

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
CENTER FOR DISEASE CONTROL
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH
CINCINNATI, OHIO 45202

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HEALTH HAZARD EVALUATION DETERMINATION
REPORT NO. 74-116-202

UNITED AIRLINES CORPORATION
SAN FRANCISCO, CALIFORNIA

JUNE 1975

I. TOXICITY DETERMINATION

It has been determined that the exposure of United Airlines Reservations Office employees to dust, radiation from cathode ray tubes, carbon monoxide, aldehydes, and other potentially toxic substances were not toxic at the concentrations measured during the NIOSH evaluation. This determination is based upon a number of factors: 1) levels of carbon monoxide, aldehydes, and radiation could not be detected by the methods used; 2) dust levels in the reservations office were well below established standards; 3) there was no medical evidence, resulting from extensive physician interviews of 92 employees, to substantiate the presence of a potentially toxic substance or physical agent in the workplace; 4) office temperatures and general ventilation as measured were within limits generally considered to be normal; and 5) the fact that no unusual working condition or environmental condition for an office building was found by the investigators.

Detailed information concerning the medical and environmental results of this determination are contained in the body of the report. General recommendations are included in this determination which are designed to keep working conditions good in the United Airlines Reservations Office.

II. DISTRIBUTION AND AVAILABILITY OF DETERMINATION REPORT

Copies of this Determination Report are available upon request from the Hazard Evaluation Services Branch, NIOSH, U.S. Post Office Building, Room 508, 5th and Walnut Streets, Cincinnati, Ohio 45202. Copies have been sent to:

- a. United Airlines Company Reservations Office, San Francisco, CA
- b. Authorized Representative of Employees
- c. U.S. Department of Labor - Region IX
- d. NIOSH - Region IX

For purposes of informing the approximately 300 "affected employees" the employer shall promptly "post" the Determination Report in a prominent place(s) near where exposed employees work for a period of 30 calendar days.

III. INTRODUCTION

Section 20(a)(6) of the Occupational Safety and Health Act of 1970, 29 U.S.C. 669(a)(6), authorizes the Secretary of Health, Education, and Welfare, following a written request by 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 National Institute for Occupational Safety and Health (NIOSH) received such a request from an authorized representative of employees regarding exposure of employees to dust, fumes, inadequate ventilation, poor sanitation, and radiation exposure at the United Airlines Reservations Office in San Francisco, California.

IV. HEALTH HAZARD EVALUATION

A. Introduction

In 1968, the United Airlines Reservations Office was moved to its present building near the Fisherman's Wharf area of San Francisco, California. The reservations offices are located on the third floor and the administrative and executive offices, as well as the cafeteria, are located on the fourth floor. The reservations offices are divided into two large, open, well-lighted work areas. Approximately 300 employees are assigned to the reservations area and more than 80% of the employees are women.

B. Description of Process - Working Conditions

On December 3, 1974, NIOSH investigator, Melvin T. Okawa, conducted an opening conference with representatives from both the employees and management as an introduction to the hazard evaluation. Following the conference, a walk-through survey of the reservations offices was conducted and non-directed medical questionnaires were administered to 24 employees on a random basis.

The reservations offices are divided into the public reservations (north) and commercial (south) reservations. Each section is 104' X 86.5' and the whole floor is tiled. Employees in each section use the same type of equipment. The reservations offices are almost completely glass enclosed with large picture windows employing tinted glass to diminish glare. The windows may be opened but employees are requested not to do so since the balance in the ventilation system would be disturbed. Toilet and administrative facilities are located in the short corridor connecting the two reservations areas.

In each of the two major reservation areas, a central office, or "tower," is used to monitor and log the total number of phone calls per day, per employee, and the percentage of calls answered within the first 20 seconds after receipt of a call. This latter figure is posted for all employees to see. On an average day, an employee may answer between 100 and 200 phone calls. The making of reservations for so many clients requires intense concentration, attention to details, and many adjustments. Consequently, each receptionist must be prepared at all times to receive phone calls in order to assure a high degree of efficiency.

The seating arrangement throughout the office is regimented. Each employee works at a desk with an attached credenza. The desk is continuous with adjoining desks which parallel each other. Employees are separated from one another by a low partition which does not obstruct view of neighbors. On the desk in front of the employee is a computer keyboard and a television readout screen. Each employee is equipped with a telephone and a small earpiece to monitor phone calls. The total work area per employee probably does not exceed 25 square feet.

The reservations offices maintain working hours from 6:30 a.m. to 1:00 a.m. and are closed for security reasons to all persons from 1:00 a.m. to 6:00 a.m. Several eight-hour shifts are staggered throughout the day with part-time employees filling in with shorter shifts. Set seating arrangements do not exist and employees may sit wherever they wish, although smoking and nonsmoking sections are located in the general public reservations section.

C. Evaluation Criteria

Since no industrial process which might generate a harmful substance is being carried out in the office building, it was difficult to pinpoint any specific environmental problem to investigate. The United Airlines Reservations Office did not appear to be substantially different from any other office. Additionally, no effluent from any nearby industrial process, except for infrequent short-term odors from a restaurant kitchen, which might enter the fresh air intake of the ventilation system was evident. Nevertheless, several factors which might have some bearing on the comfort of the employees were investigated:

1. Carbon Monoxide

The signs and symptoms of acute CO poisoning are well known and easily recognized. These may include headache, nausea, vomiting, dizziness, and drowsiness. The biological effect of CO is its ability to bind with hemoglobin (Hb) to form

carboxy hemoglobin (COHb), thereby rendering the Hb molecules in the blood less able to bind with oxygen. NIOSH recommends that no worker be exposed to a CO concentration greater than 35 parts per million (ppm) based on a time-weighted average exposure for an 8-hour workday.

2. Aldehydes

Aldehydes are irritants to the skin, eyes, and mucosa of the respiratory tract. Although aldehydes would not seem to be a problem in an office building, the presence of odors from the restaurant warranted an investigation. Oxidation of simple raw materials such as natural gas or propane can result in the production of some aldehydes.

3. Oxygen

Although there was no reason to suspect an oxygen deficient atmosphere in the office building, oxygen content was measured.

4. Ventilation - Temperature - Relative Humidity

Comfortable temperatures in an office building vary with the individual. The ASHRAE Guide contains indices for comfort, and generally, a range of 73-75^oF is considered comfortable for most people in an office building. Ventilation measurements were taken in the office building to determine the number of air changes (room volumes) per hour. It is generally recommended that 6-8 air changes per hour are adequate for an office building.

5. Radiation

Although radiation is not a substance but a physical agent, for purposes of completeness, in the investigation radiation being emitted from the computer television screens was measured. The F.D.A. (Bureau of Radiological Health) Standard for radiation from television screens is 0.5 milliroentgens (MR) per hour at a distance of 5 centimeters from the screen.

6. Total Dust

Nuisance dust has a Federal Standard of 15 milligrams of dust per cubic meter of air. Nuisance dust is defined as dust having a history of little adverse effect on the lungs and does not produce significant organic disease or toxic effect when exposures are kept under reasonable control.

D. Medical Criteria

In view of the large employee population, the nature of their activities, and in view of the alleged hazards put forward in the request, it was felt that a self-administered questionnaire given to as many receptionists as possible would be the most practical method of obtaining medical history information within the given study period time. An identical questionnaire would be given to a group of secretaries in NIOSH offices in Cincinnati, Ohio which would act as a control group of employees. The questionnaires would be self-administered and analyzed by NIOSH medical personnel.

E. Evaluation Results

1. Environmental Results and Discussion

- a. Carbon Monoxide - CO levels were measured with a Draeger Multi Gas Detector and CO indicator tubes. A separate tube was used for each area measured. Five measurements were taken in various positions in the public reservations side and four were taken in the commercial side. All the readings were nondetectable for carbon monoxide.
- b. Oxygen - O₂ content in the work area was measured with a J-W Model K Oxygen Indicator. Normal O₂ content in air is approximately 21%. O₂ levels were measured in the same locations that were selected for carbon monoxide. Oxygen levels were normal in all the locations.
- c. Aldehydes - Total Aldehydes were measured with a M.S.A. Universal Testing Kit and Aldehyde indicator tubes. Two general area samples were taken in the public reservations side of the office and two in the commercial section. One sample was collected in the morning and one in the afternoon. There were no odors apparent on the day of the investigation (February 10, 1975) and the samples were nondetectable for total aldehydes.
- d. Temperature - Relative Humidity - Temperature measurements were taken on two separate days (December 3, 1974 and February 10, 1975) with a standard dry bulb thermometer and relative humidity was measured with a Bendix psychrometer on February 10, 1975. Temperatures ranged between 72-76°F on December 3 throughout the Reservations office. On February 10, the temperatures ranged between 72-74° F and the relative humidity was 57% in the morning and 50% in the afternoon.

- e. Ventilation - The ventilation and air conditioning system is a forced air (supply) system using a plenum chamber above the false ceiling. Fresh air is supplied through small pores in the ceiling tile and air is removed from a series of six exhaust grills located in the ceiling in each side of the Reservations office. In January of 1974, the filters were changed from a 35% efficient type to Cambridge 3 piece "85" filters which are said to be capable of removing 85% of dust, pollens, molds, and spores.

Between 52-72°F outside air temperatures, the ventilation cycle contains 100% fresh air. At the temperature extremes of 42°F and 82°F outside air temperatures, the ventilation cycle contains 20% fresh air and 80% recirculated air. Air is heated or cooled according to specifications, to maintain office temperatures at 72-70°F.

Ventilation measurements were taken with an Alnor Velometer. At the Reservations or North side of the office, the six exhaust grills removed air at a rate of 17,994 CFM. At the South or commercial side of the office, air was exhausted at a rate of 28,000 CFM and the operations office was being exhausted at a rate of 1600 CFM. The total air exhausted on the third floor was 47,794 CFM. The total room volume for the third floor is 185,792 ft.³. Therefore, the air exchange is once every 3.88 minutes or about 15 air changes per hour.

- f. Total Dust - Dust samples were collected with M.S.A. Personal Sampling pumps and Millipore membrane filters with a pore size of 0.8 micrometers. Two samples were collected in the public reservations side of the office at the breathing zone level. These samples ran for 3 hours and 45 minutes each. The filters were weighed before and after sampling to determine the weight of dust. The dust concentrations in the reservations side were 0.52 and 0.15 mg/M³ (milligrams of dust per cubic meter of air). One sample was collected in the commercial side of the office. The sample ran for 3 hours and 43 minutes and the dust concentration was 0.4 mg/M³.
- g. Radiation - On March 7, 1975, the United Airlines Reservations Office was visited by NIOSH investigator, Melvin T. Okawa, and Bureau of Radiological Health Certified Health Physicist, Dale Stevenson. Mr. Stevenson used a Victoreen 666 Ionization Chamber; one IBM, Incoterm and Univac computer readout television screen was tested for radiation leakage. All the readings were no different from the measured background level of .01-.02 milliroentgens per hour.

On December 3, 1974, measurements were taken for carbon monoxide, oxygen levels and room temperature. The CO levels were zero and O₂ content of the air was normal. Temperatures ranged between 72-76 F. Additionally, on February 10, 1975 temperature and relative humidity measurements were taken and the results were not abnormal. On February 10, 1975, total dust and aldehyde levels were measured. The aldehyde level was zero and the total dust concentrations ranged from 0.4-1.15 mg/M³. The dust levels were well below the Federal Standard of 15mg/M³ and there is no reason to believe that there is any toxic component in the dust. Ventilation measurements were taken on December 12, 1974. The calculated air changes per hour of 15 is well above the recommended minimum of 6-8 air changes per hour for an office. Radiation leakage from the television screens was tested on March 7, 1975. No leakage was detected.

In conclusion, the substances, physical agents, and other environmental factors investigated during the survey were found to be not significant in producing any of the effects reported by the employees at the reservations office.

2. Medical Results and Discussion

There are approximately 300 individuals employed in the reservations office. At any given time, there are a number of employees on vacation or on sick leave. Consequently, during the study period, approximately 150 receptionists were on duty. The age range of employees is wide-spanning, the second through the fifth decades. Over 80% of the receptionists are female.

The study control group in the NIOSH offices in Cincinnati consisted of 16 secretaries. While the type of work and surroundings are not strictly comparable, these women will serve as controls. Their average age is 28.5 years (range: 18-64 years) and average length of service at NIOSH is 3 years (range: 1-8 years). There were 15 Caucasians and 1 Black female. Six employees were smokers and 10 were nonsmokers.

A total of 92 receptionists participated in the study and returned a completed questionnaire. This number represents approximately 60% of the entire work force present during the three day NIOSH visit (February 10-12, 1975). The following table summarizes the epidemiologic data of the cohort who completed the questionnaires:

No. (% Total)	Average Age (Range)	Average Length of Service (Range)
Male 17 (18%)	35yrs. (26-52 yrs.)	10 yrs. (2-21 yrs.)
Female 75 (82%)	35yrs. (24-55 yrs.)	10 yrs. (2-29 yrs.)
Total 92 (100%)		

There were a total of 87 white men and women; 4 black men and women and one woman of oriental ancestry. There were 38 smokers and 54 individuals who were not presently tobacco users. (This figure includes nonsmokers as well as former smokers.)

The questionnaire that was employed utilized a non-directed approach. In addition to a group of questions dealing with health complaints and problems possibly related to work, it included an occupational history form, a brief review of medical systems, and a smoking history form. In addition, there was a form that dealt with specific complaints that the worker felt might be related to their work or work environment. As was anticipated, a substantial number of symptoms and complaints were elicited.

The results of the questionnaires given to the United Airlines group and the control (NIOSH) group have been tabulated and are found on Table I. The results were analyzed by the X method to determine the statistical significance of the data.

The most frequent complaints among both the UAL and the control groups were referable to the eyes, nose and throat. These complaints and symptoms included: dry or sore throat, burning or itchy eyes, eye strain, decrease visual acuity, tearing of the eyes, stuffy nose and runny nose. These complaints and symptoms are grouped under the heading "ENT" (eyes, nose, throat). The most frequent causes for these symptoms and complaints given by the employees were poor air and/or ventilation, small print, reading the computer screen, poor lighting, glare, excessive heat, and air conditioning.

Other frequent complaints and symptoms were headache, eye strain, sinus condition, poor air and/or poor ventilation, tension and/or pressure created by the job, surroundings, etc. and fatigue. Headache was frequently related to stuffy air, poor lighting, glare, eye strain, tension, noise, sinus condition, and reading computer screen. Sinus conditions were frequently related to bad air, cigarette smoke and allergy. The "poor air" and/or "poor ventilation" was frequently blamed as the cause of excessive dust and smoke which aggravated pre-existing hayfever and asthma. Earaches, decreased hearing in one or both ears, and occasional ear infections were noted somewhat less frequently but were related to

bad air, cigarette smoke and allergy. The "poor air" and/or "poor ventilation" was frequently blamed as the cause of excessive dust and smoke which aggravated pre-existing hayfever and asthma. Ear-aches, decreased hearing in one or both ears, and occasional ear infections were noted somewhat less frequently but were related to the earplug-type headphone used by each employee. Occasional shortness of breath, soreness, or chest heaviness, and occasional cough were noted. These complaints were noted more frequently among the smokers than the non-smokers (13 vs. 7 times). Other complaints made by the UAL employees included: frequent colds, excessive noise, presence of cable mites and poor housekeeping. On the day of the NIOSH visit, no evidence of arthropods or bites could be found.

Statistical analysis revealed that with regard to type and frequency of each complaints, there was no statistical difference between the control and the UAL group. The only statistically significant difference between the two groups was that proportionally there were fewer persons without any complaints in the UAL group than in the control group. Stated another way, there were overall more complaints from the UAL group than from the control group, a finding that was not all together unexpected.

The following medical conditions were reported by the UAL group:

- Allergy - Milk products - 1
- Penicillin - 1
- Sulfa drugs - 1
- Dust, pollins, grass, animal dander, etc. - 6

- Seasonal pollinosis - 5
- Eczema - 2
- Asthma - 9
- Thyroid disease - 5
- Gastrointestinal complaints - 7
- (nervous stomach, mucous colitis, etc.)

- Urinary tract problem - 2
- Hypertension - 3
- Obesity - 1
- Occasional bronchitis - 2

The above medical conditions are all very common and do not appear to be excessive in number or kind, given the makeup of the UAL group. Two individuals with seasonal pollinosis (hayfever) noted their hayfever was aggravated by cigarette smoke.

V. DISCUSSION

The United Airlines Reservations Office is, in a variety of ways, typical of many large modern offices requiring large numbers of individuals who do similar work, i.e., secretaries, typists, receptionists, auditors, and telephone operators to mention only a few. In each instance the work is very demanding, repetitive and attention to detail, productivity, and efficiency is of paramount importance. It is therefore, understandable that employees of this nature should be under a greater than average stress and pressure since it is an integral part of the job. Such psychological stress and pressure could account for many of the complaints and symptoms noted in the United Airlines receptionists. Physically the Reservations Offices are clean, well-lighted and not particularly noisy. On the days of the NIOSH visit, the working conditions were judged average by the employees. The average temperature was between 70 and 76 degrees with a relative humidity of 50-57% in both of the two major reservations areas. Temperature fluctuations or drafts were not noted. No noxious odors; excessive dust, rodents, arthropods or other vermin were detectable, and the air conditioning system was in normal operation. The only objectionable odor was cigarette smoke. General ventilation and housekeeping were adequate. Although it would seem that dust could become airborne from the openings on the sides of the consoles via the cooling fans, this condition is not so. The cathoderay tube places a static charge on the dust which is then attracted to the tube. The net result is that the back of the console traps and holds dust that is in the vicinity.

At this point a comment about dust and mites is in order. Nuisance dusts have little or no effect on the lungs and do not produce significant disease or toxicity when exposures are kept under reasonable control. These dusts are biologically inert in that when inhaled the architecture of the alveoli remains intact; little or no scar is formed, and any reaction provoked is potentially reversible.

Scientifically, there are no such things as a "cable mite," although there are a wide variety of mites which infest various birds, domestic and wild animals, rodents, grains, bulbs, sheeses, straw, dust, etc. When deprived of their usual food such mites may incidentally parasitize man. Chiggers are Trombiculid mites and are perhaps the best example of this order which attack man. Scabies is another mite dermatitis although now quite uncommon in the United States.

Since the demonstration of Pyroglyphid mites in house dust in 1969, much evidence has accumulated that house dust allergy is due to the presence of these mites in the dust. The most common, but not exclusive, mite found in house dust is Dermatophagoides pteronyssinus. Allergy to house dust is a clinical diagnosis in patients with asthma which is exacerbated by exposure to house dust. Much evidence suggests that D. pteronyssinus is the allergen responsible for house dust allergy. Much testing has shown how potent and specific this allergen is. However, the role of other mites found in house dust in the etiology of asthma is not clear.

The highest density of mites in dust is found in mattress dust with lesser densities found in carpets, clothing, and furniture. Generally, more dust is found on floors, corners of rooms and other hard-to-get-at places than on desks and table tops. Thus, it is possible that a dust-sensitive person could have their allergic symptoms exacerbated by dust found in the UAL Reservations Offices.

VI. CONCLUSION

A medical and industrial hygiene survey was conducted at the United Airline Reservations Office by representatives of NIOSH. The results of this survey revealed numerous complaints and symptoms which could not be related to the employee's job or to any substance or physical agents, or equipment found in the workplace. No evidence could be found to substantiate the health hazards alleged in the health hazard request.

The results of the medical questionnaire given to the United Airlines employees and a control group revealed that there were no significant differences between the two groups when frequency and types of complaints and symptoms were compared. Only "Ear, Nose, and Throat Symptoms" and "Headache" categories approached statistically significant levels but cannot be regarded as significant at the 95% level of confidence. However, overall, there was a very statistically significantly greater number of complaints and symptoms in the United Airlines group than in the control group.

At the present time, there is every reason to believe that the working conditions at the United Airlines Reservations Office are safe. Employees with pre-existing or co-existing medical conditions mentioned above can feel assured that working conditions are such that their health will not be impaired or is endangered by the work environment. Additionally, it is the opinion of the NIOSH medical personnel involved in this investigation that at the present time dust-sensitive individuals can work safely in the UAL Reservations Office.

VII. RECOMMENDATIONS

1. Since several persons have noted mice and other vermin in the work area and several employees may have sustained arthropod bites, vermin and arthropod examinations should be carried out by a professional exterminator. Efforts should be made to get at such areas that are hard to reach as under desks and credenzas. This extermination should be done after the close of business.
2. The entire reservations area should receive a thorough vacuum cleaning.

3. The ventilation system should be maintained and serviced regularly.
4. In view of the large number of complaints relative to cigarette smoke, it is suggested that smokers and non-smokers be separated further from one another.
5. A hearing conservation program should be implemented to ascertain whether reservations employees are experiencing any unusually large decrement in auditory accuity which might be related to their job.
6. An illumination study should be conducted to determine if lighting is adequate.

VIII. REFERENCES

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TABLE I

FREQUENCY OF COMPLAINTS AND SYMPTOMS REPORTED BY
UNITED AIRLINES RESERVATIONS RECEPTIONISTS AND CONTROL GROUP RECEPTIONS

	<u>UAL</u>	<u>(%)</u>	<u>CONTROL</u>	<u>(%)</u>	<u>PROBABILITY</u>	
Ear, Nose & Throat Symptoms	58	63%	6	38%	.0981	NS
Headache	29	32	1	6	.0787	NS
Eyestrain, glare, etc.	28	30	3	19	.2880	NS
Sinus Condition	19	21	1	6	.2859	NS
Poor Air/Ventilation	15	16	0	0	.1814	NS
Tension/Pressure	12	13	2	13	.7481	NS
Fatigue	10	11	0	0	.3523	NS
Ear Ache, Decreased Hearing, etc.	13	14	0	0	.2416	NS
Occasional Chest Total Number	20	22	1	6	.7270	NS
Smokers	13		-			
Nonsmokers	7		-			
No Complaints	11	12	7	44	.0059	(Very Significant)
Smokers	38	41	6	38		
Nonsmokers	54	59	10	63		
Sample Size	92		16			