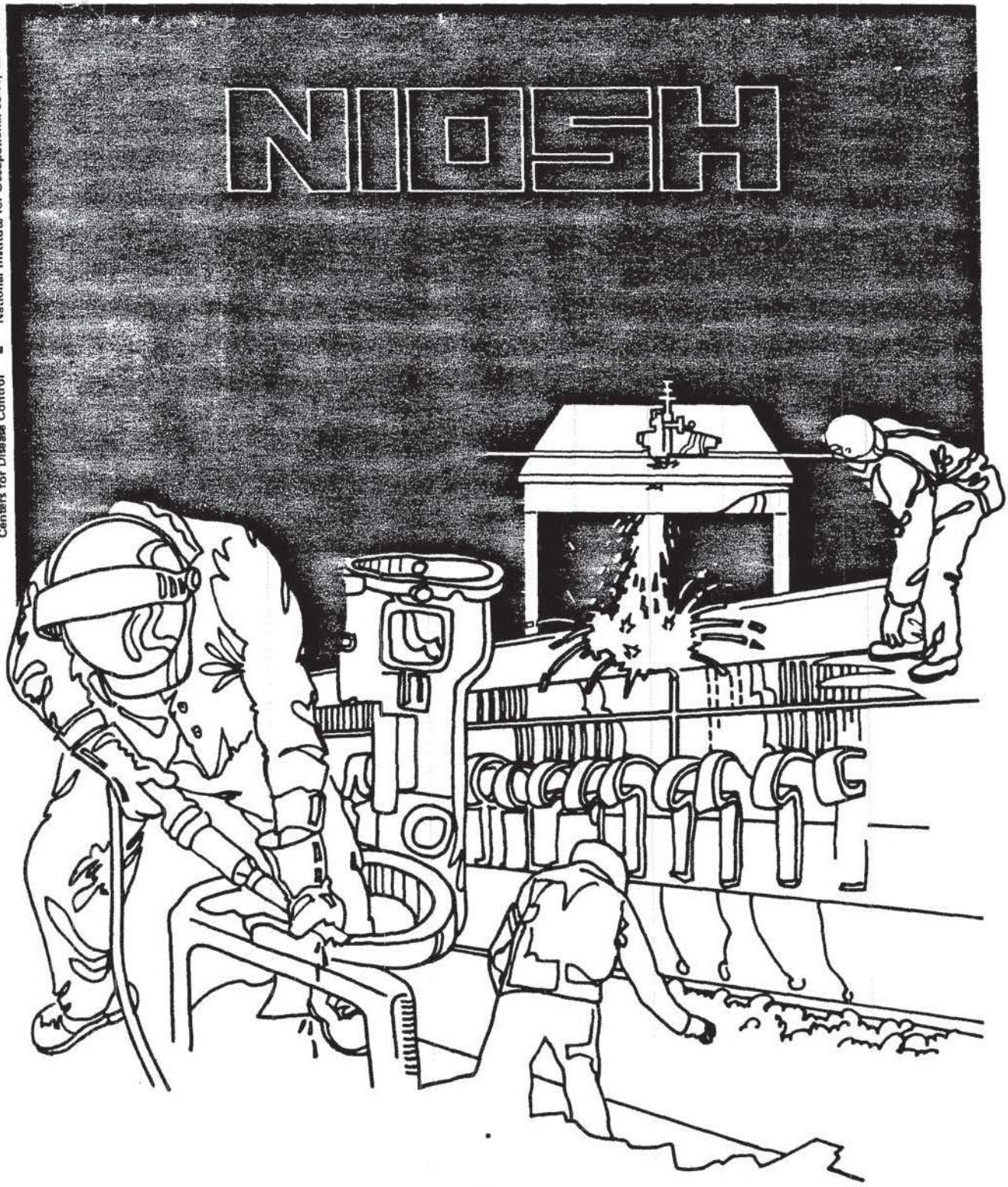
U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES ■ Public Health Service
Centers for Disease Control ■ National Institute for Occupational Safety and Health

NIOSH



Health Hazard Evaluation Report

HETA 81-103-964
UNITED NATIONS
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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NIOSH INVESTIGATORS:
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I. SUMMARY

In November, 1980, the National Institute for Occupational Safety and Health (NIOSH) received a request for a health hazard evaluation from the Director of the Medical Services of the United Nations. The request concerned potential health problems of employees housed on floors 4 though 24 of the United Nations Development Programme Building, New York. The assistance of NIOSH was requested after approximately 930 of 1500 United Nations (UN) and United Nations Development Programme (UNDP) employees signed a petition complaining of temperature extremes, lack of ventilation, and low humidity.

After initial visits during November 1980 and January 1981, NIOSH distributed a self-administered questionnaire to 345 employees on five floors selected as being representative of the employees on the UN and UNDP floors.

Environmental evaluation of temperature, humidity, and air flow, and sampling for air concentrations of carbon monoxide were done in several areas on four floors during February and June, 1981. Sampling for formaldehyde and total organic vapors was performed during September, 1981.

Analysis of questionnaires returned by 285 employees (83%) revealed widespread discontent with environmental conditions, especially temperature extremes, low humidity, and insufficient fresh air. A substantial number of employees reported frequently experiencing dry skin, fatigue at work, and eye, nose, and throat irritation. Otherwise, the general health status of the employees is good, indicating no significant systemic health effects from working within the building.

Environmental monitoring revealed no significant levels of carbon monoxide (below 5 parts per million parts of air). Formaldehyde and total organic vapors were below the limits of detection. Temperature and humidity varied from day to day in the building as a whole, but no significant variation within the building could be documented on the three days of the NIOSH visits. Air flow was consistently low throughout the building, especially in the large office spaces in the center of the building. Observations during the NIOSH visits indicate that the air ventilation system is substantially unbalanced.

While there is no evidence indicating significant adverse health effects among the employees, there is a high prevalence of symptoms of discomfort involving the skin and upper respiratory tract. Environmental monitoring revealed no significant air contamination; however, temperature and humidity are not well controlled and air flow is quite low. The latter factors are likely responsible for the reported health symptoms. Recommendations are made in the body of the report to help alleviate these conditions.

Keywords: SIC 9721 (International Affairs); closed office building, indoor air quality, low humidity, air flow, dry skin, eye irritation, fatigue.

II. INTRODUCTION

In November, 1980, the National Institute for Occupational Safety and Health (NIOSH) received a request for a health hazard evaluation from the Director of the Medical Service of the United Nations. The request concerned potential health problems of employees headquartered in the United Nations Development Programme Building, One United Nations Plaza, New York City, New York. About 750 employees of the United Nations Development Programme (UNDP) work in the building, on floors 4, a portion of 11, and 16 through 24, and about 750 employees of the United Nations (UN) work on floors 2, 3, and 5 through 15. The upper floors of this 37 story building house a luxury hotel.

The assistance of NIOSH was requested after approximately 930 of the UN and UNDP employees signed a petition complaining of temperature extremes, lack of ventilation, and low humidity.

On November 26, 1980, NIOSH met with representatives of the United Nations (UN) and United Nations Development Programme (UNDP), UN Medical Service, Staff Council (employees), and building's management. During that meeting, the staff's complaints were reviewed and general information about the building was obtained.

The NIOSH medical officer returned during January, 1981, and interviewed approximately 30 employees working on floors 14, 17, and 18. During February 1981, a self-administered questionnaire was distributed to every employee on floors 5, 10, 17, 18, and 19. The returned questionnaires were analyzed for reported environmental conditions, current health symptoms, and significant medical problems among the employees.

Environmental measurements of temperature, humidity, air movement, and air concentrations of carbon monoxide were made on four floors on February 25, 1981, and June 2, 1981. On September 1, 1981, sampling was performed for air concentrations of formaldehyde and total organic vapors.

III. BACKGROUND

The United Nations Programme Development Building was completed in 1975, allowing various offices which had been scattered to be housed in one location. The building is on the west side of 1st Avenue, across the street from the main United Nations headquarters. The staff includes clerks, secretaries, technical "officers" and advisors, consultants, and supervisors. Duties involve typical administrative and office operations, including use of telephones, typewriters, and duplicating machines. No "chemicals" are routinely used in the offices. There are a few duplicating machines and word processors on several of the floors, but no unusual complaints are associated with their use.

The area of floors 2 through 10 is 14,000 square feet each, and floors 11 through 24 have 11,000 square feet each. Total area is approximately 280,000 square feet. Ceilings are 10 feet high. The ventilation system is in operation from 7 or 8 AM to 7 or 8 PM, Monday through Friday. The nominal ventilation rate designed for the building is 1.5 cubic feet per minute (CFM)

per square foot of area, for a total of 435,000 CFM to the offices. Thus the ventilation system can supply approximately 290 CFM of air per occupant. The ventilation system automatically mixes fresh outdoor air with recirculated indoor air to maintain the office temperatures in the 68° to 78°F range. The proportion of fresh air supplied usually ranges from 15% to 30%, but can be as low as 10%.

According to the building's managers, each floor has 6 heating zones and 3 ventilation zones. Each heating zone is controlled by a master thermostat, plus one additional thermostat for every three offices. Humidity is controlled separately for each ventilation zone. According to the building's engineers, the temperature is maintained at 68°F during the winter and 78°F during the summer. The relative humidity is maintained at 40%.

The configuration of each floor is roughly that of a figure "8", with private offices on the periphery, open offices in the center, and hallways, elevator banks, stairwells and rest rooms in the two cores. A mixture of fresh and recirculated air is supplied to each floor at a constant volume through linear slots in the ceiling along the periphery of the building. Ventilation grills in the center of the building supply a variable volume of air as needed to heat or cool the office space. The air supplied to the linear slots is tempered during winter by "pre-heater" boxes, which are controlled by the thermostats. The air supplied to the central office space is not tempered after coming from the fan units. One result of this type of system is that the offices at the periphery can be too hot or cold; the center offices can receive a low volume of supplied air. Consequently, the doors to the private offices often are kept open to try to alleviate these conditions.

In general, the larger private offices are on the periphery of the east side of the building. These offices have floor to ceiling metal temporary walls, and are more plush than the other private offices. The support staff is less crowded in the east side offices. The floors are carpeted throughout. The carpeting is glued directly to the concrete floor and, in most areas, is the original carpeting. The layout of the offices on several of the floors has been changed at least once since the building was originally occupied. These changes have involved moving both office dividers and temporary walls. The ventilation system to the floors apparently has not been re-balanced following each of these re-modeling changes. Reportedly, the layout of the offices on the UNDP floors have been altered more frequently than the offices on the UN floors.

Since the offices were occupied in December 1975, many employees on different floors have complained of temperature extremes, low humidity, and insufficient fresh air. The number of complaints has increased gradually over the years, but especially since the spring of 1980. At that time, a pool in the hotel at the top of the building was painted. Paint vapors from the pool were inadvertantly recirculated throughout the building for a short period of time. After several months of increasing concern among the employees about the environmental conditions and general safety of the offices, approximately 930 employees signed a petition requesting that the quality of the air in the offices be evaluated.

IV. EVALUATION DESIGN AND METHODS

A. Environmental:

The UN and UNDP occupy floors 2 through 24 of the 37 story office building. The walk-through inspection indicated that the general office furnishings and employee activities are fairly similar on the different floors. It was decided to conduct environmental sampling in several different locations on each of approximately five floors in the building. These floors are taken to be representative of conditions in the building as a whole.

Environmental sampling was designed based on information provided during the initial meeting with representatives of the administrations, employees, and building's management. Temperature, humidity, and air flow were measured because of employees' complaints about these conditions. Carbon monoxide, formaldehyde, and general organic vapors were evaluated since these substances could sometimes be found in such office environments and possibly could cause the reported health symptoms.

Measurements of temperature, humidity, air movement, and concentrations of carbon monoxide were made on floors 14 and 17 on February 25, 1981, and on floors 19 and 21 on June 2, 1981. Temperature and humidity were measured by a Bendix Model No. 566 psychrometer. Non-directional air movement was measured by a thermo-anemometer. The concentration of carbon monoxide was measured by Draeger direct reading detector tubes. On September, 1, 1981 additional measurements of potential airborne contaminants were made on floors 16, 17, 19 and 21. Concentrations of formaldehyde were measured using Draeger direct reading detector tubes. An MSA Combustible Gas Indicator was used to indicate concentrations of organic solvent vapors.

B. Medical:

During the initial visit, the NIOSH medical officer spoke with members of the Staff Council (representing the employees), individual employees during the walk-through tour, and the staff nurse in the medical office for the building. The medical officer returned during January, 1981, and interviewed approximately 30 employees on floors 14, 17, and 18. Information obtained during the initial visit and from these interviews was used to design a self-administered questionnaire for the employees. On February 25, 1981, the self-administered questionnaire was distributed to every employee on floors 5, 10, 17, 18, and 19. These floors were selected on the advice of the Staff Council as being representative of the conditions existing in the building. Floors 5 and 10 house UN staff, while floors 17, 18, and 19 house UNDP staff. Three-hundred forty-five questionnaires were distributed. The questionnaire asked about job title, duties, and office location. Respondents were asked to indicate how frequently during the past year they had been exposed to certain adverse office conditions. In addition, they were asked about health symptoms and significant medical conditions. Analysis included calculation of the distribution of employees' responses to the questions on office conditions and health symptoms. Results were also examined stratified by age, sex, job title, and floor. Statistical analysis was by Chi-square test.

V. EVALUATION CRITERIA

The environmental evaluation criteria for carbon monoxide and formaldehyde are shown below. The criteria include the NIOSH recommended standards and the Federal occupational health standards as promulgated by the Occupational Safety and Health Administration (OSHA), U.S. Department of Labor (29 CFR 1910.1000). The NIOSH recommended standard for carbon monoxide is based on a 10 hour work day, 40 hour work week; it also includes a ceiling value, which is the maximum concentration recommended even for short periods of time. The Federal occupational health standards are based on an 8 hour work day, 40 hour work week:

Substance	NIOSH Recommended Standard (ppm[a]) (TWA[b])	(Ceiling Value)	OSHA Federal Standard (ppm[a])
Carbon monoxide	35	200	50
Formaldehyde	LFL[c]	LFL[c]	3

a. ppm = parts per million parts of air.
b. TWA = time-weighted average over the work day.
c. LFL = lowest feasible limit.(1)

There are no Federal occupational health standards for temperature, humidity, or air flow in offices. These factors can vary widely without causing any adverse health effects among employees. However, moderate variation of temperature and humidity and low air flow can result in considerable discomfort. The American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., (ASHRAE) has developed environmental guidelines for thermal comfort based on 50 years of research with human subjects(2).

The major factors affecting thermal comfort include ambient air temperature, radiant temperature (mostly from the sun), relative humidity, air flow, level of activity, and type of clothing. The effect of each of these factors on thermal comfort has been evaluated using experimental studies with human volunteers. The ASHRAE Handbook - 1977 Fundamentals contains tables which indicate the relationships between these factors in determining thermal comfort(2). Increasing radiant temperature, increasing relative humidity, decreasing air flow, increasing employee activity, and wearing heavier clothing, each require decreasing ambient air temperature to maintain thermal comfort. The usual office contains lightly clothed, sedentary individuals working in spaces with low air movement. ASHRAE has developed Comfort Standard #55-74, indicating the range of temperature and relative humidity possible for adequate thermal comfort given otherwise usual office conditions and activity. (See Figure 1.) ASHRAE recommends that ambient air temperature and relative humidity remain within the comfort zone indicated in Figure 1. It should be noted that the indicated comfort zone should be adjusted given changes from usual office conditions and activity.

VI. RESULTS AND DISCUSSION

A. Environmental:

In February, the indoor relative humidity (RH) was about 32%; outdoor RH was 55%. In June, the indoor RH was about 58%; outdoor RH was 97%. The relative humidity in the building is apparently not maintained at 40% as the specifications indicate. In February, the indoor temperature ranged from 68 to 75°F. In June, the temperature was 71 to 73°F. On both dates, the nearest thermostatic controls indicated temperatures of 72 to 73°F. During the February and June visits, as well as during the initial walk-through tour, NIOSH inspected several thermostats. Many of the thermostats were not operative. In fact, several were placed in temporary walls with no apparent connection to the heating system.

Many of the small offices, especially those on the east and south sides of the building may be affected by radiant heat. Large plate glass windows extend from the ceiling to about 4 feet above the floor. The streets of Manhattan Island are usually thought of as being layed out in a grid pattern, running perfectly north and south. In reality, the island and the grid pattern are tilted about 35°s east of true north, so that all of the building's windows receive some sunlight during the day. The offices on the east and south of the building receive the greatest radiant load, and on sunny days, the occupants of these offices usually have the blinds drawn to limit the radiant heat load.

Air flow was evaluated at several locations on each floor. The mixture of fresh and recirculated air enters each floor at a constant velocity through the linear slots in the ceilings at the periphery of the building. Most of the slots are located in private offices. Many of these offices are quite small (10 feet by 12 feet) and occupants complained about temperature excess and drafts. Air exits from the slots at about 250 to 300 linear feet per minute (LFM). At desk top level underneath the slots, air velocity may be 50 to 60 LFM maximum, although 20 LFM or less is a more typical air velocity. In about 10% of the offices, the occupants have covered the slots with tape in an effort to control the drafts. While this does control drafts in individual offices, it also prevents air from being ventilated into these offices and acts to upset the balance of the floor's entire ventilation system.

In the central office areas, the ventilation grills (1 to 2 square feet in area) supply un-tempered air at a variable volume, depending upon the temperatures outdoors and in the office space. Furthermore, some of the ventilation grills have been blocked during changes in the lay-out of the floors. In these office areas, air movement could not be detected at desk-top level during the NIOSH visits. The limit of detection of the instrument used is 10 to 15 LFM.

As mentioned in the Background section, the building is nominally capable of supplying 290 cubic feet per minute (CFM) of total air per occupant. This level of ventilation would still supply 29 CFM of fresh air per occupant even when the proportion of fresh air supplied is 10%. The ASHRAE recommended level of fresh air supplied to office spaces in 25 CFM per occupant(2).

Thus, the building is nominally capable of supplying adequate air. However, these numbers are based on the building as a whole. Ventilation to each office area is affected by the balance of the air ventilation system in distributing the air supplied. The above observations by NIOSH indicate that the air ventilation system is not adequately balanced.

Direct reading detector tubes were used to determine carbon monoxide concentrations in several of the offices during the NIOSH visits. Concentrations of carbon monoxide in the air ranged from approximately 3 to 5 parts per million parts of air, which is normal for an office environment where smoking takes place.

During environmental monitoring on September 1, 1981, no formaldehyde could be detected. Limit of detection of the instrument used is 0.5 ppm. No organic vapors could be detected. Limit of detection of the instrument used is about 2% of the lower explosive limit for the total combined organic solvent vapor.

B. Medical

Two-hundred eighty-five of 345 questionnaires (82.6%) were returned to NIOSH for analysis. The response rates for the floors ranged from 72 to 98%. The respondents included 100 males and 176 females (9 did not indicate their sex). Respondents' ages ranged from 21 to 60, with most employees being in their 20's or 30's. The average length of time working in the building was 2 years and 4 months. The response rate was good, and the respondents appear to be representative of the employees on the floors.

The five floors included in the survey were selected by the Staff Council as being representative of the office conditions on the floors. Information provided by the UNDP administration indicates that the average occupancy for the UNDP floors is 74 persons. Floors 17, 18, and 19 house an average of 78 persons. However, floors 17 and 18 have the two highest occupancies of the UNDP floors, while floor 19 houses relatively few employees. Inspection of several floors indicates fairly constant environmental conditions, and environmental monitoring did not reveal any significant differences between the floors. It can be assumed that the employees included in the survey are reasonably representative of the UN and UNDP employees in the building.

Respondents were asked to indicate how often during the past year they had experienced adverse environmental conditions in the office: "Almost Never", "Sometimes", "Often", and "Almost Daily". For the purposes of analysis, the respondents indicating Often or Almost Daily were combined. Also, depending upon the condition asked about, several respondents did not record an answer. Given the selective nature of the non-response, it was assumed that a non-response on these questions is indicative of not having a complaint about the condition. Therefore, non-responses were combined with "Almost Never" for the analysis. The reported frequency of exposure to various office conditions among the 285 persons on the five floors is indicated in Table 1. The distribution of the frequencies is also displayed graphically in Figure 2.

The greatest number of complaints were about "not enough fresh air", "low humidity", "very hot", and "very cold". Seventy-one percent of the respondents indicated that they experienced not enough fresh air often or almost daily. Fifty percent indicated that the humidity was low often or almost daily. Only 21 percent of the respondents reported that they did not feel it was very hot or very cold at least sometimes. Clearly, temperature extremes, low humidity, and insufficient fresh air are felt to be frequent problems by a substantial number of the employees.

Thirty-one percent of the employees reported excessive noise at least often and 20% reported odors at least often. Insufficient light affects a smaller number of employees. One-hundred fifteen respondents identified one or more odors as being present in the offices. The following odors were reported: food or kitchen (40 persons), cigarette smoke (28), stale air (18), and paint (17). Other odors were identified by less than 15 persons each. The source of the food odors is apparently the various eating facilities in the building.

Respondents were asked to indicate when the reported office conditions were worse. Answers could include "morning", "afternoon", "sunny day", "cloudy day", "early in week", "late in week", "winter", and "summer". The constrasting choices were compared and are reported when one clearly exceeded the other (e.g. morning versus afternoon). The times when the reported office conditions are worse for a substantial number of respondents are:

Very Hot - afternoon, sunny days
Very Cold -morning, cloudy day, winter
Low Humidity - afternoon, winter
Not Enough Light - (no pattern)
Excessive Noise - (no pattern)
Not Enough Fresh Air - afternoon
Odors - (no pattern)

There were no significant differences in the distribution of the reported frequencies of exposures to the office conditions when stratified by sex, age, or job title. Men were slightly less likely to use the response "almost daily". Executives had slightly less overall complaints (though they noted being very cold somewhat more frequently than others). These differences were not statistically significant. It appears that personal factors do not substantially affect one's perception of the office environment.

Overall, there were no significant differences in the distributions of reported exposures to the office conditions between the five floors. However, there were some consistent trends. Floor 10 generally had the least number of complaints. Some floors seemed to report particular conditions more frequently than others. The distribution of exposure frequencies for the particular condition on these floors was compared to the overall distribution of frequencies for the rest of the floors. Risk ratios were calculated by contrasting "often" or more frequent exposure with "sometimes" or less exposure on these floors compared to the rest of the floors. For floor 18, the risk ratio of reporting the office to be "very hot" at least often is 1.4. (This ratio means that employees on this floor are 1.4 times more likely than employees on the other floors to report the office being very hot at least often.) For floor 17, the risk ratio for "excessive noise"

is 1.7 compared to the rest of the floors. For floor 5, the risk ratio for "odors" is 1.7 compared to the rest of the floors. These risk ratios may indicate that the particular condition is somewhat more of a problem on the specified floor. However, it should be noted again that the overall distribution of reported conditions was fairly consistent and the distribution of exposure frequencies as illustrated in Figure 2 is likely representative of the building as a whole.

Respondents were also asked to estimate how often during the previous year they had experienced certain health symptoms. They could indicate "never or hardly ever", "some of the time", "a large part of the time", or "nearly all of the time". For the purposes of analysis, the latter two categories were combined. Non-responses on these questions were again included in the first category. The distribution of reported health symptoms is shown in Table 2.

"Dry skin" was experienced at least a large part of the time by about 40% of the respondents. "Dry or scratchy throat", "nasal congestion", and "extreme fatigue at work" each were experienced frequently by approximately 20% of the respondents. "Eye irritation", "back pain", "severe headache", and "respiratory infections" each were experienced at least a large part of the time by 11-16%. All other symptoms were experienced frequently by less than 10% of the respondents (dizziness, nausea, blurred vision, persistent cough, trouble breathing, numbness or tingling in part of the body, and skin irritation or rash). There were no significant differences in the reporting of health symptoms when examined by job title or floor.

The spectrum of symptoms experienced by the employees is fairly typical of those reported by employees in other "closed" office buildings that have been investigated by NIOSH. Dry skin and eye, nose, and throat irritation can be due to low humidity and possibly cigarette smoke in the air. Dry skin, without skin irritation or rash, most likely reflects an effect of low humidity, rather than exposure to a skin-irritating chemical. Fatigue at work is commonly reported by employees who are exposed to warm temperatures and "not enough fresh air". The latter is generally reported when the office temperature is warm, the proportion of recirculated air is high, and the perceptible air movement is negligible. Fatigue, without dizziness, nausea or a greater prevalence of frequent headache, is not likely due to a central nervous system depressant, such as organic solvent vapors. Furthermore, environmental monitoring for general levels of organic solvents was negative.

Headaches, respiratory infections (colds), and back pain are commonly experienced symptoms in the general population. It is not exceptional that approximately 10% of the respondents would report each of these symptoms.

Finally, general medical history questions revealed that the respondents were of generally good health. Seventy-five persons smoke cigarettes, while 195 do not. Only 35 persons take medications regularly - mostly taking blood pressure pills(9), thyroid pills(9), or antihistamines(5). Forty persons see medical practitioners regularly; these visits are for hypertension(10), orthopedic complaints(7), heart problems(6), skin problems(5), or allergies(4). Overall, the health status of the respondents is good and does not indicate any systemic pattern of health effects due to working in the building.

VII. CONCLUSIONS AND RECOMMENDATIONS

Analysis of questionnaires returned by 83% of the employees working on floors 5, 10, 17, 18, 19 indicates widespread discontent with environmental conditions, especially temperature extremes, low humidity, and insufficient fresh air. Personal factors are not responsible for these complaints. While there is some variation in the frequency of complaints between floors, there is no systematic variation. The reports of environmental conditions appear to be fairly consistent for the building as a whole.

Reported health effects indicate that employees commonly experience dry skin, fatigue at work, and eye, nose, and throat irritation. These symptoms can be explained largely on the basis of the reported environmental conditions. The overall spectrum of health symptoms is not particularly consistent with exposure to either an irritant vapor or a central nervous system depressant. The general health status of the respondents is good, indicating no significant systemic health effects of an exposure within the building. While there is no evidence indicating significant adverse health effects among the employees, there is a fairly high prevalence of symptoms of discomfort involving the skin and upper respiratory tract. Improving the environmental conditions within the building should help alleviate these symptoms.

Environmental monitoring of several floors of the building and observations of the conditions existing at the times of the visits revealed the following:

1. The reported temperature extremes, the lack of air movement in the central offices, and the blocked slots and ventilation grills attest to the impression that the ventilation system has become substantially unbalanced over time. It is not within the scope of a NIOSH health hazard evaluation to perform a complete audit of the building's ventilation system, but the above-mentioned measurements and observations during the NIOSH visits indicate that the system is presently out of balance. A ventilation engineer should evaluate the entire system to determine what changes must be made to improve it. The building's ventilation system is nominally capable of providing sufficient air to the employees; the distribution of air to the floors and the balance of the air flow within the floors should be further evaluated.

2. The relative humidity inside the building does not appear to be controlled at 40% as specified by the building's management. The variation in the relative humidity should not cause adverse health effects, but it may affect the staff's perception of the building. Relative humidity can range from approximately 20% to 50% and still be fairly comfortable, as long as the temperature is not very warm. While humidity can vary and not particularly affect either comfort or health, the employees should be informed if the humidity is expected to vary or be relatively constant. If the staff believes that it is normal for the relative humidity of the building to be variable, then they can more readily adjust to variable conditions. If they are told that humidity is controlled, but it is not, they will assume that something is wrong with the ventilation system.

3. The employees report frequent temperature extremes. NIOSH environmental monitoring occurred on only three days and can not evaluate the frequency of these reported environmental conditions. There are 6 heating zones per floor with a master thermostat each. Furthermore, building's management said that there is an additional thermostat for approximately every three offices. The building should be capable of eliminating temperature extremes with this degree of fine control. As mentioned above, several of the thermostat controls did not appear to be functional. The thermostat controls should be evaluated and all non-working controls should be removed. Non-working or "dummy" controls could act to confuse and frustrate employees and add to the belief that something is wrong with the ventilation system.

4. Further changes in office layout and unrecognized local environmental conditions may lead to additional complaints in the future. Effective mechanisms should be developed for increasing the effectiveness of engineering responses to environmental complaints by employees. Such mechanisms could include more regular monitoring and adjustment of temperature, humidity, and air flow on the various floors. Each floor could maintain a written record of environmental conditions by time and location on the floor. These records could be used to identify problem areas on the floor.

5. The Staff Council should be informed about the progress of the improvement of the ventilation system. One of the major complaints voiced by the staff was that they are uninformed about the conditions of the building. For example, one event which disturbed the staff occurred when the swimming pool of the hotel on the upper floors was repainted and paint solvent vapor entered the ventilation system of the building. The staff should have been promptly informed of the source of the solvent odors and informed that, although unpleasant, exposure to the solvent vapors would not have a deleterious effect on their health. Effective communication should be maintained with the Staff Council about the environmental conditions of the building.

IX. AUTHORSHIP AND ACKNOWLEDGEMENT

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IX. REFERENCES

1. NIOSH Current Intelligence Bulletin 34 - Formaldehyde: Evidence of Carcinogenicity, U.S. Department of Health and Human Services, PHS, CDC, NIOSH, April 1981 (No. 81-111)

2. ASHRAE Handbook and Product Directory - 1977 Fundamentals. American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., New York, 1977.

X. DISTRIBUTION OF REPORT

For the purpose of informing the "affected employees" the employer should post this report for at least 30 days in a prominent place(s) near where the employees work.

Copies of this report will be available from NIOSH, Division of Technical Services, Information Resources and Dissemination Section, 4676 Columbia Parkway, Cincinnati, Ohio, 45226, for 90 days. Thereafter, copies will be available from the National Technical Information Service (NTIS), Springfield, Virginia. Information concerning its availability through NTIS can be obtained from the NIOSH publication office at the above Cincinnati address.

Copies of this report have been sent to:

United Nations Development Program administration
UN and UNDP Staff Council
Building's engineer for One United Nations Plaza

TABLE 1

REPORTED FREQUENCY OF EXPOSURE TO OFFICE CONDITIONS AT ONE UNITED NATIONS PLAZA*

OFFICE CONDITION	PERCENT OF RESPONDENTS REPORTING EXPOSURE TO CONDITION		
	(Never or Almost Never)	(Sometimes)	(Often or Almost Daily)
Very Hot	20.7	37.2	42.1
Very Cold	20.7	41.6	37.7
Low Humidity	31.2	18.9	49.9
Not Enough Light	78.9	9.8	11.3
Excessive Noise	47.0	21.8	31.2
Not Enough Fresh Air	21.1	8.1	70.8
Odors	51.2	29.1	19.7

*Responses to a NIOSH questionnaire by 285 employees on floors 5, 10, 17, 18, and 19: "How often does your job expose you to the following conditions?"

TABLE 2

REPORTED FREQUENCY OF HEALTH SYMPTOMS AMONG EMPLOYEES AT ONE UNITED NATIONS PLAZA*

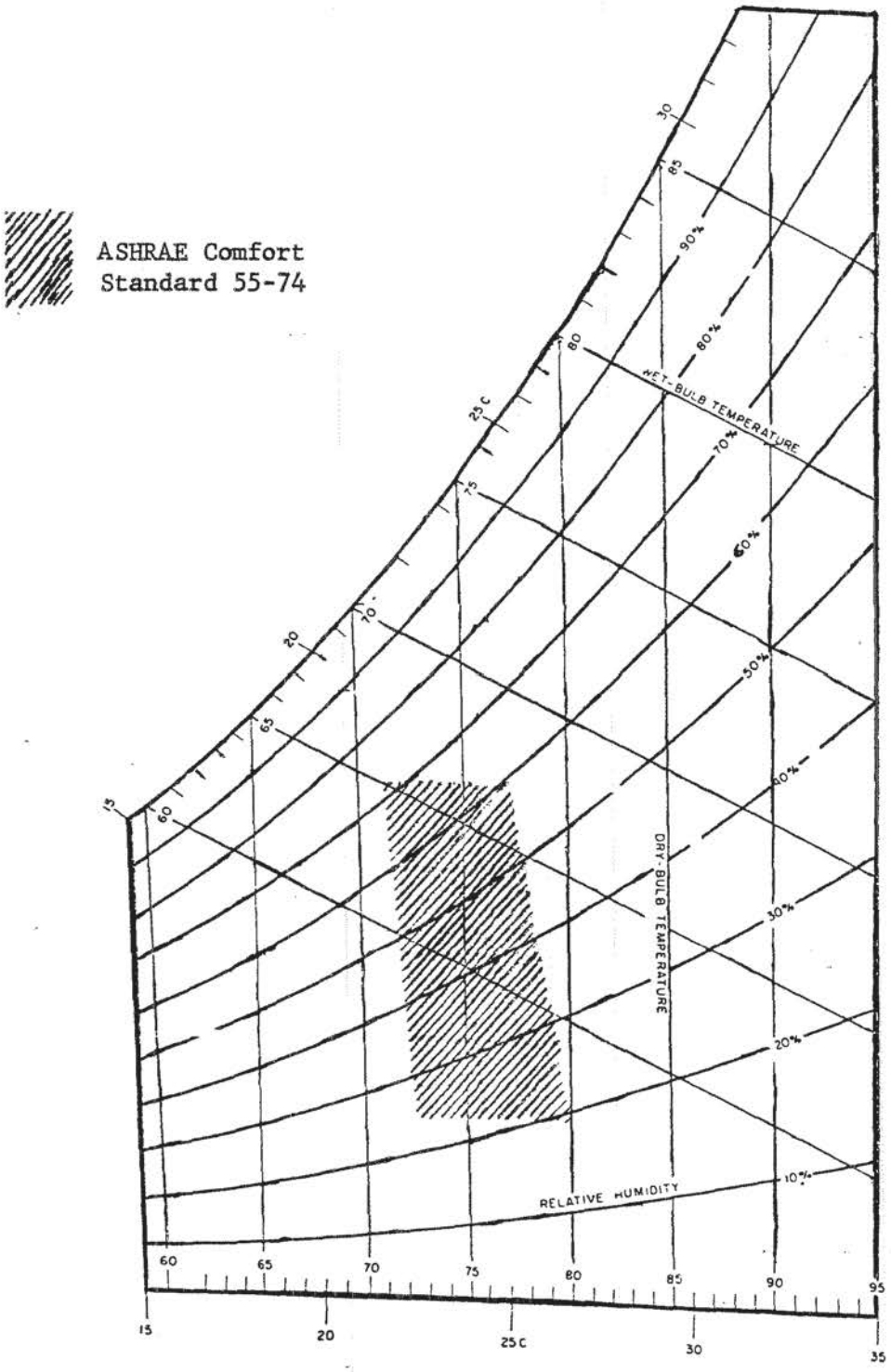
HEALTH SYMPTOM**	PERCENT OF RESPONDENTS REPORTING HAVING THE SYMPTOM		
	(Never or Hardly Ever)	(Some of the Time)	(At Least a Large Part of the Time)
Dry Skin	32.6	27.7	39.6
Dry or Scratchy Throat	31.9	46.7	21.4
Nasal Congestion	41.1	38.2	20.7
Extreme Fatigue at Work	36.8	43.2	20.0
Eye Irritation (tearing)	50.5	33.0	16.5
Back Pain	50.9	35.1	14.0
Severe Headache	46.0	42.5	11.6
Colds or Respiratory Infections	47.0	41.4	11.6

*Responses to a NIOSH questionnaire by 285 employees on floors 5, 10, 17, 18, and 19: "How often have you experienced each of the following symptoms within the past year?"

**Symptoms reported by less than 10% of respondents to occur at least a large part of the time included: dizziness, nausea at work, blurred vision at work, persistent cough, trouble breathing, numbness or tingling in part of the body, and skin irritation or rash.

FIGURE 1

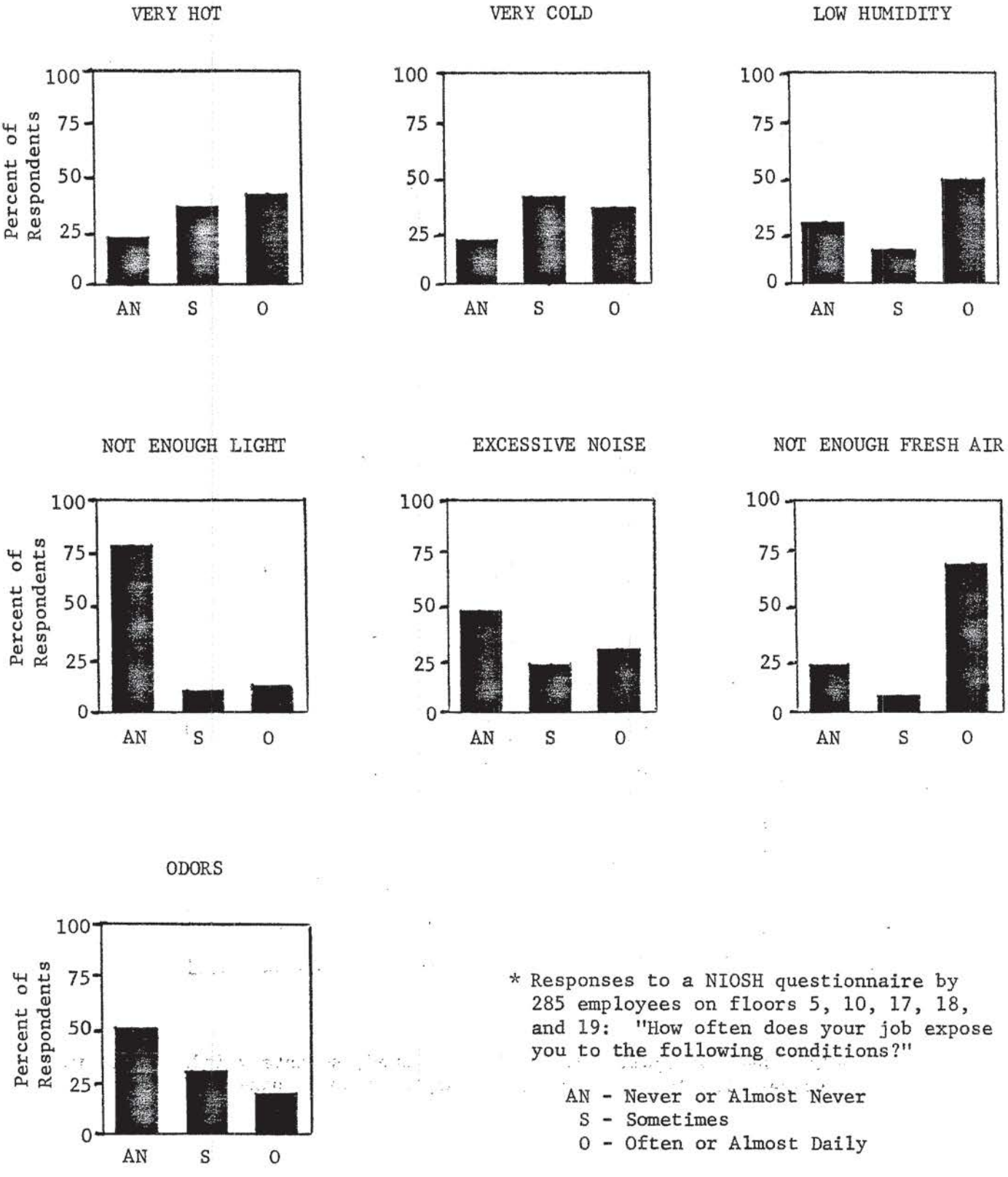
THERMAL COMFORT ZONE BASED ON AIR TEMPERATURE AND HUMIDITY*



* The envelope applies for lightly clothed, sedentary individuals in spaces with low air movement. (Adapted from 2, page 8.21)

FIGURE 2

REPORTED FREQUENCY OF EXPOSURE TO OFFICE CONDITIONS AT ONE UNITED NATIONS PLAZA*



* Responses to a NIOSH questionnaire by 285 employees on floors 5, 10, 17, 18, and 19: "How often does your job expose you to the following conditions?"

AN - Never or Almost Never
S - Sometimes
O - Often or Almost Daily

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