floor had increased from 90 in 1969, when the building was first occupied, to 310, with no increase in space provided or in ventilation capacity.

Visits were made to the work site on September 20, 25 and October 15, 1984. A ventilation survey was performed and determinations of the airborne carbon monoxide and carbon dioxide concentrations were made.

Carbon monoxide concentrations were 3 to 5 parts per million parts of air (ppm), which is normal for an office situation. The concentrations of carbon dioxide were about 1500 ppm. While these concentrations are less than the NIOSH recommendation of 10,000 ppm for exposure to carbon dioxide, concentrations of carbon dioxide usually are about 500 ppm in offices where cigarette smoking is permitted. Carbon dioxide levels this high are indicative of a lack of adequate ventilation in the office.

A preliminary ventilation survey done on September 25th indicated that the amount of outdoor air supplied to the trading floor was less than the 20 cubic feet per minute per person recommended by the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE). A second ventilation survey done on October 15, 1984, after the installation of supplemental ventilation indicated that the amount of ventilation had been increased to more than the amount indicated by the ASHRAE recommendation. Since the installation of the supplemental ventilation system, the employees's concerns and complaints about the air supply have abated.

The preliminary survey indicated that a potential health hazard existed because the amount of air supplied was less than that recommended. The installation of supplemental ventilation abated that potential hazard. Based on the results of the supplemental ventilation survey, no recommendations are considered necessary.

KEYWORDS: SIC Classification 6711--Investment Firm, general brokers. Carbon Monoxide, Carbon Dioxide, Ventilation, Closed Building Syndrome.

II. INTRODUCTION

In mid-September 1984, the Medical Department of Salomon Brothers, Inc., an investment brokerage house, telephoned the regional office of the National Institute for Occupational Safety and Health (NIOSH) to request help in determining possible causes for complaints of headache and eye, nose and sinus irritation among employees who work on the 40th floor trading floor. After an initial visit to the site on September 20th, a health hazard evaluation was requested. Ventilation surveys were performed on September 25 and October 15, 1984. The management was informed of the results immediately following the surveys.

III. BACKGROUND

Salomon Brothers occupies all or parts of 8 floors of a 50 story building at 1 New York Plaza in New York City. Salomon Brothers began occupying the building in 1969 and has expanded from 900 employees to about 3,500 employees. The 40th floor trading floor occupies approximately 20,000 square feet of area and has a ceiling about 10 feet high. The population of this trading floor has increased from 90 in 1969 to 310 in 1984. There are 4 small private offices on the south side of the area and one private office on the north side of the area. Unopenable windows line the north, south and east perimeters. The main area of the trading floor is open. Other divisions of Salomon Brothers occupy the other half of the 40th floor.

Employees on the trading floor are engaged in buying and selling of stocks. Desks are arranged in clusters of six or eight, and are blanketed with telephones and video display terminals. Stock quotations flash on the video sets and on display boards overhead. The activities are noisy and frantic. Employees arrive about 7:30 A.M. and leave after 5 P.M. They rarely leave the floor, having coffee and lunch at their desks while they work. A certain amount of tension is associated with the job, but management believes that the amount and severity of complaints from the 40th floor trading floor have escalated in the past year or so.

At the time of the first site visit, ventilation was supplied through input grills in the window sill, and through slots in the ceiling. The return was through slits around some of the lighting fixtures. Most of the window grills are at least partially blocked by piles of books and papers. The ten grills in the window sills on the west side of the floor are fitted with plastic deflectors. The drapes on these windows usually are closed to prevent drafts to the individuals who sit nearest to the windows. The deflectors and drapes also retard the circulation of the air exiting these grills. The area also has a supplemental air chilling system, which removes air from the open area, chills the air and returns it to the open area through ceiling slots.

IV. EVALUATION DESIGN AND METHODS

The initial activity in a health hazard evaluation is a site visit to determine what chemicals and processes are used and to interview a number of employees to determine their concerns. No chemicals are used on the 40th floor trading floor. Stock trading is done by telephone. The traders rarely leave their desks. A similar trading floor is located on the 41st floor of the building, where the same activities are conducted. The main differences between the two areas are that the 41st floor has about half the employees and has a two story ceiling. The employees who work on the 41st floor do not express the health concerns as do the employees on the 40th floor

In conversations with employees on the 40th floor, they expressed almost universal concern about lack of air, inadequate circulation of air, temperature discomfort and cigarette smoke (most of the employees smoke).

Based on the responses of interviews of employees, the cloud of cigarette smoke which hung in the area, and the temperature difference between the desks near to the window vents (70°F) and those away from the vents (78°F), it was decided to perform a ventilation survey of the 40th floor selling floor.

A "Flow Hood" is the survey instrument of choice in performing ventilation surveys because of its ease in use and because it is a direct reading instrument. In use, a box-like enclosure is placed over a ventilation grill and the air flow is directed to the detectors which measure the static pressure of the air flow. The quantity of air (in cubic feet per minute) is read directly from a scale. Because of size limitations, the flow hood cannot be used in all situations. The second instrument of choice is a thermal anemometer. In using this instrument, the air velocity is measured by consideration of the change in temperature as air flows past a probe. A transverse of the ventilation grill is made to determine the average velocity of air flowing through the grill. The quantity of air is then calculated by multiplying the average rate of air flow by the effective area of ventilation grill.

A thermal anemometer was used to measure the air velocity exiting from the window sill grills because the deflectors would not permit the use of a Flow Hood. The Flow Hood instrument was not available on the date of the first ventilation survey, but was used on the return visit to measure the ventilation on the return visit in October.

Because of the apparent crowding and cigarette smoke haze, it was decided to determine the concentrations of carbon monoxide and carbon dioxide. Detector tubes were used as the survey instrument. In use, air is drawn through a glass tube which contains silica gel impregnated with various chemicals. As the chemicals react with air contaminants, a color change is effected. The concentration of contaminant in the air is proportional to the length of the color change in the glass tube.

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 windows that cannot be opened, thus making the building totally dependent on mechanical systems for ventilation. 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, ant 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 often a single cause cannot be pinpointed.

Imbalance or malfunction of the air conditioning system commonly is identified by survey of the ventilation system, and in the absence of other theories of causation, illnesses are usually attributed to inadequate ventilation, heating/cooling or humidification.

Neither NIOSH nor OSHA has developed ventilation criteria for general offices. Criteria often used by design engineers are the guidelines published by the American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).

Until recently, the ASHRAE Ventilation standard 62-73 (1973) was utilized, but those recommendations were based on studies performed before the more modern, air-tight building became common. The 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. Because of the reduction in infiltration, ASHRAE questioned whether the 1973 minimum ventilation values assured an adequate outdoor air supply to modern, air-tight buildings.

Subsequently, ASHRAE revised its standard and published its new standard (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. For "General Offices" where smoking is not permitted, the rate recommended under the new standard is 5 cubic feet per minute (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 provided that the air is not recirculated from, or otherwise enters from the smoking areas.

The air supplied in closed buildings is not 100% fresh air. It is a mix of air which has been in the building and is heated to a comfortable temperature with outdoor air, which must be heated or cooled on extremely cold or hot days. Building management stated that the ventilation system operates on a minimum mix of 30% fresh air/70% return air. Therefore, for the 310 employees who work on the 40th floor trading floor, the amount of air supplied should be a minimum of 19,000 cfm.

NIOSH recommends that exposure to carbon monoxide be limited to 35 parts per million parts of air (ppm) as a time weighted average exposure for a 40 hour work week. The NIOSH recommendation for exposure to carbon dioxide is 10,000 ppm. As a practical consideration, concentrations approaching these levels are rarely encountered in office situations. The usual concentration of carbon monoxide in an office where smoking is permitted is about 3 to 5 ppm. The usual concentration of carbon dioxide where smoking is permitted is about 500 ppm. Concentrations above these levels, where these is no source of generation of carbon monoxide or carbon dioxide, is an indication that the ventilation system is inadequate.

VI. RESULTS

Carbon monoxide concentrations were determined to be about 3 to 5 parts per million (ppm), which is normal in an office where smoking is permitted. Carbon dioxide concentrations were approximately 1,500 to 1,800 ppm, which are unusually high for an office area and are indicative that the ventilation system is inadequate.

The 18 window grills in the open area of the floor are approximately 6" x 48", or 2 square feet. Because of the fan motor housings in the window sills, the effective area of each grill is about 1 square foot. The average velocity of air exiting from these grills was about 250 linear feet per minute, supplying about 4500 cfm. The 8 window grills in the perimeter offices supply an additional 1600 cfm for a total of 6,100 cfm of air supplied to the trading floor through the window sill grills. The blockage of the grills by books and drapes and the occasional closed office door reduces the amount of air supplied through these grills to some degree.

Attempts were made to estimate the air supplied (or returned) to the room through the ceiling slots with the thermal anemometer. The ceiling slots are arranged in octagonals and only certain parts of the octagons function as ventilation slots. Many of the slots could not be reached because of the height of the ceiling or because of their location. No flow of air could be measured through several of the slots, indicating that they had become inoperative. The air flow across the few slots where there was a measurable velocity was about 100 to 150 linear feet per minute. The effective area of

the ventilation slots are about 2" x 60", or .8 square feet. The additional air supplied by the ceiling slots could not have been more than a few hundred cfm. The total amount of air supplied to the office (7,000 cfm) was far less than the minimum amount recommended by ASHRAE (19,000).

A supplemental ventilation system was installed on the 40th floor selling floor in early October 1984. A survey of the new ventilation grills was made on October 15th, using the Flow Hood instrument. Although the supplemental system was not yet balanced, the output of air through the new ceiling grills was within 15% of the design criteria. The supplemental system is designed to provide an additional 13,500 cfm of mixed air to the selling floor. The total amount of ventilation supplied to the trading floor is now about 20,500 cfm of mixed air, which exceeds the minimum amount of mixed air, based on the ASHRAE recommendations. The employees' complaints have abated, and they appear to be satisified with the increased air supply.

VII. RECOMMENDATIONS

Based on the results of the ventilation survey of October 15th, and the abatement of employees' complaints following the installation of a supplemental ventilation system, no further recommendations are considered necessary. It should be emphasized that the window sill grills should not be blocked with books and papers.

VIII. REFERENCES

American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. ASHRAE handbook--fundimentals. Atlanta, GA: ASHRAE, 1981.

National Institute for Occupational Safety and Health. NIOSH/OSHA occupational health guidelines for chemical hazards. Cincinnati, OH: National Institute for Occupational Safety and Health, 1981. (DHHS (NIOSH) publication no. 81-123).

IX. ACKNOWLEDGEMENT AND AUTHORSHIP

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X. 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, OH 45226. After 90 days, the report will be available through the National Technical Information Service (NTIS), 5285 Port Royal Road, Springfield, VA 22161. Information concerning its availability can be obtained from the NIOSH Publications Office at the Cincinnati address.

Copies of this report have been sent to:

1. Salomon Brothers, Inc.
2. OSHA, Region II
3. NIOSH, Region II
4. The New York State Department of Health, Albany.

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