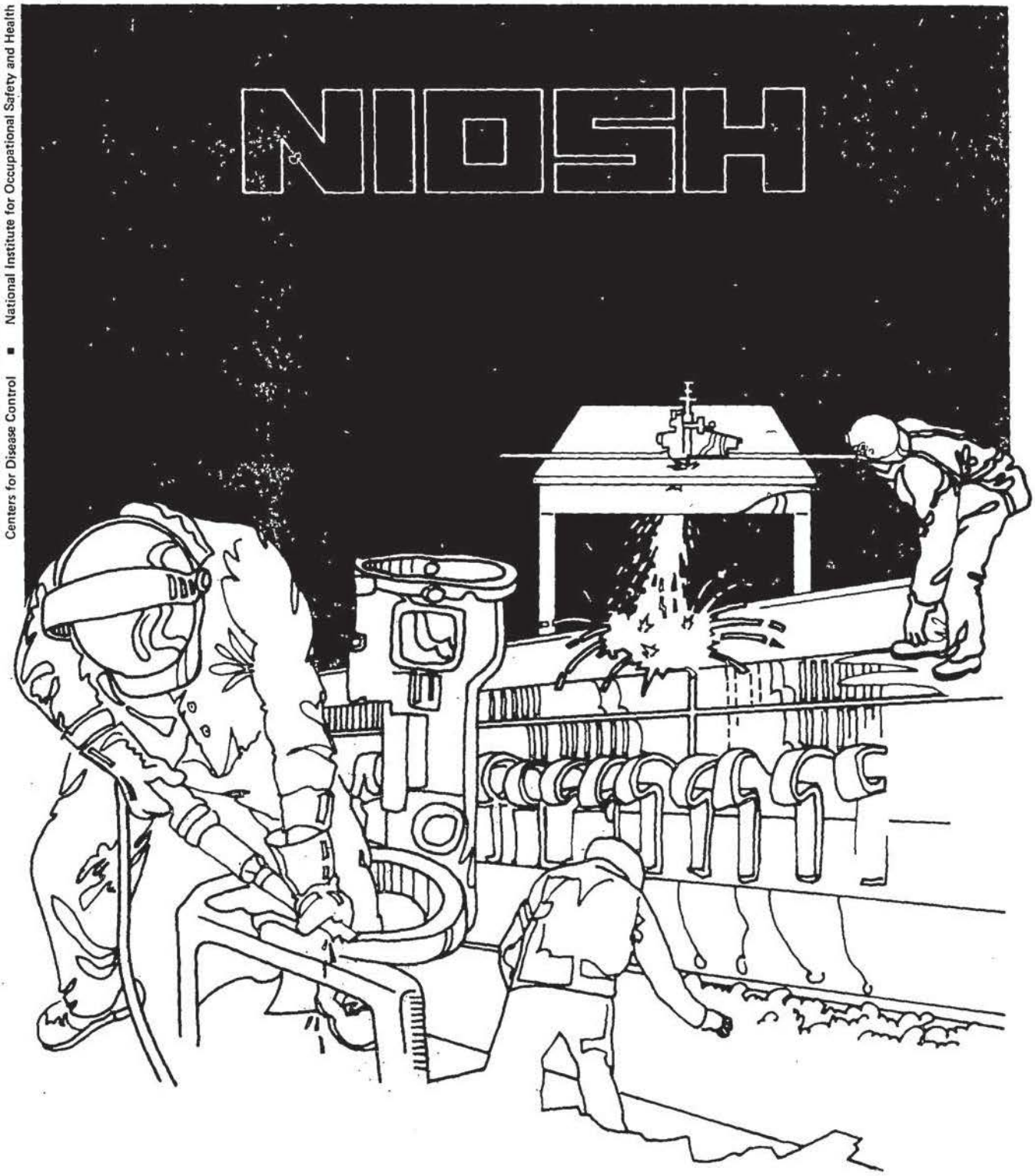
U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES ■ Public Health Service
Centers for Disease Control ■ National Institute for Occupational Safety and Health

NIOSH



Health Hazard Evaluation Report

HETA 83-320-1432
NATIONAL ENDOWMENT FOR THE ARTS
WASHINGTON, D.C.

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 83-320-1432
March 1984
NATIONAL ENDOWMENT FOR THE ARTS
WASHINGTON, D.C.

NIOSH INVESTIGATORS:
Michael S. Crandall, C.I.H.
Kenneth M. Wallingford, I.H.

I. SUMMARY

On June 20, 1983, the National Institute for Occupational Safety and Health (NIOSH) received a request for technical assistance from the National Endowment for the Arts (NEA) in Washington, D.C. concerning dust and vapor exposures to their employees, caused by renovation and remodeling construction in their office building. Employees in the NEA were complaining of respiratory difficulties, throat and eye irritation, metallic taste and increased allergy symptoms. Complaints were clustered on the sixth floor of the building.

NIOSH conducted a walk-through investigation on July 26, 1983. It was determined that toxic concentrations of gases, vapors or particulates were not present. Accumulated dust on flat surfaces in most offices indicated infiltration of particulates from the construction activities. Hydrocarbon vapor odors were noticed in the ventilation quadrant where foor tile mastic was being used. The General Services Administration (GSA) mechanic accompanying the survey team was unsure about the operational details of the new air handling systems, and whether they were working within design parameters with respect to providing adequate fresh make-up air.

An environmental survey was conducted throughout the sixth floor of the office building on July 27, 1983, to evaluate the air quality, and air distribution. Air samples were collected to measure the concentrations of total and respirable particulates, organic hydrocarbon vapor, formaldehyde, carbon monoxide, carbon dioxide, oxides of nitrogen, and sulfur dioxide. Ventilation, temperature, and relative humidity measurements were obtained. During these investigations NEA workers were interviewed regarding medical symptoms experienced at work.

Three of the four employees interviewed reported eye irritation. Two reported headaches. All four experienced respiratory irritation. Three of these employees had a history of allergies, and one of these was asthmatic. Verbal complaints from these and many other workers related to physical discomfort due to highly variable environmental conditions. The concentrations of air contaminants measured in the offices were well within established limits. The ventilation temperature and relative humidity measurements, however, indicated that the ventilation systems were not balanced and/or controlled to provide uniform comfort to the building.

Infiltration of dusts from the building renovation construction activities resulted in irritative symptoms for some NEA workers. Contaminant concentrations at the time of this survey were well below accepted criteria. Ventilation, temperature and relative humidity measurements indicated that comfort complaints resulted from ventilation system imbalance and/or control. Recommendations are made which may alleviate the symptoms, and correct the worker comfort problem.

KEYWORDS: SIC (9199) General Government office buildings, indoor air pollution, tight building syndrome

II. INTRODUCTION

On June 20, 1983, a representative of the NEA in Washington, D.C., requested technical assistance from the NIOSH, concerning employee complaints of poor air quality in their office space in the Old Post Office Building. The employees complained of respiratory difficulties, throat irritations, burning eyes, metallic tastes in mouths, and increased allergy symptoms. Most of the complaints were from employees on the sixth floor of the building.

NIOSH visited the NEA on July 26-27, 1983. A walk-through survey was conducted July 26 with representatives from the NEA and the GSA. On July 27 an environmental survey was conducted to evaluate the air quality and air distribution on the sixth floor of the Old Post Office Building. Preliminary recommendations were forwarded to the NEA officials on August 12, 1983.

III. BACKGROUND

The NEA, an independent, administrative agency of the federal government, moved into office space in the Old Post Office building in April 1983. The Old Post Office is an 84-year old, nine story building located at 1100 Pennsylvania Avenue, NW, in historic downtown Washington, D.C. The NEA employs 350 workers, and they occupy offices on the second through the eighth floors.

Interior remodeling and general renovation of the Old Post Office began in 1982, and continued as the NEA occupied their offices. Construction activities were reportedly still quite heavy in April, although they had subsided somewhat by the July survey. This had created a dusty, dirty environment for the NEA employees. The renovation was to be completed by October 1983.

Each of the floors of the building are essentially the same. The offices and a hallway form the perimeter of the building surrounding a glass-roofed cortile area. The construction activities were in the cortile area which is open space from the first floor to the roof. A floor plan is in Figure I.

The offices for the NEA were mostly open suites with modular work stations. During remodeling, a suspended ceiling was installed for a more modern appearance, and to hide duct work, wiring and lighting fixtures. All of the large double-sash windows were sealed with interior insulating glass. All office space is accessed from the hallway, and some offices are interconnected.

The Old Post Office Building is divided into four heating and cooling quardrants, or zones, centered on the corners of the building. Each quadrant is supplied by a separate heating, ventilation, and air-conditioning (HVAC) system of a complicated variable air volume (VAV) design. These four HVAC systems are housed on the ninth floor and serve all but the first and fifth floors. The first floor is commercial offices, shops and restaurants and is on separate HVAC systems. The fifth floor was not remodeled, but restored for historic purposes, and is served by wall convection heating and cooling units.

Air is supplied to the NEA offices through ceiling slot diffusers and rectangular ducts above the ceiling. Air volume to the slot diffusers is controlled through thermostatically dampened manifolds. The supplied air is heated and humidified in the winter and conditioned in the summer. The air is cleaned by high efficiency paraticulate bag filters and fiberglass pre-filters. All return air is ducted from the offices to ninth floor, mixed with a percentage (reported $\geq$25%) of fresh outside air and then recirculated. Outside make-up air intakes and system exhausts are located on the roof of the building. The systems were designed to keep the offices under positive pressure with respect to the hallway. These HVAC systems were started up between 7:00 and 8:00 am each work day and shut down between 4:00 and 4:30 pm each work day, and on the weekends.

During the walk-through, accumulated dust was noticed on most flat office surfaces. The hallway open to the cortile was particularly dusty. The ceiling material around many slot diffusers was very dirty. Employee comfort complaints outnumbered air quality complaints at the time of the survey. There did not appear to be any source other than the construction activities for contaminants which were causing the air quality and employee discomfort complaints.

IV. EVALUATION DESIGN AND METHODS

A. Environmental

General area air monitoring was conducted to determine the presence of particulates, organic hydrocarbons, and formaldehyde in four sixth floor offices, and the corridor between the offices and the cortile area (Figure I). Samples were collected in offices in each ventilation zone. Particulates and organics were suspected contaminants from the renovation work. Since the office furniture, and carpeting were relatively new, it was plausible that sufficient formaldehyde from these sources may have been present to cause irritation symptoms.

Draeger® direct reading detector tube samples were collected to determine the presence of carbon monoxide (CO), carbon dioxide (CO_2), oxides of nitrogen (NO_x), and sulfur dioxide (SO_2).

1. Particulates

Five total particulate and three respirable particulate samples were collected on polyvinyl chloride filters attached via flexible tubing to battery-powered sampling pumps calibrated at 2.5 liters per minute (lpm) for total samples and 1.7 lpm, with a 10 millimeter (mm) nylon cyclone preseparator for respirable samples. The samples were analyzed by weighing the samples plus filters on an electrobalance, and subtracting the previously determined tare weights of the filters. Subsequent to gravimetric analysis, the samples were analyzed for free silica using a modification of NIOSH Method P&CAM 259[1]. The filter samples were dissolved in tetrahydrofuran, and then scanned by x-ray diffraction to determine the presence of free silica polymorphs. The limit of quantitation for this method was 0.03 milligrams (mg) per sample.

Five samples for trace element analysis were collected on mixed cellulose ester filters attached via flexible tubing to battery-powered sampling pumps calibrated at 2.5 lpm. The samples were analyzed by NIOSH Method P&CAM 351[2]. The filters were ashed with concentrated nitric acid and the residues dissolved in dilute acid. Analysis was accomplished by nebulization of the prepared sample into an inductively coupled argon plasma and monitoring the emission spectra of the various elements. The limit of quantitation for these samples was 1.0 microgram (ug) per filter.

Five samples for qualitative particulate species analysis were collected on open faced mixed cellulose ester filters attached via flexible tubing to battery-powered pumps calibrated at 2.5 lpm. The samples were scanned with an analytical scanning electron microscope at magnifications of 2700x and 10,000x, and particulates were analyzed using energy dispersive x-ray techniques. This method is outlined in NIOSH Publication 77-204[3].

2. Organic hydrocarbons

Two organic hydrocarbon vapor samples were collected for qualitative analysis using sorbent tubes containing 150 mg of activated charcoal connected via flexible tubing to battery-powered pumps calibrated at a nominal flow rate of 200 milliliters per minute (ml/min). The samples were analyzed by desorbing in carbon disulfide, separating the sample components in a gas chromatograph, and identifying the component peaks with a mass spectrometer.

3. Formaldehyde

Two formaldehyde vapor samples were collected using sorbent tubes containing 150mg of coated Chromosorb 102® connected via flexible tubing to battery-powered pumps calibrated at a nominal flowrate of 50 ml/min. The samples were desorbed with isooctane and analyzed by capillary-column gas chromatography with flame ionization detection according to NIOSH Method P&CAM 354[2]. The limit of detection for this method is 1.0 ug per sample.

4. Ventilation

Ventilation monitoring was conducted using a KURZ® Pocket Anemometer Series 480. Temperature and relative humidity measurements were obtained using a Bendix Model 566 Psychrometer.

B. Medical

Four of the five employees on the sixth floor with health complaints were interviewed. The fifth employee was absent from work. A standard non-directed questionnaire was administered by the NIOSH industrial hygienists.

V. EVALUATION CRITERIA

A. Building-Related Illness Episodes

Building-related illness episodes have been reported more frequently in recent years as buildings have been made more air-tight in order to conserve energy and to reduce air conditioning expenses. Modern high-rise office buildings are constructed primarily of steel, glass, and concrete, with large windows that cannot be opened, thus making the building totally dependent on mechanical systems for air conditioning. Contaminants may be present in make-up air or may be introduced from indoor activities, furnishings, building materials, surface coatings, and air handling systems and treatment components. Symptoms often reported are eye, nose, and throat irritation, headache, fatigue, and sinus congestion. Occasionally, upper respiratory irritation and skin rashes are reported. In some cases, the cause of the symptoms has been ascribed to an airborne contaminant, such as formaldehyde, tobacco smoke, or insulation particles, but most commonly a single cause cannot be pinpointed.

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

In 1981, the National Research Council (National Academy of Sciences) issued a report urging a major national effort be mounted to study the subject of indoor air pollution. Some of the major types of contaminants found in indoor air are:

1. Products of combustion

   Carbon monoxide and nitrogen dioxide are often considered the most important toxic products of the combustion of fossil fuels and other organic materials. Gas stoves may be a significant source of these pollutants. Carbon monoxide is an asphyxiant, and nitrogen dioxide a pulmonary irritant.

2. Formaldehyde

   Formaldehyde and other aldehydes may be released from foam plastics, carbonless paper, particle board, plywood, and textile fabrics. Formaldehyde is an irritant to the eyes, nose, mouth, and throat. It is also a suspect human carcinogen, based on its ability to produce nasal cancer in rats.

3. Sprayed-on insulation materials

   Asbestos, fibrous glass, and mineral wool fibers have been used in some buildings in sprayed-on fireproofing insulation for walls, ceilings, and structural steel beams. Fibers and dust particles may be dislodged from the insulation and become airborne. Asbestos fibers can cause pulmonary disease and cancer. Mineral wool and fibrous glass particles are irritants.

4. Tobacco smoke

   Tobacco smoke contains several hundred toxic substances, the more important of which are: carbon monoxide, nitrogen dioxide, hydrogen cyanide, formaldehyde, hydrocarbons, ammonia, benzene, hydrogen sulfide, benzo(a)pyrene, tars, and nicotine. Tobacco smoke can irritate the respiratory system and, in allergic or asthmatic persons, often results in eye and nasal irritation, coughing, wheezing, sneezing, headache, and other related sinus problems. People who wear contact lenses often complain of burning, itching, and tearing eyes when exposed to cigarette smoke. While cigarette smoking is the leading cause of lung cancer in the United States, currently available evidence is not sufficient to conclude that passive or involuntary smoking causes lung cancer in non-smokers.[4]

5. Microorganisms and allergens

Microorganisms have been spread through ventilation systems in buildings where air filters became wet and moldy, where pools of stagnant water accumulated under air conditioning cooling coils, and where decaying organic matter was found near air conditioning intakes. Health effects may be infections, irritation, or allergic symptoms.

6. Hydrocarbon vapors

Hydrocarbon vapors are released from dispersants and toners used in photocopying machines and telecopiers, from printing processes, and from certain cleaning compounds. Hydrocarbons can be irritants and, at high concentrations, are central nervous system depressants.

B. Air Contamination Evaluation Criteria

The primary sources of air contamination criteria generally consulted include: (1) NIOSH Criteria Documents and recommendations for occupational exposures, (2) the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLV's), (3) the U.S. Department of Labor (OSHA) federal occupational health standards, and (4) the indoor air quality standards developed by the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE). The first three sources provide environmental limits based on airborne concentrations of substances to which workers may be occupationally exposed in the workplace environment for 8 to 10 hours a day, 40 hours per week for a working lifetime without adverse health effects. The ASHRAE standards are general air quality standards for indoor environments, and are applicable for the general population exposed for up to a 24-hour day of continuous exposure without known toxic effects.

Indoor air should not contain concentrations of contaminants known to impair health, or to cause discomfort to a substantial majority of the occupants. Ambient air quality standards/guidelines available from federal, state, or local authorities should be consulted. If the air is thought to contain any other contaminants, reference to OSHA, ACGIH, and NIOSH recommendations should be made; for application to the general population, the concentration of these contaminants should not exceed 1/10 of the limits which are used in industry[5].

Several examples of common contaminants found in both industrial and non-industrial (indoor air) environments are shown below with their relevant environmental exposure criteria:

Contaminant	Concentration/Exposure Period 8-Hour TWA	Continuous	Source
Carbon monoxide (ppm)	50	---	OSHA/ACGIH
	35 (200[C])	---	NIOSH
	---	9	ASHRAE
Formaldehyde (ppm)	3	---	OSHA
	CA	---	NIOSH
	---	0.1	ASHRAE
Total particulates (mg/m^3)	15	---	OSHA
	10	---	ACGIH
	---	0.26 (24-hr[C]) or 0.075 (1-yr mean)	ASHRAE
Respirable Particulates (mg/m^3)	5	---	OSHA/AGGIH
Asbestos (fibers/cc)	2	---	OSHA
	0.5--2	---	ACGIH
	0.1, CA	---	NIOSH
	---	CA	ASHRAE

NOTE: ppm = parts of contaminant (gas or vapor) per million parts of air, by volume
mg/m^3 = milligrams of contaminant per cubic meter of air
CA = lowest feasible level (suspect or confirmed carcinogen), use best control technology
C = short-term (15-30 min) or ceiling limit

Some specific organic hydrocarbons identified in the Old Post Office Building are shown below with their industrial occupational exposure criteria and inhalation exposure symptoms. ASHRAE recommends that concentrations of these contaminants should not exceed 1/10 of these industrial exposure criteria.

	8-Hour TWA Criteria (PPM)			
Contaminant	NIOSH	ACGIH	OSHA	Inhalation Symptons
Toluene	100	100	200	fatigue, weakness,confusion, euphoria
M-Octane	75	300	500	eye and nose irritation, drowsiness
Xylene	100	100	100	dizzness, excitement, drowsiness

C. Ventilation Evaluation Criteria

Neither NIOSH nor OSHA has developed ventilation criteria for general offices. Criteria often used by design engineers are the guidelines published by ASHRAE.

Until recently, the ASHRAE Ventilation Standard 62-73 (1973) was utilized, but recommendations were based on studies performed before the more modern, air-tight office buildings became common. These older buildings permitted more air infiltration through leaks in cracks and interstices, around windows and doors, and through floors and walls. Modern office buildings are usually much more airtight and permit less air infiltration. Due to the reduced infiltration, ASHRAE questioned whether the 1973 minimum ventilation values assure adequate outdoor air supply in modern, air-tight buildings.

Subsequently, ASHRAE has revised its standard and has published the new standard, ASHRAE 62-1981, "Ventilation for Acceptable Indoor Air Quality." The new standard is based on an occupant density of 7 persons per 1000 ft^2 of floor area, and recommends higher ventilation rates for areas where smoking is permitted. The new ASHRAE standard states that indoor air quality for "General Offices" shall be considered acceptable if the supply of outdoor air is sufficient to reduce carbon dioxide to less than 2500 ppm and to control contaminants, such as various gases, vapors, microorganisms, smoke, and other particulate matter, so that concentrations known to impair health or cause discomfort to occupants are not exceeded. However, the threshold levels for health effects from these exposures are poorly documented. For "General Offices" where smoking is not permitted, the rate recommended under the new standard is 5 cfm of outdoor air per person.

Higher ventilation rates are recommended for spaces where smoking is permitted because tobacco smoke is one of the most difficult contaminants to control at the source. When smoking is allowed, the amount of outdoor air provided should be 20 cfm per person. Areas that are nonsmoking areas may be supplied at the lower rate (5 cfm/person), provided that the air is not recirculated from, or otherwise enters from, the smoking areas.[5]

VI. RESULTS

A. Environmental

The results are summarized in Table 1.

1. Particulates

a. Total and Respirable Dust

The highest concentration of total dust was found in the corridor samples, 0.19mg/m^3 (OSHA 15mg/m^3). Total dust levels from four office samples averaged 0.05 mg/m^3 (range 0.01-0.09mg/m^3, SD$\pm$ 0.04). The concentration of respirable dust in the corridor was 0.13mg/m^3 (OSHA 5mg/m^3). Respirable dust concentrations from two office samples averaged 0.04mg/m^3 (range 0.01-0.07mg/m^3, SD $\pm$ 0.04). The respirable dust fraction is that part of the total dust loading which, due to the particle size (diameter <10um), may be deposited from the upper airways to the deep lung. The respirable fraction in the corridor was approximately 70 percent. In the offices the respirable fraction ranged from approximately 80 to 100 percent.

b. Trace Elements

Calcium, Sodium, and zinc were the most abundunt of the 32 elements identified. The highest air concentrations found were 0.02mg/m^3 of calcium in the corridor sample, and 0.02 mg/m^3 of zinc in room 609. Otherwise, all elemental concentrations were less than 0.004mg/m^3 in all samples, with the majority being less than the limit of detection (0.9ug/m^3, air volume adjusted).

c. Asbestos and Silica

There was no asbestos observed in any sample. Small amounts of silica were observed during the qualitative species identification by electron microscopy. However, all air samples submitted for free silica analysis contained less than the limit of quantitation (0.04mg/m^3, air volume adjusted).

2. Organic Hydrocarbons

Hydrocarbon vapors were found to be present at very low levels. Some hydrocarbons may commonly be found in office environments, but these were likely associated with the use of glues, and solvents during the renovation. Although this was a qualitative analysis, the chemist determined that the weight of the most abundant component present, Toluene, was less than 10ug. This equals a TWA exposure level of less than 0.03 parts per million (ppm), compared to the NIOSH recommended criteria of 100 ppm (OSHA 200 ppm).

3. Formaldehyde

Formaldehyde concentrations in the areas monitored averaged 0.04ppm (range 0.03-0.06ppm, SD±0.02). These concentrations are within the ranges typically found in office environments. These low levels can result from cigarette smoking and the foam backing on office carpeting. ASHRAE recommends that indoor air concentrations of formaldehyde be kept below 0.10ppm. NIOSH recommends that exposure to formaldehyde be controlled to the lowest feasible level.

4. Drager® Tubes

a. Carbon Monoxide

CO levels averaged 3ppm (range 2-4ppm, ASHRAE 9ppm).

b. Carbon Dioxide

CO_2 levels averaged 370 ppm (range 250-550ppm, ASHRAE 2500ppm).

Sulfur dioxide and oxides of nitrogen were not detected in any area.

5. Ventilation

The air flows through the ceiling slot diffusers were quite variable. Air velocities ranged from 25 to greater than 2000 feet per minute (8-63 cubic feet per minute) per slot. This range of velocities may not necessarily indicate VAV system imbalance, however the wide range of temperatures and relative humidities found does indicate non-uniform comfort control, which is an objective of HVAC system balance. Temperatures within one office suite (room 624-627) ranged from 64°F(RH=61%) to 74°F(RH=46%). Some of the smaller offices were nearer 80°F.

B. Medical

All of the employees interviewed had previously reported having symptoms while at work. Three of the four reported eye irritation. One could not wear prescribed contact lenses due to the presence of unknown irritants. Two employees reported headaches. All four experienced respiratory irritation ranging from nasal irritation, and sneezing to difficulty in breathing. Three employees had a history of allergies. One of these was asthmatic. Relief from these symptoms was noted on weekends and at night, while away from the building.

The employees interviewed did not work within the same ventilation quadrant. The symptoms appeared to be real, and had been witnessed by other workers. The frequency of symptoms seemed to be higher during the few previous months when the renovation construction work was heavier and presumably more dusty.

VII. DISCUSSION

Levels of air contaminants measured throughout the sixth floor of the Old Post Office were well within the current limits established by OSHA, NIOSH, ACGIH, and ASHRAE as listed in section V, subsection A of this report. These levels would not be expected to cause the irritative symptoms to be reported in the general population. However, most employees with symptoms reported a history of allergies which might explain their reacting to low levels of mostly respirable sized dusts. Also, in earlier months when symptoms were reported to be worse, levels of atmospheric contaminants from the renovation were reported as being higher. The fact of settled dust covering most flat surfaces, and the dirty appearance around the ceiling slot diffusers evidenced that contaminants had been introduced into this environment.

The ventilation, temperature and relative humidity measurements point out the fact that comfort levels were not uniform throughout the sixth floor of the building. NEA personnel indicated that this was also the case on the remaining floors. The NIOSH investigators witnessed that there were cooler areas, warmer areas, and some offices which were rather stuffy. A survey to determine whether the HVAC systems were within the design specifications or the ASHRAE guidlines with respect to amount of fresh outdoor air per person was not within the scope of this study. ASHRAE recommends 20 cubic feet per minute (CFM) of fresh outdoor air per smoking person, and 5CFM of fresh air per non-smoking person in office space, and 35CFM and 7CFM respectively in meeting and waiting spaces.

It was noted during the NIOSH walk-through survey that the GSA personnel assigned to maintain the HAVAC system were not knowledgeable of all operational details of this VAV system. At the time of the survey, there was no one assigned to the premises for HVAC system control. GSA reacted to complaints of system problems and supplied a mechanic when available from off-site. Until this system more reliably maintains comfort parameters, continual on-site monitoring and maintenance is indicated.

VIII. CONCLUSIONS

A. Contaminant exposures measured were well below NIOSH, ACGIH, ASHRAE and OSHA criteria at the time of the survey. They were most likely higher at earlier stages of renovation construction. Construction related exposures should cease at the termination and clean-up from these activities. No other exposure source was apparent.

B. GSA assured NIOSH that high efficiency particulate filters and pre-filters are inspected regularly. Overloading would cause the HVAC system to shut down automatically. However there was an inordinate amount of settled dust in the offices. The integrity of the air filtration systems should be checked.

C. A small percentage of NEA employees were experiencing health effects which they thought to be caused by the environment at work. The symptoms reported during interviews included respiratory difficulties, headaches, and eye and respiratory irritation. Most of these workers reported having allergy problems.

D. Environmental comfort complaints were numerous. Ventilation, temperature and relative humidity measurements confirmed widely varying conditions. These problems directly relate to an improperly balanced and/or controlled HVAC/VAV system.

E. The HVAC/VAV system needs to be balanced. Its initial balancing has been upset evidently by office rearrangement. In some instances office environments are controlled by thermostats in other offices. Once balanced, a system of this size and complexity requires full-time, on-site monitoring and maintenance.

IX. RECOMMENDATIONS

A. The four air handling systems should be inspected by the GSA to ensure the integrity and proper functioning of the air filtration systems.

B. The air handling system in this building needs to be balanced with respect to air circulation and temperature. This should include determining that supplied fresh outdoor air is within ASHRAE criteria. The balancing should be accomplished after construction activities have ended, and once office spaces are occupied as they will be for the long term. This balancing should be carried out by an expert in the area of variable air volume HVAC systems, ideally the designer of the system.

C. Automatic shut-down of the system should be adjusted to occur after workers have completed their workday (6:00pm).

D. Thermostats should be located, relocated if necessary, so that they are within the office space they are to control.

E. Someone trained in the operation and maintenance of the variable air volume HVAC systems in this building should be on-site on a full-time basis. The training received should be from experts in the area of VAV/HVAC systems, ideally the designer of this system.

These recommendations should help to ensure a comfortable and healthy work environment for the NEA.

X. REFERENCES

1. National Institute for Occupational Safety and Health. NIOSH manual of analytical methods. Vol 1, 2nd ed. Cincinnati, Ohio: National Institute for Occupational Safety and Health, 1977. (DHEW (NIOSH) publication no. 77-157-A).

2. National Institute for Occupational Safety and Health. NIOSH manual of analytical methods. Vol 7, 2nd ed. Cincinnati, Ohio: National Institute for Occupational Safety and Health, 1981. (DHHS (NIOSH) publication no. 82-100).

3. National Institute for Occupational Safety and Health. Review and Evaluation of Analytical Methods for Environmental studies of Fibrous Particulate Exposures. Cincinnati, Ohio. National Institute for Occupational Safety and Health, 1977. (DHEW (NIOSH) Publication no. 77-204).

4. U.S. Department of Health and Human Services. The health consequences of smoking: cancer 1982, a report of the Surgeon General. Washington, D.C.: U.S. Department of Health and Human Services, 1982.

5. American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. ASHRAE standard 62-1981, ventilation for acceptable indoor air quality. Atlanta, Georgia: ASHRAC, 1981.

XI. AUTHORSHIP AND ACKNOWLEDGEMENTS

Evaluation Conducted and Report Prepared by:

Michael S. Crandall, C.I.H.
Industrial Hygiene Engineer
Industrial Hygiene Section

Kenneth M. Wallingford
Industrial Hygienist
Industrial Hygiene Section

Analytical Support:

Measurements Development Section, and
Measurements Support Section,
Measurements Research and Support Branch,
Division of Physical Sciences and Engineering
Cincinnati, Ohio 45226

UBTL
Salt Lake City, Utah 84108

Originating Office:

Hazard Evaluations and Technical Assistance Branch
Division of Surveillance, Hazard Evaluations, and Field Studies

Report Typed By:

Connie Kidd
Clerk-Typist
Industrial Hygiene Section

XII. 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. Administration Services Officer, National Endowment for the Arts, 1100 Pennsylvania Avenue N.W., Washington, D.C. 20506

2. Director of Administration, National Endowment for the Arts, 1100 Pennsylvania Avenue N.W., Washington, D.C. 20506

3. Director of Administration, National Endowment for the Humanities 1100 Pennsylvania Avenue N.W., Washington, D.C. 20506

4. Chairman, National Endowment for the Arts. 1100 Pennsylvania Avenue N.W., Washington, D.C. 20506

5. Buildings Manager, Room 1314, General Services Administration, 1111 Constitution Avenue, N.W., Washington, D.C. 20224

6. NIOSH, Region III

7. OSHA, Region III

For the purpose of informing 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 1

Exposure Summary
National Endowment for the Arts
Old Post Office Building
HETA 83-320

July 27, 1983

	Location					Criteria			
Substance	Rm 602	Rm 609	Rm 619	Rm 627	Corridor	ASHRAE	NIOSH	ACGIH	OSHA
Total Dust (mg/m^3)	0.04	0.08	0.01	0.09	0.19	0.26*	-	10	15
Respirable Dust (mg/m^3)	-	-	0.01	0.07	0.13	-	-	5	5
Formaldehyde (ppm)	-	0.03	-	0.06	-	0.1	LFL	1*	3
Carbon Monoxide (ppm)	3	trace	2	trace	4	9	35(200)*	50	50
Carbon Dioxide (ppm)	400	250	250	400	550	2500	10,000	5000	5000

*ceiling
LFL = lowest feasible level

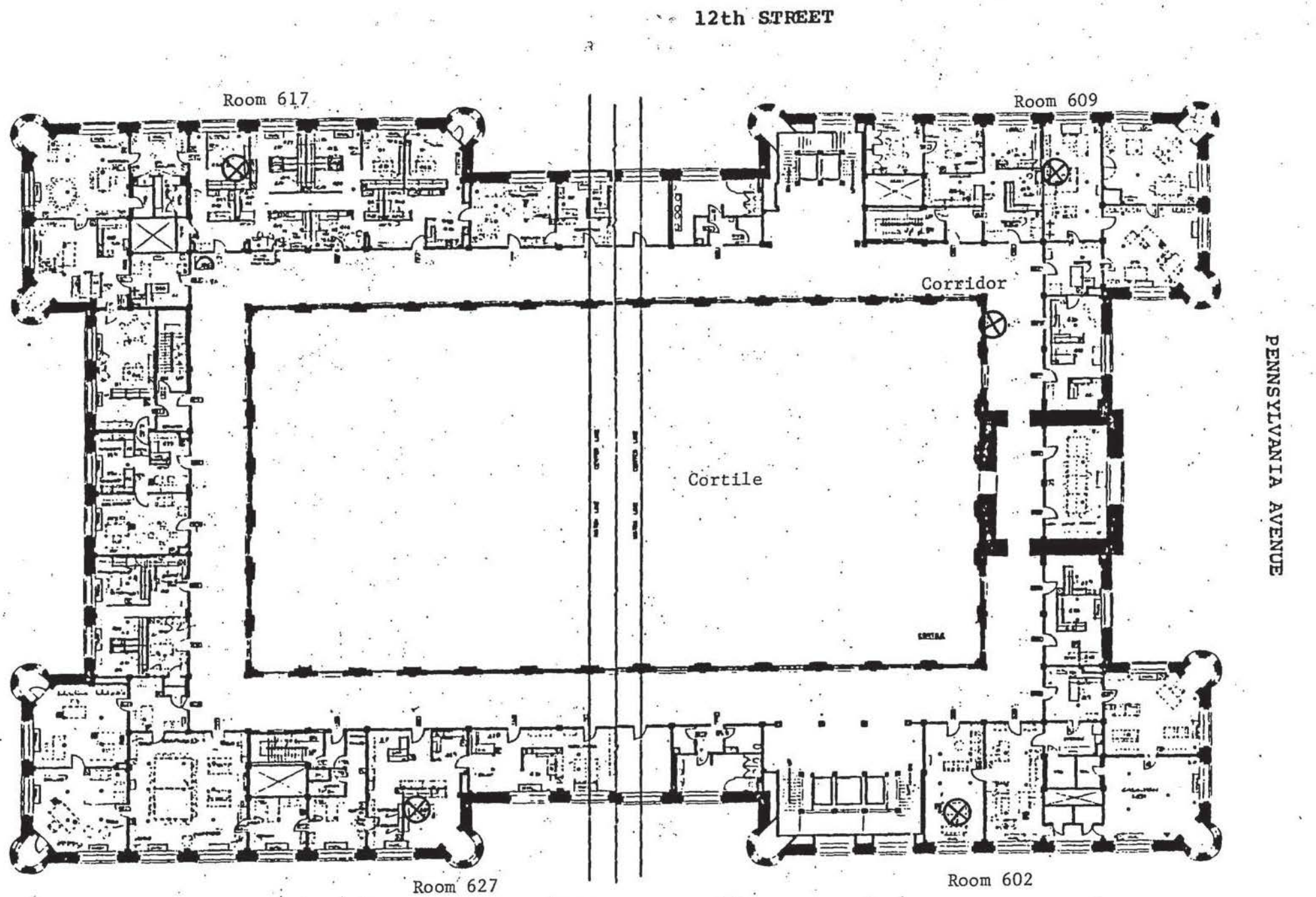


Figure 1
Old Post Office Building

⊗ Indicates Sampling Location

DEPARTMENT OF HEALTH AND HUMAN SERVICES
PUBLIC HEALTH SERVICE
CENTERS FOR DISEASE CONTROL
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH
ROBERT A. TAFT LABORATORIES
4676 COLUMBIA PARKWAY, CINCINNATI, OHIO 45226

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE. $300

Third Class Mail

U.S.MAIL

POSTAGE AND FEES PAI
U.S. DEPARTMENT OF HI
HHS 396