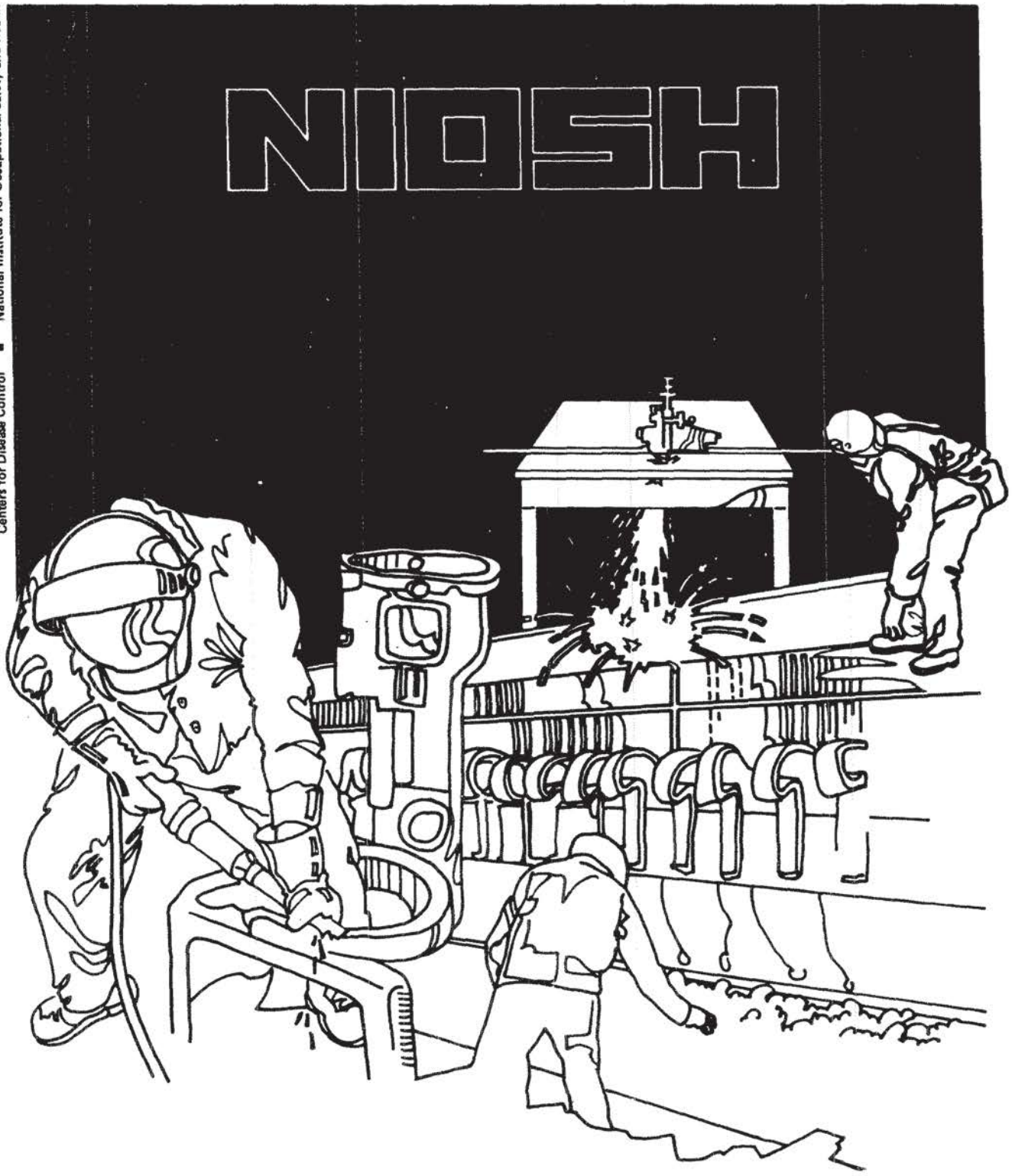
U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES ■ Public Health Service
Centers for Disease Control ■ National Institute for Occupational Safety and Health

NIOSH



Health Hazard Evaluation Report

HETA 82-373-1363
TRANSAMERICA OCCIDENTIAL
LIFE INSURANCE COMPANY
ATLANTA, GEORGIA

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 82-373-1363
SEPTEMBER 1983
TRANSAMERICA OCCIDENTIAL LIFE
INSURANCE COMPANY
ATLANTA, GEORGIA

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I. SUMMARY

On August 26, 1982, the National Institute for Occupational Safety and Health (NIOSH) received a request from Transamerica Occidential Life Insurance Company (TOLIC) to investigate health complaints among their office workers at 2220 Parklake Drive N.E., Atlanta, Georgia. The regional NIOSH industrial hygienist made two site visits in September of 1982, and a NIOSH team from the Division of Respiratory Disease Studies (DRDS) visited the Atlanta office building on October 14 and 15.

A walk-through inspection of the building was performed and a health questionnaire was administered. Air samples were taken for analysis of respirable particulate and contaminant compounds. Air flow measurements were made in various components of the heating, ventilation, and air-conditioning (HVAC) system. The building's structural steel fire proofing material was also analyzed.

On the basis of our investigation, we found that an irritating odor emanates intermittently from the air supply ducts. The source of the odor was not determined. There was no evidence of irreversible health effects associated with the odor. Airborne industrial hygiene measurements were within normal limits except for the elevated concentrations of total hydrocarbons, which may reflect lack of fresh air ventilation. The fresh air intake into the HVAC system was less than that recommended by the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) standards. In addition, it was also determined that the insulation fire proofing material applied to the structural steel of the building contains 25 to 50% chrysotile asbestos. Air samples failed to detect airborne asbestos.

Recommendations relevant to these findings are contained in the body of this report.

II. BACKGROUND

The Transamerica Occidental Life Insurance Company (TOLIC) has a branch on the third floor of the south wing of the 2220 Parklake Drive Building, N.E., Atlanta, GA complex. The company has 4,231 square feet of net usable space, composed of one large room in which most employees work, a manager's office, a computer room and a lunch room that opens onto the main office space.

The five-story 2220 Parklake Drive Building was constructed in 1970. A penthouse containing HVAC and other mechanical equipment covers a small, centrally located area on the roof of the building. Heating and air-conditioning for each floor is provided by a centrally located air handling unit (AHU). The five AHUs comprising the building HVAC system are provided with fresh air through a shaft originating on the west side of the penthouse. Fresh air enters this shaft by the negative pressure created by two fan units near louvered intakes on the west wall of the penthouse. This fresh air intake is located about 20 to 25 feet from the main west wall of the building. Air from building restrooms and surrounding areas is exhausted through a common shaft leading to a fan located on the roof of the penthouse. Each floor's AHU consists of a filter bank, a fan, and chiller and heat decks. Fresh air enters the plenum in which each AHU is housed via a small port on the north wall. Fresh air mixes with return air in the plenum, and the mixed air is then filtered and heated or cooled. Conditioned air then passes through one of eight major supply ducts from which it is passed via a smaller diameter duct system to supply diffusers in the false ceiling. The space between the suspended ceiling and floor above functions as the common return plenum serving each AHU. Air enters this common return plenum through perforated grilles in the false ceiling.

Rooftop and penthouse facilities include a cooling tower and centrifugal chiller that function in net removal of heat from the chiller bank of each AHU. A boiler providing hot water to the heat deck in each AHU is also located in the penthouse.

TOLIC has 30 employees in its Parklake office; many of whom were reported by an employee representative to have a variety of complaints including headaches, sore throat, dizziness, nausea, chest pain, shortness of breath, drowsiness, weakness in limbs, irritability, lightheadedness, fatigue, difficulty swallowing and nasal passage burning. These symptoms occurred at work usually following the detection of odors emanating from the air supply diffusers. These odors were described as having a humid, musty or mildew quality.

Indoor air quality has been implicated in numerous buildings as being associated with health complaints. Of 115 building investigations undertaken by NIOSH between 1978 and mid-1981, the most common cause for employee complaints has been the inadequacy of ventilation, temperature, and humidity control. The symptoms associated with these conditions

have been mucous membrane irritation, headache, and fatigue. Seventy-one percent of these buildings were tightly constructed and had a HVAC system through which most of the building air was recirculated and filtered. In some of the investigations, the cause of complaints was thought to originate outside of the building by entry of gasoline, diesel or boiler exhaust fumes and gases into fresh air intakes. In other buildings, the cause was felt to come from off-gasing of building materials such as carpet glue, paint, solvents and window caulking. Occasionally, serious respiratory conditions are associated with indoor air environment. Hypersensitivity pneumonitis (cough, chills, fever, and chronic interstitial fibrosis caused by immune reactions to bacteria, molds and protozoa) and pneumonias (i.e., Legionnaire's disease) are examples.[1]

The investigation of the health complaints from the 2220 Parklake Drive, N.E. Building in Atlanta, Georgia required an approach that considered all these causes medically and environmentally. The NIOSH regional industrial hygienist visited the building twice in September to review the problem. A team from the Division of Respiratory Disease Studies of NIOSH met with representatives of TOLIC and representatives of building management, Carter and Associates, on October 14, 1982 and then conducted a two day investigation of employees and the building.

III. MATERIALS AND METHODS

A. Medical

On October 14 and 15, two NIOSH physicians administered a questionnaire (See Appendix I) to 27 employees of Transamerica Occidental Life Insurance Company. Sick leave data, made available by management, was examined. A random survey of the rest of building was made for the presence of health complaints.

B. Industrial Hygiene

During this investigation, the cooling tower, penthouse facilities, all AHUs, elevator shafts and selected air supply ducts were examined. On the third and fifth floors, air samples were collected on charcoal and silica gel sorbents and analyzed by gas chromatography and mass spectroscopy for contaminant compounds. In addition, airborne particulate matter was sampled with open-faced filter cassettes (Type AA filters, with a nominal pore size of 0.8 mm and a flow rate of 2 liters per minute). Samples were taken of the spray-applied thermal insulation from structural components of return air and AHU plenums. Slime like residue was also collected from the chiller bank zone of several AHUs. Measurements were made of air flow rates across the fresh air intake and across the filter bank of several AHUs with a velometer and a rotating vane anemometer. Tracer tests using 60 second smoke candles were carried out on the penthouse roof to determine if

cooling tower aerosol and exhaust and stack gases are likely to contaminate the building fresh air intake.

IV. EVALUATION CRITERIA

The questionnaire was designed to distinguish between symptoms of irritation (i.e., stuffy nose, sore throat, burning eyes, dizziness and headaches) and symptoms of hypersensitivity pneumonitis and pneumonia (i.e., shortness of breath, wheezing, cough, muscle aches, chills and fever). Industrial hygiene criteria were based on ASHRAE, OSHA, EPA, and NIOSH standards and recommendations. Particular attention was given the quality of indoor air as related to the recommendations in ASHRAE Standard 62-1981.

V. RESULTS DISCUSSION

A. Medical

Examination of TOLIC employee sick leave, secondary to upper respiratory tract infections and viral syndromes, showed an expected seasonal pattern with a zenith in winter and nadir in summer during 1981 and 1982. During the first year of occupancy (1979), no distinct pattern was evident and sick leave amounted to about one half of that taken in each of the two succeeding years. There was no increase in sick leave in the spring and summer of 1982, when the odors have been described as most pronounced.

Of 30 personnel employed at Transamerica Occidental Life, 27 were available for interview by a NIOSH physician. Of those 27, 24 individuals offered symptoms. Most symptom complexes included headaches, dizziness, and nausea. Some individuals also complained of diarrhea, stuffy nose, burning of eyes, and sore throat. No individuals described symptoms of classic hypersensitivity pneumonitis (i.e., shortness of breath, wheezing, cough, chills and fever, and malaise).

Twenty-two individuals associated their symptoms to odors from the supply air ducts. Two of the three individuals without symptoms also reported smelling unusual odors. These odors were variously described as "musty", "acrid", "old tennis shoes" and "burnt wire". Questionnaire responses indicated the odors were worse from vents along the south wall.

Seventy percent of the individuals had onset of their complaints after March of 1982, though several individuals date their complaints back to 1979, when TOLIC first occupied their office space. Allergies were not more common among individuals with symptoms compared to those without symptoms. Five of the 24 symptomatic individuals smoked, whereas none of the three non-symptomatic individuals smoked. The individuals affected were located throughout the office room.

A random survey of employees was made of the rest of the building. A NIOSH investigator spoke with office managers and, with permission, spoke to some of their employees. In the south wing of the building reports of unusual odors, similar to those described in the 3rd floor Transamerica Occidental Life office, were elicited from the 5th, 4th, and 2nd floors. The first floor had a cafeteria but no offices. No complaints were elicited from the cafeteria staff.

The random survey of employees in the north wing of the 2220 Parklake Drive Building showed no complaints of odors or symptoms, with the exception of several individuals on the first floor.

B. Environmental

An unusual odor was detected in the fifth floor hall and bathroom. It was intermittently noted in the lobby and from a supply air diffuser on the third floor. This odor was identified by an employee as the one associated with symptoms.

Fresh air enters all HVAC system AHUs because of negative pressure created by two side by side fan units located adjacent to louvers in the west wall of the penthouse. On the morning of October 15, we observed that one of these fan units was not operational because of an electrical malfunction. According to building occupants this is a common occurrence. The total amount of fresh air entering the mixing plenum serving a representative AHU (fifth floor unit chosen) and the total amount of mixed air (fresh plus return air) entering the filter bank of this unit were measured at this time. We found that while the fifth floor AHU was handling 35,000 CFM of mixed air only about 800 CFM of outside air was entering the mixing plenum. Therefore, only 2.3% (800 CFM fresh air divided by 35,000 CFM total air being handled) of the ventilation air being supplied to occupied space was fresh. Assuming that 800 CFM of fresh air is equally distributed to occupied space on the fifth floor and also that approximately 100 people work on this floor, only about 8 CFM of outside air per person was being supplied to occupied space at this time (800 CFM fresh air divided by 100 people equals 8 CFM per person). Current ASHRAE standards recommend a minimum of 20 CFM fresh air per person in office buildings where smoking is allowed (ASHRAE Standard 62-1981).

Later, on the same day after building maintenance personnel had repaired the malfunctioning fan unit (characteristics of fans were not studied), we again measured air flow parameters for the AHU on the fifth floor. Fresh air influx into the mixing plenum was 3280 CFM and total flow across the filter bank was 35,000 CFM. Thus, with both penthouse fan units operational, the AHU on the fifth floor was providing occupied space with ventilation air containing about 9.4% fresh air or about 33 CFM fresh air per person.

The fresh air intake for the 2220 Parklake Drive Building is located on the west wall of the penthouse. Exhaust stacks for restrooms and the boiler are located on the penthouse roof near its west wall. Additionally, the building cooling tower is located just to the south of the penthouse. Smoke candle tests conducted on the penthouse roof indicated that the cooling tower aerosol, boiler stack gases and air from restroom exhaust can enter the fresh air intake depending upon prevailing wind direction. Prevailing wind direction in Atlanta is usually from the northwest or the southwest. Winds out of the east or southeast are often common in the summer. On October 15, winds on the building roof were predominantly out of the northwest and we observed (by smoke candle tests) that air from the restroom exhaust stack contaminated the fresh air intake on the west side of the penthouse. In the summer, wind out of the southeast would be especially likely to contaminate the same fresh air intake zone with drift aerosol from the cooling tower located just to the south of the penthouse.

A pipe carrying overflow cooling tower water was apparently broken during the past winter and has remained broken since that time. Cooling tower water containing an algaecide (sodium pentachlorophenate-active ingredient) is present on the roof surface southeast of the fresh air intake louvers. A wind from the southeast will carry vapors from the cooling tower water spill into the fresh air uptake zone.

Inspection of AHUs showed that, due to indadequate drainage and stagnation, all condensate trays were contaminated with a microbial slime. Slime was found both on the surface and beneath the plastic liner on the bottom tray of each chiller bank. Microscopic examination of the material revealed the dominant component was bacteria.

All AHUs are housed in a large, mixing plenum receiving ducted fresh air and return air from the common ceiling plenums. Several containers of cleaning agents and chemicals are stored in mixing plenums. Among these are sulfuric acid for drain treatment, ammonia and calcium chloride.

Identified in air samples were trichloroethylene, 1,1,1 trichloroethane, toluene, xylene and dichlorobenzene all at concentrations equal to or less than 0.1 ppm, or 2 to 3 orders of magnitude less than applicable occupational standards. Also identified was a series of seven branched alkanes, mostly in the C_{10} to C_{11} range. These hydrocarbons collectively were present at concentrations equal to or less than 2900 mg per cubic meter. Outdoor air quality standards set by EPA stipulate that nonmethane hydrocarbons shall not exceed 160 mg per cubic meter. The level of nonmethane hydrocarbons within the 2220 Parklake Drive Building

exceeds this air quality standard. Our investigation, however, did not determine if high indoor levels of hydrocarbons were the result of indoor office-related activities or the result of intake of polluted outside air, or both. It should also be emphasized that the EPA standard for hydrocarbons was established to control the production of precursors of smog and this standard does not imply that the C_{10} to C_{11} alkanes found are harmful to health.

Spray-applied thermal insulation coating the exposed structural steel on all floors of the 2220 Parklake Drive Building was identified as containing 25-50% chrysotile asbestos. The material is friable and is located in the return plenums and in the plenum housing air handling units. Dislodgement of this insulation, either naturally or by workmen conducting maintenance activities in the space between the false ceiling and the floors above, may cause asbestos fibers to enter office air. Analysis of airborne particulates collected at the time of the survey did not reveal excessive amounts of fibers. The recommended NIOSH standard of 0.1 fibers (longer than 5 mm) per cubic centimeter of air was not exceeded in the samples we collected.

VI. CONCLUSIONS

A. The employees in the TOLIC office describe an unusual odor that they associate with symptoms. This effect appears acutely symptomatic and completely reversible.

B. The implicated odor is detected, in varying intensities, throughout the building.

C. The chiller banks of AHUs were contaminated with microbial slime.

D. Fresh air intakes are in close proximity to cooling tower and restroom exhaust.

E. Chemicals are inappropriately stored in the AHUs.

F. A cooling tower overflow pipe has gone unrepaired, allowing algaecide-containing water to spill onto the building roof.

G. When one of the two fresh air intake fan units is not operational, there is inadequate fresh air inflow.

H. The precise nature or origin of the odor was not determined, though several possibilities (see above Conclusions C-F) were identified.

I. Though unrelated to the present employee complaints, structural surfaces within return air plenums and AHU plenums are coated with an insulation containing chrysotile asbestos. Airborne measurements did not reveal aerosolized fibers. However, the presence of

asbestos-containing thermal insulation does present a potential hazard; namely that asbestos fibers might become airborne during maintenance operations or as a result of vibration from AHUs.

VII. RECOMMENDATION

The following remedial action is recommended to address the above findings:

(1) Utilize both fresh air intake fan units at all times during working hours to insure that an adequate outside air supply (20 CFM per person) occurs on all building floors.

(2) Remove chemical materials from AHU mixing plenums.

(3) Remove slime and stagnant water from all AHUs and initiate a maintenance program to control slime buildup.

(4) Repair the cooling tower overflow pipe.

(5) If odors persist after carrying out the above recommendations:

(A) Conduct a thorough evaluation and inspection of the supply ducts to affected areas; and

(B) The fresh air intake is now located on the west wall of the penthouse about 20 to 25 feet from the main west wall of the building. Move the fresh air intake so that it is flush with the main building west wall. The fresh air intake will then be separated from penthouse and cooling tower facilities by an additional 20 to 25 feet.

(6) Carter and Associates should contact the EPA Regional Asbestos Coordinator for assistance in determining the appropriate course of action with regard to the presence of chrysotile asbestos within the 2220 Parklake Drive Building. (Asbestos Coordinator, EPA Region IV, 345 Courtland Street, Atlanta, Georgia 30308, 404-881-3864). We further recommend that maintenance personnel be advised of the nature of this insulation material and its potential for causing serious respiratory disease.

VIII. REFERENCES

1. K.Kreiss, Building-Associated Epidemics, Indoor Air Quality, CRC Press, 1983 (in press).

IX. AUTHORSHIP AND ACKNOWLEDGEMENT

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X. DISTRIBUTION AND AVAILABILITY

Copies of this 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), Springfield, Virginia. Information regarding its availability through NTIS can be obtained from NIOSH, Publications Office, at the Cincinnati address.

Copies of this report have been sent to:

1. Transamerica Occidential Life Insurance Co.
2. U.S. Department of Labor/OSHA.
3. NIOSH - Region IV.

For the purpose of informing affected employees, a copy of this report shall be posted in a prominent place accessible to the employees for a period of 30 calendar days.