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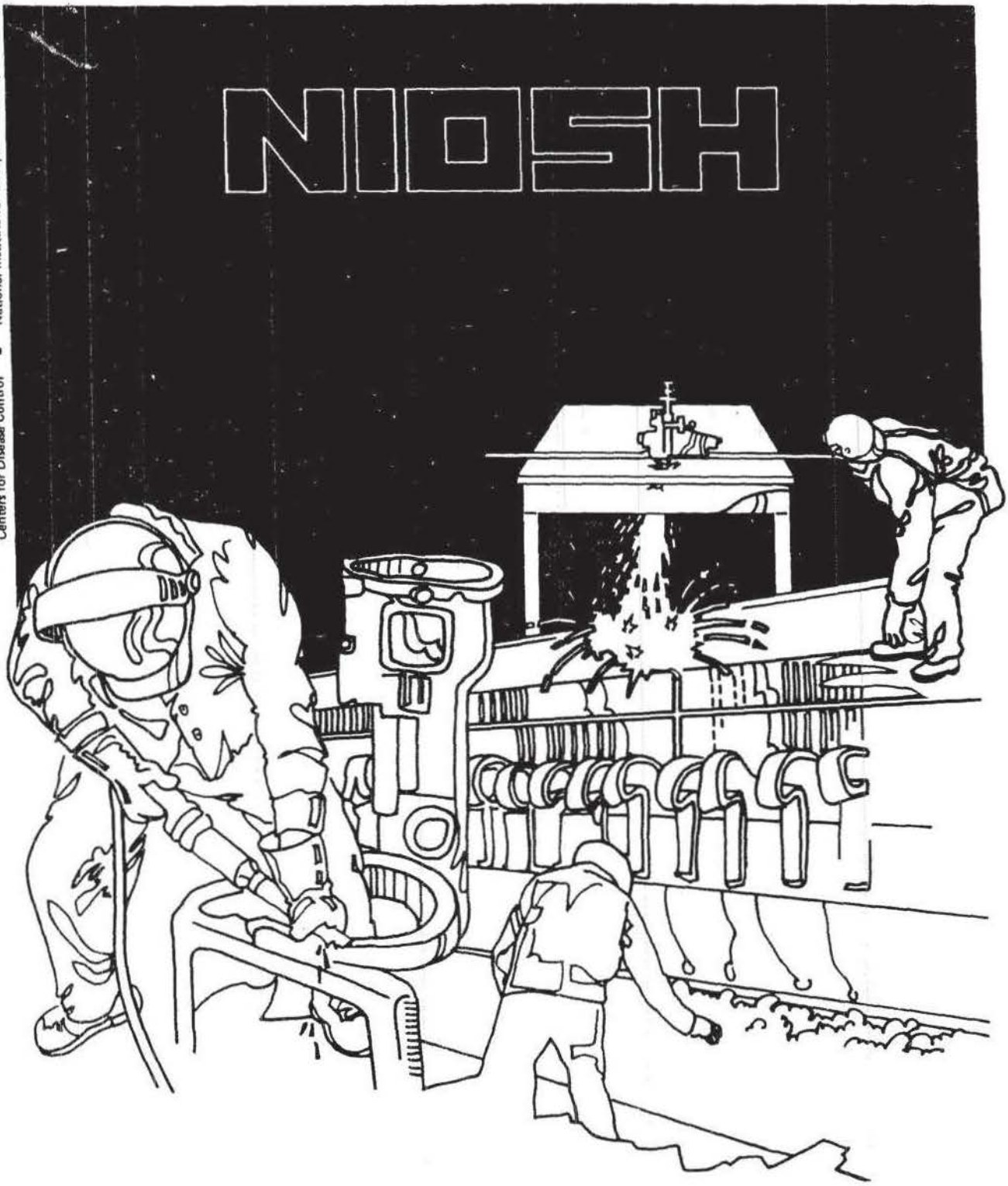

Health Hazard Evaluation Report

HETA 81-469-1096
CINCINNATI INCOME TAX BUREAU
CINCINNATI, OHIO

PREFACE

The Hazard Evaluations and Technical Assistance Branch of NIOSH conducts field investigations of possible health hazards in the workplace. These investigations are conducted under the authority of Section 20(a)(6) of the Occupational Safety and Health Act of 1970, 29 U.S.C. 669(a)(6) which authorizes the Secretary of Health and Human Services, following a written request from any employer or authorized representative of employees, to determine whether any substance normally found in the place of employment has potentially toxic effects in such concentrations as used or found.

The Hazard Evaluations and Technical Assistance Branch also provides, upon request, medical, nursing, and industrial hygiene technical and consultative assistance (TA) to Federal, state, and local agencies; labor; industry and other groups or individuals to control occupational health hazards and to prevent related trauma and disease.

HETA 81-469-1096
April 1982
Cincinnati Income Tax Bureau
Cincinnati, Ohio

NIOSH INVESTIGATOR:
Steven H. Ahrenholz IH

I. SUMMARY

On September 21, 1981, the National Institute for Occupational Safety and Health (NIOSH) received a request from the Tax Commissioner of the Cincinnati Income Tax Bureau to investigate office conditions contributing to poor air circulation and the presence of oppressive odors in the Bureau.

The Cincinnati Income Tax Bureau employs 65 workers and is involved in the collection and processing of Cincinnati city income tax. It is located in a six story, remodeled turn of the century concrete, brick, and steel factory. Conversion to office spaces involved the installation of electric heating and cooling units, walls, insulation, suspended ceilings, and sealing or covering factory windows. Except for for Bureau's small tax form printing operation, the entire second floor bureau is occupied by office space. Occupants immediately below and above the bureau are not engaged in activities requiring extensive use of chemical agents.

Evaluation methods included an inspection of the premises for specific odor sources, evaluation of the ventilation system, and microbial sampling. No single odor source was identified either by inspection or questioning workers expressing complaints. Microbial sampling did not indicate the presence of organisms not normally associated with areas of human habitation.

Examination of the ventilation systems revealed that no provisions have been made for direct return of air to the air handling units from the various offices and areas; fresh air intake on the units may be inadequate; and there is no active means of exchanging air other than that occurring through leakage. Additionally, the units were installed prior to sealing the windows and erecting office walls which considerably changed circulation patterns.

NIOSH did not identify any specific odor source or agent responsible for oppressive odors. While no health hazard was identified, the problem is considered to be one of insufficient air intake, air exchange, and air return to the units from office areas. The recommendation is made to evaluate air supply to the various office areas and to make provisions for adequate air exchange and fresh air intake based on occupancy levels and odor control. The Ohio Basic Building code specifies a fresh air intake of at least 25 percent.

KEYWORDS: SIC 9311 (Public Finance, Taxation, and Monetary Policy), office environment, ventilation.

II. INTRODUCTION

On September 21, 1981, the National Institute for Occupational Safety and Health (NIOSH) received a request for a Health Hazard Evaluation from the Tax Commissioner at the Cincinnati Income Tax Bureau. The request expressed concern about poor ventilation and the presence of oppressive odors.

NIOSH conducted an initial site visit on October 26, 1981 to obtain background information on the problem and conduct a walk-through survey of the office and adjacent building areas. A brief visit to the bureau was conducted on the morning of November 2, 1981 in an effort to evaluate the reported poor air quality associated with Monday mornings. Limited microbial sampling of office air was conducted on November 12, 1981. A summary letter was issued following the first two visits and an Interim Report was issued in January 1982 which presented the results of the microbial sampling.

III. BACKGROUND

The Cincinnati Income Tax Bureau occupies the second floor of a six story brick, concrete, and steel building which originally housed the Methodist Publishing House printing operations. The basic structure dates back to the turn of the century. Remodeling of the second and third floors into office space was undertaken in 1974. The Tax Bureau moved into the 8,000 square foot office space it currently occupies in December of 1974. A total of 61 employees regularly occupy the area.

The building has steam heat with the exception of the second and third floors which are serviced by independent electric heating and cooling units. The Bureau's general ventilation needs are provided by three of these units.

The Bureau is involved with the collection and processing of Cincinnati city income taxes. A small offset printing operation (reproduction office) is located in a separate room along the east side of the second floor. Equipment present in remaining areas was that generally associated with an office setting. Numerous fans were in use by employees located in the various office (14) and work areas (4).

Other occupants of the building included a television commercial studio, cigar sales office, and electrical contractor's warehouse (all located on the first floor); and a contact lens manufacturing and eyeglass assembly laboratory occupy part of the third floor. The remaining three-fourths of the third floor is vacant.

Problems with odor and poor circulation were reported back to the time of initial occupancy. Slight improvement was reported when fibrous glass ceiling tiles were removed to expose sprinkler heads above the suspended ceiling - an action required by the fire inspector.

IV. METHODS AND MATERIALS

A decision was made not to sample for any chemical contaminants since the area of concern (the second floor occupied by the tax bureau) involved almost exclusively office work. The only exception to this being a lithographic printing operation which is used intermittently to produce tax forms. Additionally the complaints of office workers focused on stagnant air and offensive odor.

Other factors considered in ruling out sampling for chemical contaminants included the following: the bureau does not share its ventilation system with any other building occupants; complaints were not limited to any one area of the office or to any unusual work activity; no exhaust ductwork passed through the second floor to another level and no exhaust discharges could be seen near ventilation unit air intakes (located in the walls of the second floor); and the use of chemicals by building occupants immediately above and below the second floor, as well as in the building in general, was limited.

Individuals who were expressing complaints about the odors and stuffy air were interviewed in an effort to obtain information on an odor source.

Passive microbial sampling was conducted to determine if any unusual organisms (those not routinely associated with areas of human habitation) were present in the air which could contribute to the reportedly high absenteeism rate due to illness among workers. Six petri dishes containing standard plate count agar were exposed open-faced in pairs to the air in three different locations of the tax bureau. Plates were placed so that they weren't directly beneath a ventilation system discharge vent. One plate of each pair was exposed for 15 minutes and the other for 45 minutes. Additional sets were exposed in the NIOSH office of the Federal Office Building and a private residence for the purpose of comparison. Following exposure, the dishes were sealed and sent to Metpath Laboratories Inc., a contract laboratory to NIOSH, where viable organisms were subcultured and identified. Three procedures were undertaken on the collected plates: incubation of the environmental cultures for growth of bacteria and fungi; subculture of fungi from the original culture with identification; and subculture of bacterial colonies with identification and a determination of selected antibiotic sensitivity or resistance.

An evaluation of the ventilation system to determine air distribution and quantity of makeup air (fresh air from outdoors) was anticipated. However, in consideration of the prolonged acquisition time for replacement ceiling panels and their subsequent installation(over six months with no proposed completion date), the decision has been made to present as a recommendation the appropriate guidelines for a ventilation system assessment following the restoration of the ceiling to its original configuration. This assessment could be undertaken by the heating and cooling contractor retained by the property management company.

Temperature and humidity levels were measured during both the November 2 and November 12, 1981 visits.

V. RESULTS AND DISCUSSION

Results of the investigation demonstrated that workers interviewed considered the problem to be due to insufficient fresh air intake and circulation. Inspection of the ventilation systems and office area and discussions with the contractor responsible for system installation revealed deficiencies which may contribute to the problems of odor and poor air circulation.

A. Odor Profile

Interviews with five of the employees (those expressing the most concern over the odor) and management resulted in an odor described as a stale, closed up, musty odor with some reference to stale tobacco smoke, emanations from human bodies, lavatory odors, and food odors from the lunch room. The auditing and compliance areas located in the front (or north west end) of the office was generally considered the most problematic and was also an area involving the public. The odor was considered especially noticeable on Monday mornings. An impression frequently reported was that there was no circulation and that no fresh air was being brought in by the ventilation system. None of the occupants on the third floor, which has identical ventilation units, reported any odor problems.

B. Microbial Sampling

The results of the agar plate cultures and their corresponding sample locations are presented in Table I and Figure I. Organisms isolated from the plates were Mycelia-sterila, Penicillium sp., Aspergillus niger, Cladosporium sp., and Staphylococcus epidermidis. These organisms are ubiquitous to the environment and human skin. Although these organisms are capable of causing disease in man, the incidences are rare unless one's resistance is compromised by trauma, surgery, medication, or disease. The microbial samples did not indicate the presence of organisms not normally associated with areas of human habitation.

C. Temperature and Humidity

Temperature and humidity values obtained November 2, 1981 averaged 76° F and 48% relative humidity. On November 12, 1981 the office temperature was 76° F with 28% relative humidity. Research has indicated that odor perception is affected by temperature and humidity, with temperature having only a slight effect on odor level at constant specific humidity. In order to keep odor perception at a minimum, air conditioned spaces should be operated at about 45 to 60% relative humidity.[1]

D. Ventilation System Evaluation

The ventilation in the bureau is provided by three self-contained or single-package Carrier® air-cooled vertical heating and cooling units. Each unit serves about one-third of the total office area. Units 2-1 and 2-2 are 20-ton units and unit 2-3 is a 15-ton unit. (See Figure I for locations). The units have no humidification system and air is filtered for dust by a bank of six filters. The units operate off of a seven day clock and are run 24 hours a day except from 1:00pm on Saturday until 6:30pm Sunday evening. Each of the units takes in air through the 18 square foot air return at the back (wall side) of the units. Additionally each has a 14 inch square duct (1.4 square feet) coming in through the wall and butting up against the air intake screen. A damper control was present on each of these ducts but direct exterior observation as to whether they were open or closed was not possible due to the external inaccessibility of the units' second floor through-the-wall installation.

Each of the units is connected to independent air distribution systems which terminate at ceiling diffusers. Units 2-1 and 2-2 produce a nominal air supply of 8000 cubic feet per minute (cfm) and unit 2-3 produces an air supply of 6000 cfm.

No provisions were made for exhausting air in the office other than for lavatory fans present in each of the three restrooms. Additionally, contact with the original contractor indicated that the units were installed prior to the installation of office walls, the suspended ceilings, additional insulation, and sealing of the windows. At the time of installation the area was a large open factory floor with numerous windows permitting rapid infiltration of outside air and exfiltration of heated or cooled air. Current office practice is to prop the entrance door open to the public stairwell to permit some added circulation.

The units take in return air directly through the back from their immediate location. Plastic grills were installed in the ceiling located about 30 inches above the air return on the unit apparently with the intention of using the space above the suspended ceiling as a return air plenum, but there is no direct connection of the unit to the ceiling for air return. Additionally small plastic grills were installed in the ceiling of the various offices but are not connected to any ductwork. The suspended ceiling height is 8 feet 10.5 inches, creating a 38 inch plenum below the original concrete ceiling. Air return to the units from remote areas is considered inadequate.

The Ohio Basic Building Code[2] requires office ventilation systems to provide a minimum of 5 cfm of outdoor air per office occupant and 40 cfm per water closet or urinal in restrooms. Total minimum fresh air intake introduced into the air return should be 25 percent. Eighty-five percent of the air supply may be recirculated provided the system is equipped with effective absorption or

filtering equipment to maintain a specified minimum air quality including the absence of objectionable odors.[2] Calculations obtained from dimensions of the outside air intake and ventilation unit air returns are presented in Table II. A comparison of these figures to those calculated using the Ohio Building Code requirements appears in Table II.

Direct communication with the City of Cincinnati Building Department indicated that the amount of fresh, outdoor air introduced into a ventilation system would be determined from the governing building codes at the time of installation. However, provisions must also be made for adequate air distribution within the building and this includes both air supply and return systems.

VI. SUMMARY AND RECOMMENDATIONS

While odors in themselves are not the cause of disease, the discomfort and disagreeable nature associated with obnoxious odors including a conglomeration of occupied - space odors may cause temporary ill effects. The effects that fringe upon ill health include lowered appetite, lowered water consumption, impaired respiration (i.e. shallow breathing), nausea, vomiting, and insomnia.[1,4]

Inspection of the Tax Bureau and surrounding areas did not reveal any specific odor sources. Information obtained concerning the ventilation units and their operation indicates that the current conditions of operation are significantly different from those existing at the time of installation. Therefore, the problem appears to be largely due to 1) insufficient intake of fresh outside air and 2) inadequate circulation and air return to the ventilation units.

NIOSH recommends that the units be evaluated for adequate air supply, return, and exchange (intake of outside air) under present operating conditions after replacement of the suspended ceiling is completed (See Table II and reference 2), provisions should then be made for bringing the ventilation system up to code. This would include the installation of an active recirculation or air return system to the units.

VII. REFERENCES

1. American Society of Heating, Refrigerating and Air-Conditioning Engineers. ASHRAE guide and data book fundamentals and equipment for 1965 and 1966. NY, NY: ASHRAE, pp. 161-170, 1965.

2. Ohio Basic Building Code Section M-317.0 Ventilation. Cleveland: Banks Baldwin, 1979.

3. American Society of Heating, Refrigeration and Air-Conditioning Engineers. Ventilation for acceptable indoor air quality. Atlanta, GA: ASHRAE 62-1981, 1981.

4. McCord CP, Witheridge WN. Odors: physiology and control. McGraw-Hill: New York, 1949.

IX. AUTHORSHIP AND ACKNOWLEDGEMENTS

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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, Ohio 45226. After 90 days, the report will be available through the National Technical Information Service (NTIS), 5285 Port Royal, Springfield, Virginia 22161. 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. Cincinnati Income Tax Bureau
2. Authorized Representative of Employees, Local 1543, American Federation of State, County, and Municipal Employees
3. NIOSH, Region V
4. OSHA, Region V

For the purpose of informing 65 affected employees, copies of this report shall be posted by the employer in a prominent place accessible to the employees for a period of 30 calendar days.

TABLE I

Passive Microbial Air Sampling Results

Cincinnati Income Tax Bureau
Cincinnati, Ohio 45202
HETA 81-469

January 1982

Sample Location*	Exposure Duration (minutes)	CULTURE GROWTH	
		Bacterial	Fungal
Center row, north end, filing area; served by ventilation unit 2-1.	15	No growth	Penicillium species
	45	No growth	No growth
Auditing area, north end, along center partition; served by ventilation unit 2-3.	15	No growth	No growth
	45	No growth	No growth
Lunch room, west end, by aisle; served by ventilation unit 2-2.	15	Staphylococcus epidemidis	No growth
	45	No growth	Aspergillus niger
Office area, room 9403 Federal Office Building Cincinnati, Ohio.	15	No growth	No growth
	45	Staphylococcus epidermidis	No growth
Private residence, Cincinnati, Ohio.	15	Staphylococcus epidermidis	Cladosporium species
	45	Staphylococcus epidermidis	Cladosporium species
Unopened Control 1	--	No growth	No growth
Unopened Control 2	--	No growth	Mycelia sterila**

* Samples in each set were obtained side by side. Plates were laid open on flat surfaces about 1.5 meters above the floor and an effort was made to avoid locating them directly under an air supply vent. Suspended ceiling height is 2.7 meters. Set obtained at residence was at level of 0.76 meters.

** Presumptive designation.

TABLE II

Fresh Air Supply Requirements

Cincinnati Income Tax Bureau
Cincinnati, Ohio 45202
HETA 81-469

March 1982

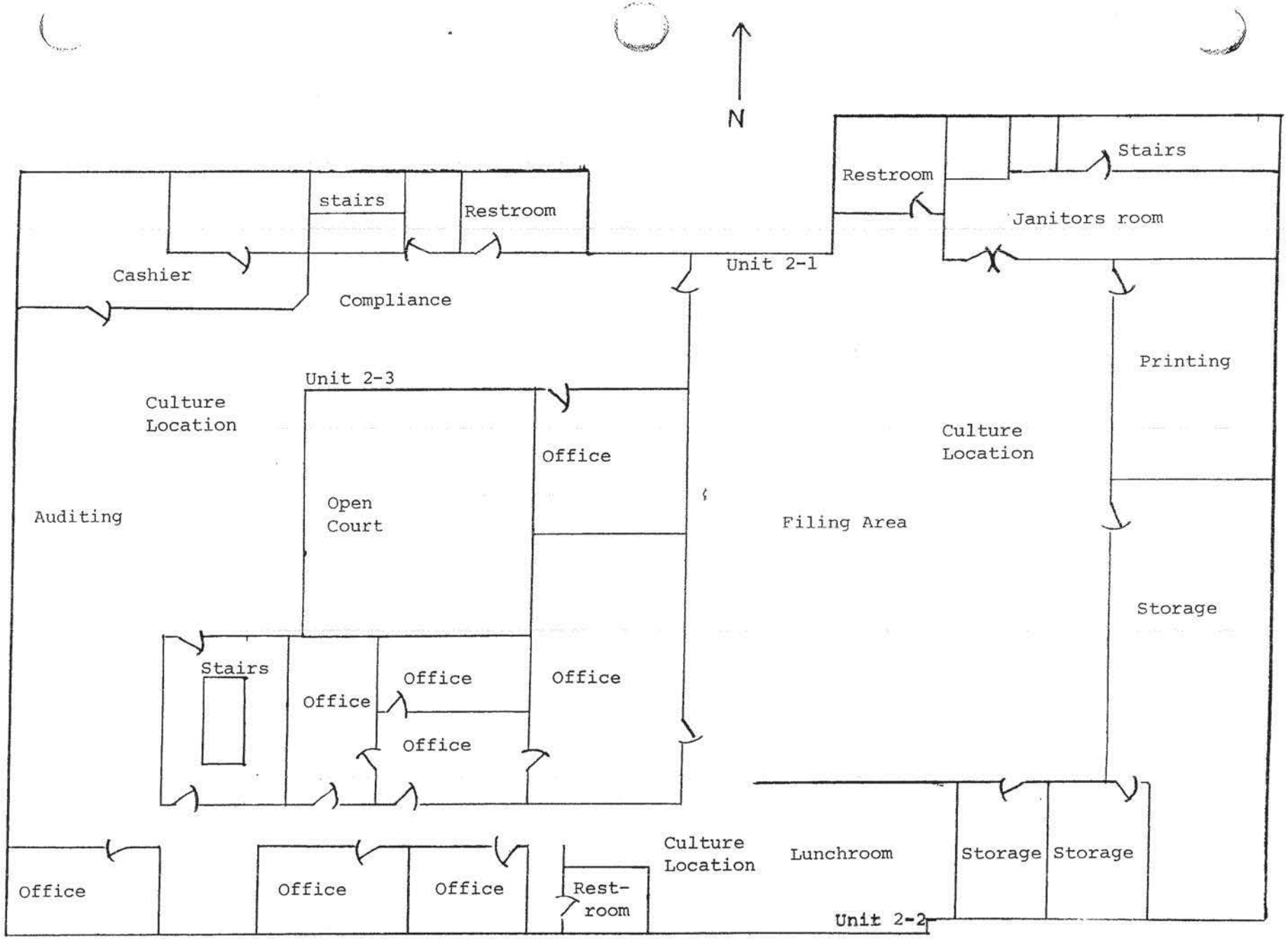
Ventilation Unit	Nominal CFM[1]	Calculated Fresh Air Intake[2] CFM	OBBC[3] Required Air Intake CFM	ASHRAE[4] Recommended Air Intake CFM
2-1	8000	640	2000	986
2-2	8000	640	2000	986
2-3	6000	480	1500	740
Totals:	22000	1760	5500	2712

1. Evaporator fan performance CFM from manufacturer's product literature.

2. Fresh air intake for each unit calculated by dividing the area of the intake duct by total unit air intake area and multiplying this value (0.08) times total CFM. No allowances made for resistance or reduced duct area due to dampers.

3. Values indicated are those required by the Ohio Basic Building Code which specifies 25 percent of the return air be fresh, outside air. Value may be lower if office has operable windows. Note that on July 1, 1982 the City of Cincinnati will require 33 percent outside air for new ventilation installations.

4. Values indicated are those recommended by ASHRAE for offices where smoking is permitted, (20 CFM per person) and the higher ventilation value for restrooms (75 CFM per water closet). Percentages and total CFM calculation are based on 65 employees; 27 taxpayers (variable numbers); and 12 water closets. Unit 2-3 handles 27% of the total CFM; units 2-1 and 2-2 handle 36% each.



Scale: 1" = 20'

Figure I
Tax Bureau Floor Plan