U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES ■ Public Health Service
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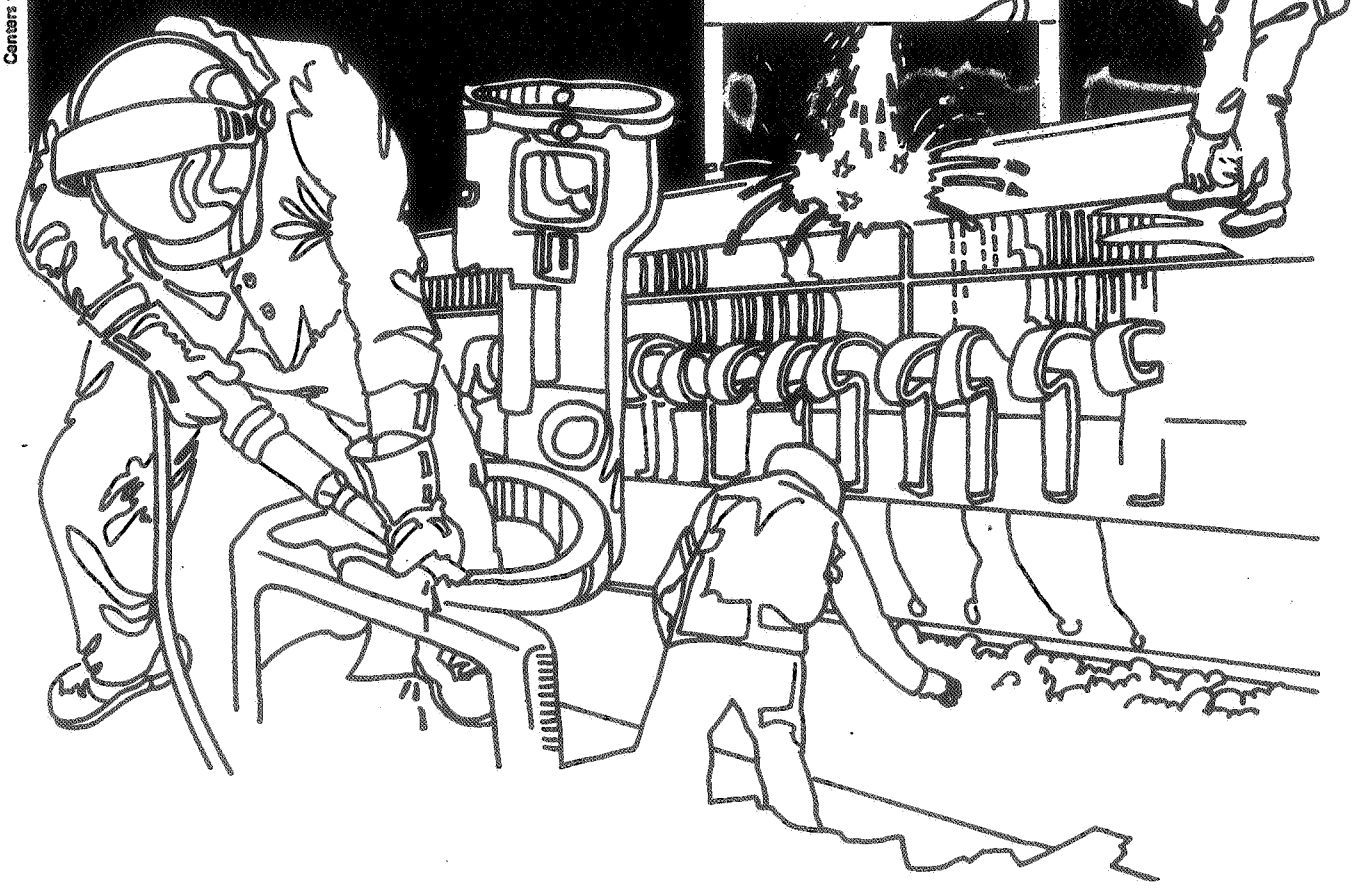
NIOSH



Health Hazard Evaluation Report

HETA 82-269-1341
CINCINNATI TECHNICAL COLLEGE
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 82-269-1341
JULY 1983
CINCINNATI TECHNICAL COLLEGE
CINCINNATI, OHIO

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I. SUMMARY

In May 1982, the National Institute for Occupational Safety and Health (NIOSH) received a request from the Cincinnati Technical College (CTC) Cincinnati, Ohio to evaluate the cause(s) of such symptoms as lethargy, allergies, headache, sinus problems, and fainting spells experienced periodically by several employees in the College's Learning Resource Center (LRC), specifically in the media distribution area, television control room, and the television studio.

On July 14-15, 1982, NIOSH investigators conducted an environmental/medical survey. Since there were no known contaminant sources within the building, air sampling was conducted to screen for substances potentially emitted from building materials or taken into the building via fresh air intakes (vehicle or industrial emissions). These substances included organic vapors, ammonia, carbon dioxide, carbon monoxide, formaldehyde, ozone, and nitrogen dioxide. Temperature, humidity, and ventilation were also measured. Thirteen CTC employees were interviewed about their medical history, current symptoms/health problems, occupational history, and possible workplace exposures.

Except for detection of background levels of toluene (1.0 mg/m^3), carbon monoxide (3.4 mg/m^3), and carbon dioxide (1800 mg/m^3), no other airborne contaminants were detected. Temperatures were within the comfort zone (73-77°F), but relative humidity levels (70-72%) exceeded the 20-60% criteria recommended by the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE).

The most frequent employee complaint concerned the air quality of the LRC. Eleven of the thirteen employees complained of stuffy air, odors (vehicle exhaust and new mown grass), and variations in temperature. All thirteen employees reported at least two of the following symptoms: headache, lethargy, sinus congestion, persistent colds, eye irritation, dizziness, faintness, nausea, nose bleeds and skin rash. Eight reported that their symptoms diminished or abated entirely when they were away from work. Two reported biomechanical problems associated with use of a video display terminal and floor model card catalogues.

On the basis of the data obtained during this evaluation, NIOSH could not determine a definite cause of the symptoms experienced by the LRC employees. Although no excessive exposures to airborne chemicals were documented, the interview data suggest that some of the reported symptoms could be related to low-level contamination of the fresh air supply by vehicle exhausts. Recommendations to improve workers' comfort, safety, and health are included in Section VIII of this report.

KEYWORDS: SIC 8222 (Technical Institutes), office building, office workers, carbon dioxide, carbon monoxide, formaldehyde, ozone, humidity, ventilation, video display terminal

II. INTRODUCTION

In May 1982, the National Institute for Occupational Safety and Health (NIOSH) received a request from the Cincinnati Technical College, Cincinnati, Ohio, to evaluate the causes of reported symptoms such as lethargy, allergies, headache, sinus problems, and fainting spells reported by several employees in the College's Learning Resource Center (LRC), specifically the media distribution area, television control room, and the television studio.

On July 14-15, 1982, NIOSH investigators conducted a survey at CTC.

III. BACKGROUND

The Cincinnati Technical College, in operation since 1975, has a fluctuating student enrollment of about 1700 students and has nearly 200 full-time and 125 part-time faculty on staff. CTC occupies a three-story, 500,000 ft^2 building just above the Mill Creek Valley. In 1978, the college's auditorium was completely refurbished, creating the LRC with the addition of new walls, carpeting, ceilings, lighting, and a ventilation system. Soon after the LRC was renovated, several employees experienced various symptoms of physical discomfort. These symptoms reportedly increased in frequency and severity during the period from 1978 to 1981 and resulted in two employees being briefly hospitalized. One for fainting; and one for chronic sinusitis.

The LRC houses the main library, media distribution area, television control room, television studio, and several offices and workrooms. Twelve full-time employees work in these areas regularly. Except for one workroom/breakroom, the LRC is designated as a non-smoking area. Nearly eighty percent of the LRC is carpeted and the remainder is covered by either linoleum or tile flooring. Most of the lighting is fluorescent with a few incandescent lights.

The media distribution area has a staff of two full-time and two part-time employees. Operations in this department include the cataloging and storage/distribution of media materials such as films, slides, and audio cassettes. The windows along the one exterior wall of this 3200 $ft.^2$ area can be opened but seldom are.

The television control room (approx. 700 $ft.^2$) is situated next to the television studio and contains the equipment used to monitor operations in the studio. The north wall of the control room is a common wall with the television studio. Along the south wall of the control room are two offices each about 200 ft^2. Both of these offices are generally in use daily by one employee. In 1979, the common wall shared by these two offices was insulated with a foam insulation material. The contractor who initially performed the

insulation work for CTC has since gone out of business. School administrative officials were concerned about the content and possible fugitive emissions of the insulation materials, especially since some employees who work in this area reportedly experienced the symptoms described earlier.

The television studio, about 3000 ft.^{2}, is used occasionally for media production and allied health classes. A cellulose fiber insulation material was applied to ninety percent of three of the four walls and to the entire ceiling including exposed ventilation ductwork, in 1979. One part-time employee reportedly fainted in the studio during a filming operation in 1980.

One workroom/breakroom adjacent to the main library is used to repair, label, and catalogue books and other teaching materials. Housed in this 800 ft.^{2} area is one video display terminal and one photocopier. This is the only area within the LRC where smoking is allowed.

Major ventilation changes were made in the LRC during the renovation performed in 1978. A variable, in-line air conditioning system was installed throughout the LRC. Prior to 1978 there was no air-conditioning in this area. The steam heating system provided for the LRC is not equipped with a humidification device.

For energy conservation purposes, air-conditioning in the LRC is turned off between 9:30 pm and 7:30 am on week-days and is off all day on holidays and weekends. When turned on, the air-conditioning cycles off for 20 minutes of every hour. The ventilation system is reportedly set to recirculate ninety percent of the air with only ten percent (fresh) outdoor air incorporated into the make-up air. Windows in the LRC can be opened but seldom are.

The fresh air intake port for the media distribution area is located about five feet off the ground in the wall adjoining a parking lot. Fifty feet away from this supply air intake is the exhaust air vent for the television control room and television studio. The exhaust ports for the television rooms are located on ground level at the edge of a parking lot and are situated only four feet away from the intake units for these areas. (See Figure I). The intake air unit for the LRC main library is located on the roof in the penthouse. All the air handling units in the LRC are equipped with fiber-mesh filters which are changed bi-annually.

The college hired an engineering firm to "balance" the LRC air handling system in March 1978. In December 1981, various supply air diffusers were readjusted due to discomforting drafts experienced by several employees. This change resulted in the ventilation system becoming unbalanced.

IV. EVALUATION DESIGN AND METHODS

A. Environmental

On July 15, 1982, long-term area environmental air samples were collected in the television control room television studio, and the media distribtuion center for measurement of exposure to organic gases and vapors. Sipin low-flow sampling pumps calibrated to pull 50 cubic centimeters of air per minute (cc/min) were used in conjunction with activiated charcoal tubes (150 mg) to obtain full shift air samples. The charcoal tubes were analyzed by gas chromatography/mass spectrophotometry techniques.

On July 14, and 15, 1982, short-term, direct-reading, colorimetric detector tubes were used to measure airborne concentrations of ammonia, carbon dioxide, carbon monoxide, formaldehyde, ozone, and nitrogen dioxide. These substances sampled were selected on the basis of potential irritants associated with building materials, indoor pollutants, and the nature of the symptoms experienced by the employees.

NIOSH personnel limited their ventilation measurements in the LRC to those office areas where the exhaust and intake duct faces were easily accessible. Thus, ventilation measurements, made with a Kurz Velometer and smoke tubes, were restricted to the television control room and the two interior offices within this area. Psychrometric readings were taken on this same date and in the same areas to determine temperature and relative humidity.

B. Medical

NIOSH interviewed eleven current and two former employees of the Learning Resource Center. The interviews were conducted in a nondirected manner to elicit complaints and/or symptoms believed by the employees to be work-related. The interviewees were questioned about their medical history, current symptoms/health problems, possible workplace exposures, and occupational history. No employer-generated medical records were available for review.

V. EVALUATION CRITERIA

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 ysstems 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 one of several possible contaminants found in indoor air such as formaldehyde, tobacco smoke, or insulation particles. However, 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.

A. Chemical

A number of sources recommend environmental limits based on airborne levels of substances to which it is believed that nearly all workers may be repeatedly exposed 8-10 hours per day, 40-hours per week, over a working lifetime, without suffering adverse health effects. Such airborne levels are referred to as permissible exposure limits or threshold limit values (TLV's). However, due to variations in individual susceptability, a small percentage of workers may experience effects at levels at or below the TLV: a smaller percentage may be more seriously affected by aggravation of a pre-existing condition or by a hypersensitivity reaction.

The environmental evaluation criteria utilized in this study are presented in Table I. Listed for each substance are the primary sources of exposure criteria including: (1) occupational health standards as promulgated by the U.S. Department of Labor (29 CFR 1910.1000)[1] and; (2) NIOSH recommended standards for occupational exposure to substances (Criteria Documents) or; (3) recommended TLV's and their supporting documentation as set forth by the American Conference of Governmental Industrial Hygienists (ACGIH - 1982)[2]. Also included are the primary health effects which have been associated with overexposure to each of the substances.

B. Ventilation and Temperature/Humidity

Neither NIOSH nor OSHA has developed ventilation criteria for general offices. Criteria often used by design engineers are the guidelines published by (ASHRAE)[3] the American Society of Heating, Refrigerating, and Air-Conditioning Engineers.

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 seven 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 sufficinet 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.[3]

The majority of references addressing temperature and humidity levels as they pertain to human health frequently appear in the context of assessing conditions in hot environments. Development of a comfort chart by ASHRAE[3] presents a comfort zone considered to be both comfortable and healthful for most people. This zone lies between 73 and 77°F (23 and 25°C) and 20 to 60 percent relative humidity.[4]

VI. RESULTS

A. Environmental

1. Air Sampling

Results of the short-term, colorimetric detector tube measurements taken on July 14-15, 1982, are shown in Table II. Carbon dioxide (CO_2) and carbon monoxide (CO) were the only

substances detected, at a maximum level of 1800 milligrams per cubic meter of air (mg/m^3) and 3.4 mg/m^3 respectively. These are well below the OSHA standard[1] and NIOSH recommended standard[5] of 9,000 mg/m^3 CO_2 and 40 mg/m^3 CO. Ammonia, formaldehyde, nitrogen dioxide, and ozone indicator tube measurements revealed no detectable concentrations.

The findings of the long-term area air samples collected on July 15, 1982, for evaluation of worker exposures to organic compounds are presented in Table III. Three charcoal tubes, one each in the media distribution area, television control room, and television studio were initially analyzed by gas chromatography/flame ionization techniques. Several small peaks were observed on the chromatograms of all three charcoal tubes, but the air sample taken in the media distribution area had the largest peaks. This charcoal tube was further analyzed by mass spectrometry for identification of the chromatographic peaks. The only detectable substance, toluene, was found at a concentration of less than 1.0 mg/m^3, well below the NIOSH recommended standard[5] of 375 mg/m^3. Perchloroethylene was identified as the other substance at a concentration less than the laboratory analytical limit of detection (0.06 mg).

2. Ventilation

NIOSH made ventilation measurements on July 15, 1982, in the television control room using smoke tubes and a Kurz velometer. All exhaust/supply systems were operating while air tests were made. Air velocity measurements were taken in the television control room main equipment office and two interior offices (Rooms 277 and 278A) at the supply air ceiling diffusers and exhaust vents.

These ventilation measurements and smoke tube tests revealed that the air handling system that serviced the television control room and the two interior offices within the television control room may be unbalanced and that there is very little air movement when the system is cycled off (20 minutes every hour for every conservation). Also, one ceiling exhaust vent in Room 278A was found totally occluded by insulation material.

The ventilation system in the LRC is reportedly set up to provide 10% outdoor (fresh) air. This was not confirmed by measurement during the survey. Very few windows in the LRC canbe opened thus increasing the reliance on the ventilation system to supply and circulate fresh air and to exhaust contaminated air.

3. Temperature and Humidity

Psychrometer measurements taken in the media distribution area, television studio, and television control room on July 15, 1982, resulted in similar readings:

Media Distribution Area (10:20)
Wet Bulb: 68°F
Dry Bulb: 76°F
Relative Humidity: 72%

Television Studio (10:34)
Wet Bulb: 66°F
Dry Bulb: 73°F
Relative Humdidity: 70%

Television Control Room (10:51)
Wet Bulb: 66°F
Dry Bulb: 73°F
Relative Humidity: 70%

All of these temperatures are within the comfort zone (dry bulb temperature range of 73 to 77°F) but the humidity levels (70-72%) are in excess of the relative humidity comfort range of 20-60% recommended by ASHRAE.[4] This high relative humidity may be due to the fact that the air-conditioning system is cycled off 20 minutes of every hour.

The composition of the insulation material installed in 1979 in the common wall shared by the two interior offices of the television control room could not be determined. However, short-term detector tube samples taken in these two offices revealed no detectable ambient formaldehyde concentrations.

B. Medical

The interviews with eleven current and two former LRC employees produced the following information. Amongst these staff members the average length of employment with the college was 3.5 years (range 10 weeks - 8 years). Three of the workers were smokers and the other ten nonsmokers. The most frequent complaint concerned the air quality of the LRC. Eleven of the thirteen employees complained of stuffy air, odors (vehicle exhaust emmissions and new mown grass), and variations in temperature. All thirteen employees reported at least two of the following symptoms: headache (8 persons) lethargy (7), sinus congestion (6), persistant colds (5), eye irritation (5), dizziness/faintness (4), nausea (3), nose

bleeds (2) and skin rash (1). Eight of the workers reported that their symptoms diminished or abated entirely when they were away from work for several days. Two of the LRC workers reported musculoskeletal stresses (back pain) associated with the use/access of the library video display terminal (VDT) and floor model card catalogues.

No employer generated medical records were available for review. It was further learned that CTC does not have an infirmary equipped with essential first aid supplies.

VII. DISCUSSION

All the environmental air concentrations of contaminants measured during the NIOSH survey were below the OSHA and NIOSH standards and ACGIH recommended evaluation criteria. Some LRC employees reported offensive odors which may be attributable to activities or conditions near the two intake air ports for the media distribution area and the television control and studio rooms (see Figure I). A few LRC employees reported that they detect a "newly cut" grass odor inside the building when the grass surrounding the LRC parking lot is mowed. Several staff members stated they periodically smelled "motor vehicle" type emissions in the early morning or late afternoon. During this time, the commuter traffic surrounding the LRC is at a maximum. CTC is located just above the industrialized Mill Creek Valley area and two major highways, I-74 and I-75. It may be possible that under certain meteorological conditions (i.e. air inversions and/or prevailing winds) emissions from the nearby industries and highway motor vehicles could enter the LRC through the fresh air make-up system.

Consequently, the reportedly uncomfortable work environment may be due to several factors, including: (1) the ventilation system make-up air being "contaminated" with odors/emissions from motor vehicles, mown grass, and possibly pollutants from industries located in the nearby Mill Creek Valley area; (2) the air-conditioning being shut off for 20 minutes of every hour, resulting in little or no air movement within the LRC offices; (3) the ventilation system being unbalanced resulting in inadequate fresh air supply and/or exhaust of stale air; and (4) relative humidity levels in excess of ASHRAE's[4] recommended comfort range.

VIII. RECOMMENDATIONS

The following recommendations are made to minimize the potential for outdoor contaminants to enter the building and to provide a more comfortable work environment.

1. Prohibit the parking/idling of motor vehicles near the LRC fresh air supply intakes.

2. Elevate the fresh air intake vents for the media distribution area and television rooms, to the roof in order to prevent exhaust contaminants from motor vehicles entering the building.

3. Private ventilation consultants should be retained by CTC to balance the LRC ventilation system.

4. Relative humidity levels should be maintained between 20 and 60 percent. This can probably be accomplished by keeping the air-conditioning system in the on mode for longer than 40 minutes of every hour.

5. In order to reduce the recycling of office pollutants, fresh (outdoor) make-up air should be maintained at a minimum volumetric flow rate of 5 CFM per occupant for non-smoking areas and at 20 CFM per person in areas where smoking is allowed.

6. To reduce the biomechanical stresses (low back pain) associated with the use/access of the library VDT and floor model card catalogues, (1) raise the floor model card catalogues; (2) place the library VDT on an adjustable work surface; (3) install an anti-glare screen on the library VDT; and (4) use a VDT operator's chair with an adjustable backrest and height control.[6,7]

7. With a student population of nearly 1700 and an employee staff of about 300, a health care unit equipped with appropriate first aid supplies and manned by personnel adequately trained to render first aid should be available.[8]

IX. REFERENCES

1. Occupational Safety and Health Administration OSHA safety and health standards. 29 CFR 1910.1000. Occupational Safety and Health Administration, revised 1980.

2. American Conference of Governmental Industrial Hygienists. Threshold limit values for chemical substances and physical agents in the workroom environment with intended changes for 1982. Cincinnati, Ohio: ACGIH, 1982.

3. American Society for Heating, Refrigerating, and Air-Conditioning Engineers. Ventilation for acceptable indoor air quality (ASHRAE Standard 62-1981). American Society for Engineers, 1791 Tullie Circle, N.E., Atlanta, GA 30329, 1981.

4. American Society for Heating, Refrigerating, and Air-Conditioning Engineers, Handbook of Fundamentals, New York, N.Y., 1977.

5. National Institute for Occupational Safety and Health. NIOSH/OSHA occupational health guidelines for chemical hazards. Cincinnati, OH; National Institute for Occupational Safety and Health, 1981. (DHHS NIOSH) publication no. 81-123).

6. National Institute for Occupational Safety and Health. NIOSH Research Report: potential health hazards of video display terminals. Cincinnati, Ohio: National Institute for Occupational Safety and Health, 1981 (DHEW (NIOSH) publication no. 81-129).

7. National Institute for Occupational Safety and Health. The industrial environment: it's evaluation and control, Chapter 32, Ergonomic Aspects of Biomechanics. Cincinnati, OH: National Institute for Occupational Safety and Health, 1973. (DHEW (NIOSH) publication no. 74-117).

8. Occupational Safety and Health Administration. OSHA safety and health standards. 29 CFR 1910.151. Medical Services and first aid. Occupational Safety and Health Administration, revised 1980.

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XI. 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 Technical College
2. NIOSH, Region V
3. OSHA, Region V

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 I

Environmental Evaluation Criteria

Cincinnati Technical College
Cincinnati, Ohio
HETA 82-269

SUBSTANCE	RECOMMENDED ENVIRONMENTAL LIMIT AND SOURCE (mg/m^3)	OSHA STANDARD (mg/m^3)	PRIMARY HEALTH EFFECTS[1]
Ammonia	18 (ACGIH)[2]	35	eye, nose, throat, and respiratory system irritation
Carbon Dioxide	9000 (ACGIH)	9000	headache, dizziness, and dyspnea
Carbon Monoxide	40 (NIOSH)[1]	55	headache, nausea, dizziness, and heart effects
Formaldehyde	____[3]	3.7	irritation to mucous membranes including the respiratory tract and eyes and a potential carcinogen
Ozone	0.2 (ACGIH)	0.2	irritation to eyes, nose, and throat and dyspnea
Nitrogen Dioxide	1.8 (NIOSH-15 min. ceiling)	9	eye irritation, dyspnea, pulmonary, edema, and tachycardia
Toluene	375 (NIOSH)	750	irritation of the eyes, respiratory tract, and skin, fatigue, headache, and dizziness

1. NIOSH/OSHA occupational health guidelines for chemical hazards. Cincinnati, OH: (DHHS NIOSH publication no. 81-123).[6]
2. American Conference of Governmental Industrial Hygienists (ACGIH) - 1982.[2]
3. NIOSH recommends that formaldehyde be handled in the workplace as a potential occupational carcinogen. An estimate of the extent of the cancer risk to workers exposed to various levels of formaldehyde at or below the current OSHA 3.7 mg/m^3 standard has not yet been determined. In the interim, NIOSH recommends that as a prudent public health measure, engineering controls and stringent work practices be employed to reduce occupational exposure to the lowest feasible limit.
4. mg/m^3 = milligrams per cubic meter of air
5. All air contaminants are time-weighted average (TWA) exposures for a normal workday, 40-hour workweek unless otherwise designated.

TABLE II

Results of Detector Tube Measurements

Cincinnati Technical College
Cincinnati, Ohio
HETA 82-269

July 14-15, 1982

SAMPLE LOCATION & DATE/TIME	SUBSTANCE	CONCENTRATION (mg/m^3)	EVALUATION CRITERIA[1] (mg/m^3)
Media Distribution Area 7/15/82 11:40	Carbon Dioxide	1800	9000
Media Distribution Area 7/15/82 11:45	Formaldehyde	N.D.[2]	-
Media Distribution Area 7/15/82 11:54	Ozone	N.D.	0.2
Media Distribution Area 7/15/82 11:59	Carbon Monoxide	3.4	40
Media Distribution Area 7/15/82 12:05	Nitrogen Dioxide	N.D.	1.8 (ceiling)
Workroom #147 7/15/82 13:50	Formaldehyde	N.D.[2]	-
Workroom #147 7/15/82 13:57	Ozone	N.D.	0.2
Workroom #147 7/15/82 14:02	Carbon Dioxide	1080	90000
Workroom #147 7/15/82 14:06	Nitrogen Dioxide	N.D.	1.8 (ceiling)
Workroom #147 7/15/82 14:10	Carbon Monoxide	Trace	40

(Continued)

TABLE II
(Continued)

SAMPLE LOCATION & DATE/TIME	SUBSTANCE	CONCENTRATION (mg/m^3)	EVALUATION CRITERIA[1] (mg/m^3)
Television Control Room 7/14/82 14:30	Formaldehyde	N.D.[2]	-
Television Control Room 7/14/82 14:45	Ozone	N.D.	0.2
Television Control Room 7/14/82 14:55	Carbon Monoxide	N.D.	40
Television Control Room 7/14/82 15:04	Carbon Dioxide	1440	9000
Television Control Room 7/14/82 15:10	Ammonia	N.D.	35
Television Control Room 278A 7/14/82 15:40	Formaldehyde	N.D.	-
Television Control Room 277 7/14/82 16:00	Formaldehyde	N.D.	-
Television Studio 7/14/82 14:05	Carbon Monoxide	N.D.[2]	40
Television Studio 7/14/82 14:14	Carbon Dioxide	1800	9000
Television Studio 7/14/82 14:20	Ozone	N.D.	0.2
Television Studio 7/14/82 14:25	Formaldehyde	N.D.	-

1. Evaluation Criteria (See Table I)
2. N.D. = nondetectable concentration
3. mg/m^3 = milligrams per cubic meter of air

TABLE III

Results of Environmental Air Samples For Organics
Area Samples

Cincinnati Technical College
Cincinnati, Ohio
HETA 82-269

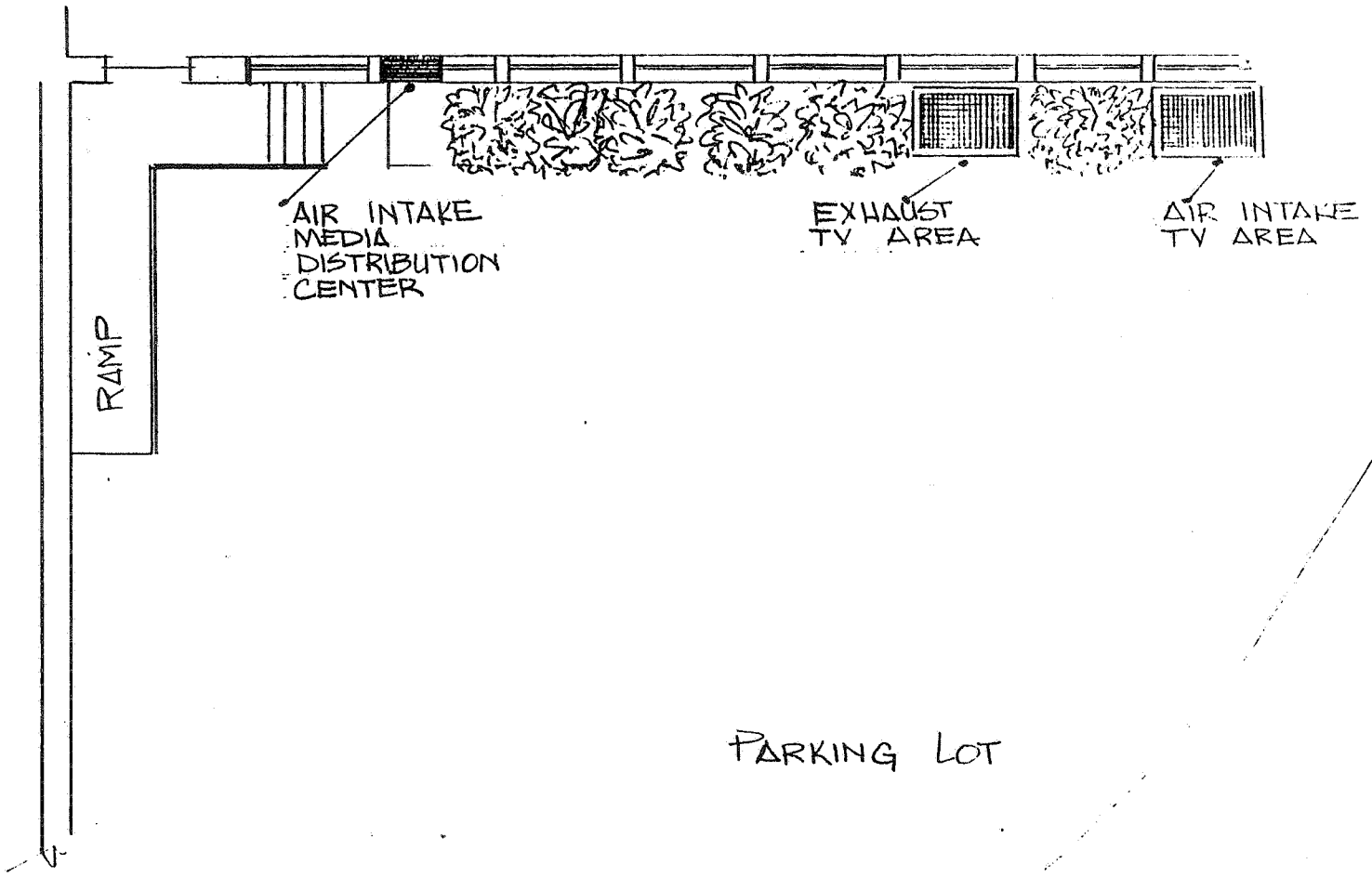
July 15, 1982

SAMPLE LOCATION	SAMPLE VOLUME (LITERS)	SAMPLE TIME	TOLUENE (mg/m^3)	PERCHLOROETHYLENE (mg/m^3)
Media Distribution Area	26.3	08:28-15:48	>1.0	N.D.[1]
Television Studio	21.8	08:34-15:53	N.D.[1]	N.D.
Television Control Room	21.4	08:40-15:49	N.D.	N.D.
Evaluation Criteria (normal workday, 40 hr/wk time weighted average)			375	335
Laboratory analytical limit of detection (mg/sample)			0.01	0.06

1. N.D. = nondetectable concentration

2. mg/m^3 = milligrams per cubic meter of air

FIGURE I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