CDC Workplace Safety and Health™

NIOSH HEALTH HAZARD EVALUATION REPORT:

HETA #2002-0343-2902
Fayette County Courthouse
Uniontown, Pennsylvania

May 2003

DEPARTMENT OF HEALTH AND HUMAN SERVICES
Centers for Disease Control and Prevention
National Institute for Occupational Safety and Health

NIOSH

PREFACE

The Field Studies Branch (FSB) of the National Institute for Occupational Safety and Health (NIOSH) conducts field investigations of possible respiratory health hazards in the workplace. These investigations are conducted under the authority of Section 20(a)(6) of the Occupational Safety and Health (OSHA) 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.

FSB also provides, upon request, technical and consultative assistance 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. Mention of company names or products does not constitute endorsement by NIOSH.

ACKNOWLEDGMENTS AND AVAILABILITY OF REPORT

This report was prepared by Christopher Coffey and Stephen Martin of the Laboratory Research Branch (LRB), and Nancy Sahakian, M.D. (Field Studies Branch), Division of Respiratory Disease Studies (DRDS). Field assistance was provided by Catherine Calvert, Robert Lawrence, Judith Hudnall, Matthew Duling (LRB, DRDS), and Steven Fotta (Office of Administrative and Management Services). Analytical support was provided by DataChem Laboratories, Inc. Desktop publishing was performed by Terry Rooney. Review and preparation for printing were performed by Penny Arthur.

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Highlights of the NIOSH Health Hazard Evaluation

Evaluation of Occupational Exposures and Health Concerns Among Employees at the Fayette County Courthouse Uniontown, Pennsylvania

In July 2002, the National Institute for Occupational Safety and Health (NIOSH) received a formal request for a health hazard evaluation (HHE) from employees at the Fayette County Courthouse in Uniontown, Pennsylvania, for health concerns related to the quality of the air.

What NIOSH Did

- We met with Fayette County and union representatives.
- An extensive indoor environmental quality evaluation was conducted including measurement of ventilation flow rates, carbon dioxide and carbon monoxide concentrations, temperature, and relative humidity.
- Instantaneous and one-week area air samples were collected in basement and first-floor offices and analyzed for volatile organic compounds.
- Swab samples were collected to determine the presence of mold.

What NIOSH Found

- Not enough fresh air was being supplied to the work areas.
- Heavy mold contamination was detected in some areas of the building.
- Temperature and carbon dioxide levels were largely within recommended values in all monitored areas.
- All volatile organic compound exposures were determined to be less than 1.0 ppm.

What County Managers Can Do

- Regularly clean the chilled-water fan-coil units and duct work.
- Provide adequate fresh air to all work areas.
- Repair any inoperable fans.
- Correct water leaks in pipes, roof, walls, etc.
- Replace damaged walls and ceiling tiles.
- Communicate to employees what is being done to improve the air quality.
- Establish an IAQ team consisting of a coordinator and representatives of the building employees, employers, and building management to oversee implementation of the program.

What Courthouse Employees Can Do

- Participate in educational or informational sessions regarding the courthouse air quality.
- Promptly notify building maintenance personnel of any water leaks.

What To Do For More Information:
We encourage you to read the full report. If you would like a copy, either ask your health and safety representative to make you a copy or call 1-513/841-4252 and ask for HETA Report #2002-0343

Health Hazard Evaluation Report 2002-0343-2902
Fayette County Courthouse

Uniontown, Pennsylvania
May 2003

Christopher C. Coffey, Ph.D.
Stephen B. Martin, Jr.
Nancy Sahakian, M.D.

SUMMARY

In July 2002, the National Institute for Occupational Safety and Health (NIOSH) received a request for a health hazard evaluation (HHE) from employees at the Fayette County Courthouse in Uniontown, Pennsylvania. Employees had reported a variety of health concerns: headaches, nausea, tiredness, nasal and sinus symptoms, vomiting, burning eyes, sore throats, breathing problems, coughing, ear infections, and dizziness. The employees reported strong and unpleasant odors from the carpeting, old papers, and dirty ceiling tiles; poor air quality; lack of airflow; stale water; mold, fungus, and mildew; asbestos; excessive dust; and dampness. All of the concerns involved the basement and first floors of both the original courthouse and annex buildings.

On August 28, 2002, NIOSH investigators completed a preliminary site walkthrough evaluation. Medical interviews and an environmental investigation were conducted in October of 2002. The environmental investigation revealed a number of locations in the courthouse that may have had mold growth due to water incursion or leakage. The ventilation systems in most of the basement and first floors were inadequate (i.e., air changes and the amount of fresh air entering the offices did not meet the American Society of Heating, Refrigerating, and Air-Conditioning Engineers [ASHRAE] minimum requirements). Temperature, relative humidity, carbon dioxide and carbon monoxide levels were largely within recommendations in all monitored areas. The levels for volatile organic compounds were generally below established exposure limits.

The ventilation systems should be upgraded to meet ASHRAE recommendations. Water leaks should be repaired and damaged ceiling tiles and walls should be replaced with care to ensure that any generated dust does not enter occupied sections of the building.

Interviewed office workers reported respiratory symptoms consistent with asthma with onset after the date of hire. Environmental assessment demonstrated insufficient ventilation, mold growth, and water incursion in the building.

Keywords: SIC 921(Executive, Legislative, and Other), indoor air quality, indoor environmental quality, IAQ, IEQ, asthma

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INTRODUCTION

In July 2002, the National Institute for Occupational Safety and Health (NIOSH) received a request for a health hazard evaluation (HHE) from 50 employees at the Fayette County Courthouse in Uniontown, Pennsylvania. Employees had reported a variety of health complaints: headaches, nausea, tiredness, nasal and sinus symptoms, vomiting, burning eyes, sore throats, breathing problems, coughing, ear infections, and dizziness. The employees reported strong and unpleasant odors from the carpeting, old papers, and dirty ceiling tiles; poor air quality; lack of airflow; stale water; mold, fungus, and mildew; asbestos; excessive dust; and dampness. All of the concerns involved the basement and first floors of both the original courthouse and the annex.

An opening meeting and site walkthrough survey was conducted on August 28, 2002. NIOSH personnel met with Fayette County representatives from the Office of Human Resources, the Controller's office, the Facilities Department, the County Board of Commissioners, and the Service Employees International Union. Reports from a previous indoor environmental quality (IEQ) assessment were reviewed. Preliminary volatile organic compound (VOC) air samples were taken in a records room in the basement of the annex where employees believed the strongest odors to be. On September 6, 2002, additional VOC air samples were taken in the records room and the first-floor Clerk of Courts' office. An indoor environmental survey was conducted on October 28-29, 2002. Prior to the October 28-29, 2002 visit, a building-related asthma questionnaire was administered to a number of employees over the telephone. This final report serves to summarize the various activities, observations, and findings and closes this evaluation.

BACKGROUND

The Fayette County Courthouse is located at 61 East Main Street in Uniontown, Pennsylvania. It is a three-story masonry building with a basement constructed in 1890-1891. In 1927, a three-story annex connected to the original building by a corridor on each floor was constructed. The number of employees in the courthouse is approximately 200. The buildings house the county courtrooms, judges' chambers, a veteran's office, law library, a Penn State University Agricultural Extension office, and the offices of the County Commissioners, Controller, Prothonotary, Recorder of Deeds, Coroner, Sheriff, Public Defender, District Attorney, Register of Wills, Treasurer, Jury Commissioner, and Clerk of Courts. The courthouse's heating was provided by space heaters in some rooms and radiators supplied with steam from a central source. Individual window units provided air conditioning. General ventilation was provided by a number of independent systems with only a few having the capacity for outside air intake. The intakes were wall-mounted above ground level. The purpose of the general ventilation was to provide air circulation.

In May and June 2002, an investigation was conducted by AGX, Inc. to determine the general indoor air quality of the Controller's Office located on the basement and first-floor level of the courthouse. The Maintenance Department requested this investigation due to complaints received from occupants who reported symptoms of discomfort while spending time in this area.

That investigation was limited to the Controller's office and was performed in two site visits.[1,2] It consisted of: (1) a survey to gather information about the occupants' concerns; (2) preliminary assessment of suspect surfaces to determine fungal contamination; (3) preliminary assessment of air quality based on bioaerosol particulate (fungal spores) concentrations, volatile organic compounds (VOCs), formaldehyde, arsenic particulate in air, and various gases such as hydrogen sulfide; and (4) real-time monitoring of indoor air quality indicators such as temperature, relative humidity, and carbon dioxide.

The AGX, Inc. investigation determined that the duct lining in the supply vent in the Controller's office had medium to heavy fungal contamination with *Penicillium* as the dominant species. The samples of the carpet on both floors indicated elevated fungal

concentrations. In the basement samples, *Hormonema dematiodes* was the dominant species; while on the first floor, it was *Chaetomium*. *Cladosporium* was found on damaged pipe insulation in the basement. The total bioaerosol fungal counts in the office suite were lower than the average outside concentration. AGX, Inc. reported the volatile organic compounds as hexane. They measured a concentration of 0.57 parts per million (ppm).[1] The results for arsenic, formaldehyde, and the other gases were below the detection limits. The air quality indicators (temperature, relative humidity, and carbon dioxide) showed that a potential deficiency might exist in the office ventilation.

Based on the results of the AGX, Inc. investigations, the Controller's office suite was remodeled in late 2002. In the first-floor offices, all of the carpeting was removed, the flooring underneath was sealed, plywood installed, and tile installed except in two offices where new carpeting was placed. In the basement portion of the office, all of the ceiling tiles, ductwork, and flooring were replaced.

METHODS

Environmental Evaluation

Three NIOSH personnel made an initial site visit to the Fayette County Courthouse on August 28, 2002. During the opening meeting of this visit, it was determined that the Prothonotary's basement storage room would be the location of the initial sampling since it had the strongest odors (e.g., a musty, old paper odor). Instantaneous VOC samples were collected.

On September 6, 2002, two NIOSH personnel obtained additional VOC air samples in the basement records room (where the preliminary samples were taken) and in the Clerk of Courts' offices (inside a rusted cabinet and in the basement office).

During October 28 and 29, a team of five NIOSH personnel performed the main survey. This consisted of instantaneous and 168-hour (one-week) time-weighted average (TWA) VOC samples in several locations, direct-reading instrument sampling of indoor environmental quality (IEQ) indicators, a visual and boroscopic examination and flow measurements of the ventilation system in several locations, a detailed examination of the Clerk of Courts' office wall, an examination of the inside of the wall with possible mold on it in the Coroner's office, and swab sampling of some potential mold areas. In addition, a sample of the potentially contaminated paneling from the Coroner's office was taken for analysis to determine if the contamination was releasing any potentially harmful VOCs.

On November 4, 2002, the 168-hour TWA VOC samples were turned off. Outside instantaneous VOC samples were taken at several locations. Figures 1 through 4 show all the sampling locations.

Volatile Organic Compounds (VOCs)

Instantaneous air samples for VOC analysis were collected in evacuated Entech Silonite™ coated 0.4-liter (P/N 29-MC400L) or 1-liter (P/N 29-MC1000L) canisters which fill with air immediately upon activation. The 168-hour (one-week) time-weighted average samples were taken with 6-liter (P/N 01-29-106228) canisters connected to Entech TWA samplers (P/N 39-CS1200E5 or 39-CS1200P5). The TWA samplers restricted the flow into the canisters such that it took one week for the canisters to fill. The wallboard sample from the Coroner's office was placed in a 0.4 L headspace jar consisting of a coated enclosure (P/N 39-72224) and jar cover with a quick disconnect fitting (P/N 39-74020).

Gas chromatography was used to analyze the air and headspace samples for VOCs. The analysis system for the 0.4 and 1-liter canisters consisted of an Entech Model 7100 preconcentrator and an Agilent Technologies Model 5890 gas chromatograph with a Model 5972 mass selective detector. The 6-liter canisters were analyzed using an Agilent Technologies 6980 gas chromatograph and a 5873N mass selective detector connected to an Entech 7100

preconcentrator. The 7100 preconcentrators were programmed with EPA TO-15 canister analysis method using Microscale Purge and Trap Water Management. The air sample was trapped cryogenically on glass beads in the first module to concentrate the VOCs. The module was then heated and helium transferred the VOCs to the second module containing Tenax. In the second module, the carbon dioxide (CO_2) was purged. After the second module, the sample was cryo-focused in the third module allowing a rapid injection of the VOCs onto the HP-5MS 30m x 0.32 mm x 0.25 µm column. The gas chromatograph was programmed with an initial oven temperature of -30ºC. This temperature was held for 2 minutes. The oven temperature was then ramped at 8ºC/min until a temperature of 220ºC was reached. The oven temperature was then held constant for 5 minutes. The total run-time for a sample was approximately 28 minutes. The resulting chromatograms were analyzed for compound identification and concentration using Agilent Technologies Chemstation software.

Indoor Environmental Quality (IEQ) Parameters

Indicators of occupant comfort [relative humidity (RH), temperature, carbon dioxide (CO_2), and carbon monoxide (CO)] were measured in the first-floor Controller's office, the Clerk of Courts' office, and the Prothonotary's basement storage area (Figures 1 and 3). These three areas were selected for long duration, continuous sampling due to the employees stating these were the worst areas. These measurements were taken once a minute with TSI Q-Traks model 8551 (TSI Inc., St. Paul, MN). The model 8551 is an electronic meter capable of running on either battery or AC power. The meter is capable of providing direct readings for dry-bulb temperature using a thermistor and RH using a thin-film capacitive sensor, ranging from 32ºF to 122ºF (±0.6ºF) and 5% to 95% (± 3%), respectively. The model 8551 measures CO_2 with a non-dispersive infrared sensor and CO with an electrochemical sensor in the range of 0 to 5,000 ppm (±3% of reading) and 0 to 500 ppm (±3% of reading), respectively. The instruments were calibrated for temperature and RH by the manufacturer in accordance with their standards and recommendations.[3] Just prior to use, the instruments were calibrated for CO_2 and CO with certified gas standards provided by the manufacturer. Instantaneous temperature and humidity readings were taken in the basement District Attorney's office (detective area), the back of the Prothonotary basement records room, and the reception area of the Sheriff's office with Extech Instruments, model 445580 humidity/temperature pens. These locations were chosen because they either felt warm and humid during the walk-through or the employees expressed concerns.

Fungal Swab Samples

Fungal swab samples were taken by rubbing a sterile cotton swab over approximately four square inches of the area that had potential mold growth (Figure 5). Samples were taken from: (1) the chilled-water fan-coil unit number 1 above the suspended ceiling in the snack room, (2) the chilled-water fan-coil unit number 2 above the suspended ceiling in the snack room, (3) the condensate pan of the chilled-water fan-coil above suspended ceiling in snack room, (4) the fan-coil unit supply diffuser vent above the freezer in snack room, (5) the metal filing cabinets in the room anterior to the water meter room (between the witness waiting and water meter rooms) in the basement, (6) the paper pile in the water meter room, (7) the vent in the assistant district attorney's office in the basement, (8) the pipes above the assistant district attorney's office in the basement, (9) the ceiling tile with apparent mold from assistant district attorney's office in basement, (10) the wall paneling in semicircular assistant district attorney's office in basement, and (11) the coroner's office arched wall separating the coroner's private office from the conference area (samples were taken of both the white and black materials). The samples were then analyzed for fungal contamination by P&K Microbiology Services, Inc. by counting the number of colonies cultured on DG18 and 2% malt extract agar media.

Ventilation Measurements

Airflow measurements were taken of all the 2-foot-square supply and return vents using a TSI AccuBalance® Plus Air Capture Hood, Model 8373. The 8373 can measure flows between 30 and 2,000 cubic feet per minute (cfm) with an accuracy of ±5% reading and ±5 cfm. When the vents were of a size other than 2-foot-square, either a TSI Model AM-600 (11.5 inch round) or AM-1200 (8.5 inch by 24 inch) airflow horn with a model 8386 VELOCICALC ® Plus Multi-parameter ventilation meter was used.

Medical Interviews

Of the 50 health hazard evaluation requesters, 35 provided both their name and contact telephone number(s). Four workers, selected on the basis of respiratory symptoms on the health hazard evaluation request, were interviewed by telephone.

EVALUATION CRITERIA

As a guide to the evaluation of the hazards posed by workplace exposures, NIOSH field staff employ environmental evaluation criteria for the assessment of a number of chemical and physical agents. These criteria are intended to suggest levels of exposure to which most workers may be exposed up to 10 hours per day, 40 hours per week for a working lifetime without experiencing adverse health effects. It is, however, important to note that not all workers will be protected from adverse health effects even though their exposures are maintained below these levels. A small percentage may experience adverse health effects because of individual susceptibility, a pre-existing medical condition, and/or a hypersensitivity (allergy). In addition, some hazardous substances may act in combination with other workplace exposures, the general environment, or with medications or personal habits of the worker to produce health effects even if the occupational exposures are controlled at the level set by the criterion. These combined effects are often not considered in the evaluation criteria. Also, some substances are absorbed by direct contact with the skin and mucous membranes, and thus potentially increases the overall exposure. Finally, evaluation criteria may change over the years as new information on the toxic effects of an agent become available.

The primary sources of environmental evaluation criteria for the workplace are: (1) NIOSH Recommended Exposure Limits (RELs),[4] (2) the American Conference of Governmental Industrial Hygienists' (ACGIH®) Threshold Limit Values (TLVs®),[5] and (3) the U.S. Department of Labor, Occupational Safety and Health Administration (OSHA) Permissible Exposure Limits (PELs).[6] Employers are encouraged to follow the OSHA PELs, the NIOSH RELs, the ACGIH TLVs, or whichever are the more protective criterion. The NIOSH RELs are recommendations and cannot be legally enforced.[7] The OSHA PELs are listed in federal regulations which are legally enforceable.[6]

OSHA requires an employer to furnish employees a place of employment that is free from recognized hazards that are causing or are likely to cause death or serious physical harm [Occupational Safety and Health Act of 1970, Public Law 91–596, sec. 5(a)(1)]. Thus, employers should understand that not all hazardous chemicals have specific OSHA exposure limits such as PELs and short-term exposure limits (STELs). An employer is still required by OSHA to protect their employees from hazards, even in the absence of a specific OSHA PEL.

A time-weighted average (TWA) exposure refers to the average airborne concentration of a substance during a normal 8- to 10-hour workday. Some substances have recommended STEL or ceiling values which are intended to supplement the TWA where there are recognized toxic effects from higher exposures over the short-term.

Indoor environmental quality is affected by the interaction of a complex set of factors that are constantly changing. Four elements involved in the development of IEQ problems are: (1) sources of odors or contaminants, (2) problems with the design or operation of the heating, ventilation, and air conditioning (HVAC), (3) pathways between contaminant sources and the location of complaints,

and (4) the activities of building occupants. A basic understanding of these factors is critical to preventing, investigating, and resolving IEQ problems.

The symptoms and health complaints reported to NIOSH by non-industrial building occupants have been diverse and usually not suggestive of any particular medical diagnosis or readily associated with a causative agent. A typical spectrum of symptoms has included headaches, unusual fatigue, varying degrees of itching or burning eyes, irritations of the skin, nasal congestion, dry or irritated throats, and other respiratory irritations. Usually, the workplace environment has been implicated because workers report that their symptoms lessen or resolve when they leave the building.

A number of published studies have shown prevalences of symptoms among occupants of office buildings. Scientists investigating IEQ problems believe that there are multiple factors contributing to building-related occupant complaints. Among these factors are imprecisely defined characteristics of HVAC systems, cumulative effects of exposure to low concentrations of multiple chemical substances, odors, higher than normal levels of particulate matter, microbial contamination, and physical factors such as lightning, noise levels, and thermal comfort.[8,9,10,11]

Problems that previous research has uncovered in the non-industrial indoor environment have included poor air quality due to ventilation system inadequacies and/or problems, overcrowding, VOCs being emitted from the furnishings, office equipment such as fax machines and copiers, emissions from the building structure and contents, microbial contamination, and outside air pollutants; comfort problems due to improper temperature and RH conditions, poor lightning, high noise levels; adverse ergonomic conditions; and job-related psycho-social stresses. In most cases, these problems could not be directly linked to the health effects being reported.[8,9,10,11]

Regulatory standards for non-industrial indoor environments currently do not exist. NIOSH, OSHA, and ACGIH have promulgated regulatory standards or published recommended limits for occupational exposure. With a limited number of exceptions, air contaminant concentrations found in non-industrial indoor air environments usually fall well below these occupational standards and recommended exposure limits.

Measurement of indoor environmental contaminants has rarely been useful in determining the cause of symptoms and complaints except in cases where there are strong or unusual sources, or a proven relationship between contaminants and specific building-related illnesses. The low-level concentrations of particles and mixtures of organic materials usually found are difficult to interpret and usually impossible to causally link to observed and reported health symptoms. Measuring ventilation and comfort indicators such as CO_2, temperature, and RH, has proven to be useful in providing information relative to the proper functioning and control of HVAC systems. The American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) has published recommended building ventilation design criteria and thermal comfort guidelines.[12,13]

Volatile Organic Compounds (VOCs)

Volatile organic compounds are found both in ambient and indoor air environments, including offices, commercial and retail buildings, and houses. Hundreds of different VOCs have been identified in indoor environments. The VOCs come from three sources: air being brought into the building from the outside, emissions from the materials in the building, and human activities inside the building. Building materials can adsorb VOCs thereby acting as reservoirs which slowly release the VOCs over time. Due to VOCs being generated inside buildings, the ratio of indoor-to-outdoor concentrations can be quite high (as much as 18-to-1).[14]

Table 1 lists the VOCs found during the study with the corresponding concentration at which most people can detect the VOC (i.e., the odor threshold), the NIOSH and OSHA exposure limits, and common

uses. The method of defining and determining odor thresholds varies widely which leads to a significant range of odor thresholds in the literature. Individuals may also respond differently to the same odor. At a given concentration, one person may smell and recognize the odor, while another person may barely notice it. The odor threshold values reported in the literature are often for a single compound with no other chemicals present. The cumulative concentration of all VOCs present may have a perceptible odor to some individuals.[15]

Indoor Environmental Quality (IEQ) Parameters

Temperature and Relative Humidity (RH)

The perception of comfort is related to one's metabolic heat production, the transfer of heat to the surrounding environment, physiological adjustments, and body temperatures. Heat transfer for a person's body to the environment is influenced by factors such as temperature, humidity, air movement, personal activities, and clothing. American National Standard Institute (ANSI)/ASHRAE Standard 55-1992 specifies conditions in which 80% or more of the occupants would be expected to find the environment thermally comfortable.[13] The recommended level of relative humidity is 30% to 60% RH. Relative humidity below 30% may

produce discomfort from dryness. Relative humidity should be at the lowest possible level in order to inhibit microbiological growth. The recommended range for temperature in winter is 68ºF to 76ºF and 74ºF to 80ºF in summer. As temperature increases beyond 76ºF, air quality is perceived as degraded regardless of the actual quality. The OSHA recommendations are: humidity control in the range of 20% to 60% and temperature in the range 68ºF to 76ºF.[16]

Carbon Dioxide (CO_2)

CO_2 is a normal constituent of exhaled breath and, if monitored, may be useful as a screening technique to evaluate whether adequate amounts of fresh air are being brought into an occupied space. The ASHRAE Standard 62-2001, Ventilation for Acceptable Indoor Air Quality, recommends outdoor air supply rates of 20 cubic feet per minute per person (cfm/person) for office spaces and conference rooms, and 15 cfm/person for reception areas, and provides estimated maximum occupancy figures for each area.[12]

Indoor CO_2 concentrations are normally higher than the generally constant ambient or outdoor concentration (300 to 350 ppm). When indoor CO_2 concentrations exceed 800 ppm in areas where the only known source is exhaled breath, inadequate ventilation is suspected. Elevated CO_2 concentrations suggest that other indoor contaminants may also be increased.[17]

Carbon Monoxide (CO)

At low concentrations, carbon monoxide causes fatigue in healthy people and chest pain in people with heart disease. At higher concentrations, it causes impaired vision and coordination, headaches, dizziness, confusion, and nausea. It can produce flu-like symptoms that clear up after leaving the area where it is present. Carbon monoxide is fatal at very high concentrations. The NIOSH REL for carbon monoxide is 35 ppm.[7] The OSHA PEL is 50 ppm.[6]

Fungi

The growth of molds is common throughout the outdoor environment. Given the proper conditions, molds may also grow in the indoor setting. Molds enter indoor environments by circulating through doorways, windows, heating, ventilation systems, and air conditioning systems. Spores in the air also deposit on people, making clothing, shoes, etc., common carriers of mold into indoor environments. The most common indoor molds are *Cladosporium, Penicillium, Aspergillus,* and *Alternaria*.[18]

Molds are a type of fungi. They survive by using plants and decaying organic matter for food. Molds reproduce by releasing tiny spores that are carried by air currents to other locations. Mold spores are so small that magnification is usually required to see

them. Molds are widely distributed in nature and human exposure to mold spores occurs commonly, both indoors and outdoors, at home and at work. It is important to understand that no environment is completely free from mold spores, not even a surgical operating room.

Medical Issues

A small percentage of people may experience symptoms such as mucous membrane irritation, runny nose, and upper airway congestion when exposed to excessive mold in a building. Less common symptoms such as breathing difficulties may also occur. The types and severity of symptoms depend in part on the types and extent of the mold, the extent of the individual's exposure, and the susceptibility of the individual (for example, whether they have pre-existing allergies or asthma). In general, excessive exposure to mold may produce health problems by several primary mechanisms, including: (1) allergy or hypersensitivity, (2) irritant effects, (3) infection, and (4) toxic effects. Each of these is discussed below.

Allergy or Hypersensitivity

Inhaling or touching mold or mold spores may cause allergic reactions in sensitized (allergic) individuals. Allergic responses are usually characterized by: sneezing; itching of the nose, eyes, mouth, or throat; nasal stuffiness and runny nose; and red, itchy eyes. Repeated or single exposure to mold or mold spores may cause previously non-sensitized individuals to become sensitized.

Asthma. Molds can trigger asthma symptoms (shortness of breath, wheezing, cough) in persons who are allergic to mold. A recent review of the scientific literature concluded that exposure to molds in the indoor environment may make pre-existing asthma worse, but also concluded that there was not enough evidence to determine whether exposure to mold in the indoor environment could cause asthma.

Hypersensitivity pneumonitis. Hypersensitivity pneumonitis, which can result when the immune system reacts to certain types of inhaled substances (such as mold spores), is a rare illness which may resemble bacterial pneumonia. Typically this condition involves respiratory symptoms (such as cough, shortness of breath, and sometimes wheezing) as well as other symptoms (such as extreme fatigue and low-grade fever). It has developed in people following both short-term (acute) and long-term (chronic) exposure to molds.

Irritant Effects

Exposure to excessive concentrations of molds in airborne dust can cause irritation of the eyes, skin, nose, throat, and lungs. Irritation of the upper and lower airways may possibly cause a worsening of pre-existing conditions such as allergic symptoms or asthma. Molds produce a variety of volatile organic compounds, the most common of which is ethanol, that may also cause upper airway irritation.

Infection

People with weakened immune systems (immune-compromised or immune-suppressed individuals) may be more vulnerable to infections by molds. For example, *Aspergillus fumigatus*, a mold that has been found almost everywhere on every conceivable type of substrate, has been known to infect the lungs of immune-compromised individuals after inhalation of the airborne spores. Healthy individuals are usually not vulnerable to infections from airborne mold exposure.

Toxic Effects

Recently, there has been increased concern related to exposure to specific molds that produce toxic substances called mycotoxins. Illness associated with exposures (from inhalation and/or skin contact) to mycotoxins in agricultural or industrial environments has been reported. However, there is currently no conclusive evidence of a link between mycotoxin exposure in the indoor environment and human

illness. Some of the molds that are known to produce mycotoxins have been commonly found in moisture-damaged buildings; research is ongoing related to the importance of these findings.

Indoor Mold Prevention

There are essentially no exposure guidelines for mold in air. Therefore, it is not possible to distinguish between safe and unsafe levels of exposure. We do know, however, that moisture intrusion along with nutrient sources such as building materials or furnishings allow mold to grow indoors. It is extremely important, therefore, to keep the building interior and furnishings dry to prevent unwanted mold growth. Areas which have poor air circulation and a source of moisture are likely to be sources for fungal amplification. Table 2 provides a suggested qualitative assessment of surface contamination by the University of Minnesota.[19] Attempts to link surface contamination to airborne concentrations of fungal organisms are often difficult. There are at present no strict numerical guidelines which are appropriate for assessing whether the surface contamination in an area is acceptable or not.

Ventilation

For office buildings, ASHRAE recommends air movement of 25 to 45 feet per minute and 4 to 10 air changes per hour.[20] ASHRAE also recommends that a minimum of 20 cubic feet per minute of outside or fresh air be supplied to each person in an office.[12]

RESULTS

Environmental Evaluation

The various sampling locations are shown in Figures 1 through 4.

Visual Inspection of Occupied Spaces

During the walk-through evaluation of the basement and first floor, water stains and/or damaged plaster were noticed in the following basement offices: the Lower Commissioner's (Figure 6), Public Defender's (Figure 7), Sheriff's Gun Permits (Figure 8), and the Witness Waiting Room (Figure 9). Water stains were present on the first-floor offices of the Controller (Figure 10) and Treasurer (Figure 11). Dirty and possibly moldy vents were found in the lunch room (Figure 12), and the Witness room (Figure 13). Possible mold was found on the back of a ceiling tile in the basement District Attorney's office (Figure 14); pipes above the ceiling in the Sheriff's Gun Permits office and the Clerk of Courts' basement storage room (Figure15); wall in the Coroner's office (Figure 16); inside of exterior walls of the Assistant District Attorney's basement office (Figure 17) and the Clerk of Courts' basement storage room (Figure 18).

In the first-floor office of the Clerk of Courts, it was noticed that the wallpaper was bulging (Figure 19). At the bottom of this section of wallpaper, a white dust was found (Figure 20). It was hypothesized that this dust was either crumbled plaster or wallboard.

(The employees in the office stated that the wallpaper was put on over mildew.) The back of the sagging wallpaper in the Clerk of Courts' first-floor office was examined (Figures 21 and 22), which revealed that mold may have been present at one time.

The outside of the building was examined for places where water could enter the building. An opening was located under each window on all three floors (Figure 23). In some instances, these openings were plugged (Figure 24). The openings on the second floor may have allowed in some of the water that damaged the Clerk of Courts' office wallpaper. In the front (main) office of the Clerk of Courts' suite a cabinet was rusted out with possible mold growth on the wall behind it (Figure 25). It was noted that the renovated Controller's office was cleaner than the other areas.

Paper covered supply vents in some of the rooms (Figure 26). General housekeeping was poor in some areas of the basement (Figures 27 through 29).

A boroscope was used to look inside the arch wall in the Coroner's office since the outside apparently was heavily contaminated with mold (Figure 30). The boroscopic examination revealed that the inside of the wall was also heavily contaminated (Figure 31) suggesting that the mold may have originated inside the wall and migrated through the wood paneling.

Volatile Organic Compounds (VOCs)

A total of 122 air and headspace samples were analyzed for VOCs (Tables 3 through 5). The analysis revealed 25 compounds that appeared in 5 or more samples with concentrations greater than or equal to 0.001 parts per million (ppm). The results in Tables 3 through 5 are generally much lower than the NIOSH RELs, OSHA PELs, and odor thresholds given in Table 1. The headspace analysis of the contaminated portion of the Coroner's office wall resulted in very low concentrations (<0.006 ppm) of some of the compounds found in the air samples and was not a source of high levels of VOCs. The outside air samples (Table 6) contained a number of the same chemicals and concentrations as the air samples taken inside the courthouse. Some of the chemicals found in the courthouse were probably entering the courthouse from the outside.

Indoor Environmental Quality (IEQ) Parameters

Figures 32 through 34 show the IEQ parameters as measured by the TSI Q-Traks in the Prothonotary's basement storage area, the first-floor Clerk of Courts' office, and the first-floor Controller's office. In the Prothonotary's basement storage area (Figure 32), the CO_2 concentration was less than 550 ppm, which is well below the maximum recommended level of 800 ppm, for most of the week-long sampling period. During the first and second days of sampling, there was one peak of approximately 750 ppm. Since the concentration of CO was very low (essentially zero) throughout the sampling period, it is not graphed. The relative humidity level was within the recommended range for most of the sampling period. During mid-afternoon of November 1, 2002, the relative humidity was less than 30%. The temperature exceeded the ASHRAE and OSHA recommended maximum winter temperature of 76^0F during the afternoon of October 28, 2002 and from the morning of October 30, 2002 to the end of the sampling period.

Figure 33 does not contain CO_2 information for the Clerk of Courts' office because the sensor failed near the beginning of the sampling period. Since the CO level was 0 for the sampling period, it is not graphed. The temperature and relative humidity were within the recommended levels during the workday (9:00 A.M. to 5:00 P.M.).

In the first-floor Controller's office, the recommended level of 800 ppm for CO_2 was exceeded for several hours on October 28, 2002 (Figure 34). At the beginning of the sampling period, the temperature reached approximately 82^0F. Since the CO level was 0 for the sampling period, it is not graphed. The temperature immediately started to decrease and remained within the recommended levels until the end of the sampling period.

The temperature and humidity pen readings (Table 7) showed humidity readings that were all within recommended values. The temperatures in the back of the records room and the Sheriff's reception room were slightly above the recommended maximum value.

Fungal Swab Samples

The samples from the chilled-water fan-coil unit numbers 1 and 2 above the suspended ceiling in the snack room contained hardly any fungi [approximately 3,000 and 1,000 total colony forming units (CFUs) per sample, respectively]. The sample taken from the condensate pan of the chilled-water fan-coil above the suspended ceiling in the snack room was not sent out for microbiological analysis since it was determined that the sample was rust. The sample from the fan-coil unit supply diffuser vent above the freezer in the snack room resulted in approximately 800,000 total CFUs (71% *Cladosporium* and 29% *Penicillium*). The file

cabinets and paper in the water meter room area did not have any fungi present.

A swab from the vent in the Assistant District Attorney's office in the basement had some fungi present; a total of 250,000 CFUs were found, all of them *Penicillium*. The pipes above the Assistant District Attorney's office in the basement had little fungi (2,500 total CFUs, comprised of *Penicillium* and *Rhodotorula glutinis*). The sample from the ceiling tile from the Assistant District Attorney's office in the basement (Figure 14) resulted in a total of 3,051,000 CFUs (92% of which was *Penicillium*) using DG18 media and 5,235,000 (65% *Penicillium corylophilium* and 34% *Stachybotrys chartarum*) using MEA media.A swab from the wall paneling in the round room of the District Attorney's office in the basement resulted in a total of 590,000 CFUs using DG18 media and 1,041,000 CFUs using MEA media. All were *Penicillium*. The white material on the archway wall of the Coroner's office yielded 4,300,000 CFUs (95% *Scopulariopsis sphaerospora*). The black material from in the same area yielded 800,000 total CFUs (50% *Scopulariopsis sphaerospora*, 20% *Sporothrix sp.*, 17% *Penicillium*, 10% *Aspergillus*).

Of the 11 samples, 5 had low levels of contamination, 4 had medium to heavy contamination, and 2 had heavy contamination.[19]

Ventilation

Basement Offices

Each of the basement offices/rooms had a small individual chilled-water fan-coil unit(s) (Figure 35) for ventilation. The snack room had three of the chilled-water fan-coil units mounted above the drop ceiling. Each unit was connected to two round supply vents via flex duct. The condensate drained into a pan and then to a sink via plastic tubing. All three units and their ducts were dirty (Figure 36).

The District Attorney's file storage area had one unit. It did not work because the electric motor was locked up. The vent in the Witness Room was blocked with paper (Figure 27). The Lower Commissioner's office had two air cooling-units. Each unit was connected to three vents. The units are controlled from wall thermostats. The damper in one of these offices was shut. The vent in another office was blocked with tape and paper.

The Coroner's office had one unit. In addition, it had a separate unit to supply fresh air located in the corner of the conference area. There were two supply vents in the arch wall between the conference area and the coroners' office area. Two thermostats were located in the hallway outside the Coroner's office but it was not able to be determined which air-cooling units they controlled. The ceiling unit in the Jury Commissioner's room was not working.

The Sheriff's Gun Permit office in the basement did not have an air unit above the ceiling. Two window units provided air-conditioning. There was no building heat provided to this area. The employees used space heaters. The Assistant District Attorney's basement office had a chilled-water fan-coil unit controlled with a wall thermostat. The supply was through a vent in the ceiling. The return was in the ceiling with a filter in the duct. Heat was supplied independently of the ventilation system by an electric wall heater. A small vent was found that leads to the Civil Defense and Emergency Communications area. There was no measurable flow through this vent and its purpose is not known.

When a ceiling panel was removed in the detectives' area of the basement office to access the chilled-water fan-coil unit, it was discovered that one of the steam pipes was wrapped with plastic sheeting and duct tape (Figure 37). Inside the plastic sheeting was standing water. The top of the ceiling tile below this patch had water damage and heavy fungal contamination. There was a steam radiator above the ceiling but it could not be determined if this was still used. This office was supplied by the same air-handling unit as the Assistant District Attorney's office.

First-floor Offices

A unit located on the boiler house (Figure 38) across the driveway from the courthouse handled the ventilation for the first floor except for the Sheriff's office. This air handler provided only heated air and did not provide any cooled air. The first-floor Sheriff's Office had its own air-handling unit located in the confiscated weapons room above the main office (Figure 39). It can cool the air but not heat it. Radiators located in the wall provided heat. Per the employees the air conditioning usually did not provide adequate cooling. The air-handling unit has a duct to the outside wall for fresh air. The recycled air can be mixed with the fresh air using temperature settings on a damper control (Figure 40). The air-handling unit has washable air filters for cleaning both the outside and return intake air. Ventilation measurements were not taken in this area since inadequate cooling was the only complaint.

The District Attorney's secretary's office was supplied by an outside air duct from an air-handler located above the next door restroom ceiling. It was determined that the damper was closed but the electrical switch was set in the open position. Changing the switch position did not have any effect on the damper. The return was in the end office. This unit did not have any measurable air flow.

Airflow Measurements

Table 8 contains the airflow measurement results. Only the basement level of the District Attorney's office and the Coroner's office were found to have a measurable fresh air supply. Since there were desks for four detectives in the basement District Attorney's office and the AHSRAE recommendation (20 cfm/person) for the amount of fresh air per person, the fresh air supply of 40 cfm is too low for the four employees who could be potentially working in this area at the same time. The Coroner's office met the fresh air requirement since there are only two people working in this office. In addition, ASHRAE recommends 4 to 10 air changes per hour for office buildings with air movement of 25 to 45 feet per minute.[20] The areas with no fresh air supply do not have any air changes so they do not meet this requirement. The basement District Attorney's office was calculated to have less than 1 air change per hour. The Coroner's office met the recommendation with 7 air changes per hour.

Medical Interviews

All four individuals interviewed reported work-related symptoms consistent with asthma (wheeze, chest tightness, or cough). Onset of respiratory symptoms occurred from 6 months to 11 years after date of hire and 5 months to 3 years prior to time of interview. One individual reported a physician diagnosis of asthma, a history of positive skin testing for mold and dust mite allergens (after date of hire), symptoms of wheezing and chest tightness twice weekly, and strong evidence for work-relatedness (no symptoms at home in the evenings or on days not at work). In the four workers interviewed, non-respiratory work-related symptoms include: migraine headaches in two workers; fatigue in two workers; burning eyes in two workers; and sneezing in one worker.

CONCLUSIONS

The building had a number of deficiencies, most notably in terms of ventilation and housekeeping, as well as water leaks.

VOCs

All of the VOCs detected were found in low concentrations (less than 1 ppm). The concentrations found were less than the established OSHA PELs (where they exist) and the NIOSH RELs (except for the five compounds for which NIOSH recommends the lowest feasible limit).[6,7] There is very little information regarding the effects of mixtures of VOCs at low concentrations. Some VOCs detected could be coming in with outside air that is brought into the building, and some of the VOCs may be resulting from the commercial products such as cleaning compounds, consumer products such as perfumes, and furnishings and building materials present in the building.

Most levels of VOCs detected were also well below the respective odor threshold values and thus should not be individually detected by the sense of smell by the majority of people. However, little is known about the odor thresholds of complex mixtures of low levels of VOCs.

IEQ Parameters (Temperature, Relative Humidity, CO, and CO_2)

For the most part, the indoor environmental quality factors were within recommended guidelines with a few exceptions. The most notable exception was the temperature in the Prothonotary's basement storage area but it is not occupied regularly.

Microbiological Contamination

Mold is definitely present in the Coroner's and basement District Attorney's offices. The swab samples taken in these locations showed heavy levels of contamination. There are a number of other locations where mold also appeared to be growing, as swab samples came back with some lower levels of contamination. Moisture for mold growth was provided by a number of water leaks and incursions into the building, as well as by leaking steam and other types of pipes.

Ventilation

The ventilation system had a number of problems. There was an inadequate supply of outside air for the offices in the basement and first floor. The ventilation system was not operating properly. There were blowers that were inoperative and vents that had been sealed. Most of the ventilation systems were very dirty, which can further reduce its efficiency. Having total recycled air, as was the case for most of the systems, is not recommended.

Medical Interviews

Based on the results from medical interviews, some workers in this building have work-related asthma. Relocation of persons with asthma related to the building sometimes results in substantial improvement and even resolution of asthma symptoms. Moisture-damaged buildings are commonly associated with respiratory problems. Dust during remediation efforts can cause worsening of respiratory symptoms in those with asthma.

RECOMMENDATIONS

The following recommendations are intended to help address the symptoms reported by the employees:

- Fix leaks and replace damaged materials. All water leaks and infiltration should be corrected. All porous materials (such as walls and ceiling tiles) that have potential fungal contamination should be replaced. Care should be taken when this is performed to ensure that any generated dust does not enter occupied sections of the building. Both containment and the use of negative pressure will help accomplish this. Containment may be achieved through the use of plastic sheeting and negative pressure through the use of a high-efficiency particulate air (HEPA) filter vented to the outside of the enclosure.

- Upgrade ventilation system to provide fresh, tempered, and well-circulated air to all occupied spaces. The fresh air should be heated so that fresh air intakes can be used in the winter. ASHRAE standard 62-2001 recommends that 15 cfm of outside air be provided per person in office reception areas and 20 cfm per person in the offices.[12]

- Clean the cooling coils for the chilled-water fan-coil units located above the ceilings on a regular basis. Alternatively, the duct system could be re-worked to include a filter bank to clean the air before it enters the units. The dirt affects cooling efficiency and may cause the supply air to contain high levels of dirt or serve as a substrate to facilitate microbial growth. The condensate drain pans need to be cleaned regularly and drains should be cleared of any debris so that the water drains freely.

- Fix the pipe with the plastic wrap located in the basement office of the District Attorney (detectives' office) and dispose of the plastic wrap and associated water.
- Fix the inoperable fan-coil unit in the file room adjacent to the District Attorney detectives' office.
- Filter the outside (fresh) air for the systems in the basement District Attorney's suite and the Coroner's office.
- Unblock all supply and outside air vents.
- Repair the malfunctioning blowers in the Coroner's Office and Jury Commissioner's Room.
- Vent the Prothonotary's file room in the basement to provide fresh air and control the temperature. One possible way is to use a small air-handler located outside with a duct run through the window.
- Consider maintaining a more constant temperature in the first-floor Controller's office so that it does not exceed 76°F in the winter.
- Clean and disinfect the inside of all contaminated exterior concrete and masonry walls.
- Follow Environmental Protection Agency and other recommended procedures for mold abatement and improving indoor air quality.[19,21,22,23]
- Refer individuals with possible and suspected work-related asthma for medical evaluation. Remediation efforts put such persons at special risk due to disturbance of moldy dusts. Consider relocating these workers during remediation and, if symptoms persist, following remediation.

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Table 1

Volatile Organic Compounds Exposure Limits and Odor Threshold Values in parts per million (ppm)

Compound	NIOSH REL (ppm)[7]	OSHA PEL (ppm)[6]	Odor Threshold (ppm)[15]	Uses and Remarks
Acetonitrile	20	40	170.0	Perfumes; dyes; textiles; found in vehicle exhaust and cigarette smoke[A]
Acrylonitrile	1	2	21.6	High impact plastics; found in vehicle exhaust and cigarette smoke[A]
Benzene	0.1	1	1.5	Dye; detergents; drugs; found in vehicle exhaust and cigarette smoke[A]
1,3-Butadiene	LFC[B]	1	1.6	Rubber and plastics; found in vehicle exhaust and cigarette smoke[C]
2-Butanone	200	200	5.4	Gums; resins; lacquers, varnishes; paint remover; glues[A]
Chloroform	2[D]	50[E]	200.0	Ingredient of cleaners; glues; aerosol sprays; and correction fluid[A]
Chloromethane	LFC	100	10.0	Ingredient in polystyrene insulation; found in cigarette smoke[A]
1,2-Dichloroethane	100	100	11.2	PVC items; solvent; removing lead from gasoline; pleasant odor[A]
1,2-Dichloroethene	LFC	200	None reported	Production of gums, rubber, etc.; cleaning agent for printed circuit boards[A]
1,2-Dichloropropane	LFC	75	0.9	Production of perchloroethylene and related chemicals; chloroform odor[A]
Ethylbenzene	100	100	2.3	Found in petroleum; inks; insecticides; paints; fuels; gasoline-like odor[A]
Freon-12	1,000	1,000	None reported	Used primarily as a refrigerant[A]
n-Hexane	50	500	65 - 130	Cleaning agent; textile printing; gasoline; furniture; shoe-making[A]
Methylene Chloride	LFC	25	250	Paints; paint removers; correction fluid; urethane foam[A]
4-methyl-2-Pentanone	50	50	0.1	Solvent in paints, varnishes, and lacquers; alcohol denaturant; flavorings[C]
2-Propanol	400	400	0.4	Production of other chemicals; solvent; cosmetics; antiseptic; disinfectant[C]
Styrene	50	10	3.4	Rubber; plastic; auto parts; carpeting; found in fruits; meats; cigarettes[A]
Tetrachloroethene	LFC	100	6.2	Dry cleaning; metal degreasing; consumer products; sharp, sweet smell[A]
Toluene	100	200	0.2	Paints; paint thinners; adhesives; lacquers; leather tanning[A]
1,1,2-Trichloroethane	100	100	22.4	Production of other chemicals; sweet smell[A]
Trichloroethene	LFC	100	1.4	Metal and glass degreasing; solvent in greases, oils, waxes, paints, waxes[A]
1,2,4-Trimethylbenzene	25	None	2.4	Gasoline additive; solvent in coatings, etc.; pharmaceuticals; dyes[F]
1,3,5-Trimethylbenzene	25	None	2.4	Solvent; pesticides; inks; dyes; pharmaceuticals[F]
Vinyl Acetate	4	None	0.5	Paint, textile, paper manufacturing, plastic film and paper coatings[A]
o-, m- & p-Xylene	100	100	0.5 - 0.9	Cleaning agents; gasoline and other fuels; printing; rubber; paint thinner[C]

[A]Department of Health and Human Services, Agency for Toxic Substances and Disease Registry, ToxFAQs; http://www.atsdr.cdc.gov/toxfaq.html

[B]LFC=lowest feasible concentration. NIOSH considers compound an occupational carcinogen (see Appendix 1).

[C]Grayson, M. and D. Eckroth (eds.): Kirk-Othmer Encyclopedia of Chemical Technology. 3rd ed., Vol. 19, New York: John Wiley & Sons, 1982.

[D]Short-term exposure level (a 15-minute time-weighted average exposure which should not be exceeded during the working day).

[E]Ceiling value(exposure value which may not be exceeded at any time).

[F]U.S. Environmental Protection Agency: Chemical Summary for 1,2,4-trimethybenzene, http://www.epa.gove/opptintr/chemfact/s_trimet.txt

Table 2
Qualitative Assessments of Fungal Concentrations on Swab Samples[19]

Concentration (Colony Forming Units)	Qualitative Assessment of Contamination
Less than 10,000	Low
10,000 to 100,000	Medium
100,001 to 1,000,000	Medium to Heavy
Greater than 1,000,000	Heavy

Table 3
Instantaneous Volatile Organic Compound Sampling Results (in ppm)[A]
Basement Level

Compound	Office							
	Witness Room	Snack Room	Recorder of Deeds	Public Defender	Prothonotary Storage Area	Farm Office	Coroner	Lower Commissioners
Acetonitrile	0.002	0.002	ND	ND	0.005	0.003	0.001	0.003
Acrylonitrile	ND	0.002	0.001	ND	0.001	ND	ND	ND
Benzene	0.001	0.001	0.001	0.001	0.002	0.001	0.001	0.001
1,3-Butadiene	0.005	0.002	0.001	ND	0.006	0.001	0.001	0.001
2-Butanone	0.014	ND	0.009	0.003	0.005	0.003	0.006	0.002
Chloroform	0.001	ND	0.003	ND	0.001	0.001	0.001	0.001
Chloromethane	0.001	0.001	0.001	ND	0.002	0.001	0.008	0.001
1,2-Dichloroethane	0.003	0.003	0.003	0.003	0.016	0.003	0.003	0.003
1,2-Dichloroethene	0.001	0.001	0.001	ND	0.002	ND	ND	0.001
1,2-Dichloropropane	0.003	0.003	0.003	ND	0.208	0.003	ND	0.002
Ethylbenzene	0.002	0.001	0.003	0.001	0.005	ND	0.003	0.001
Freon-12	0.001	0.001	0.001	0.002	0.001	0.001	0.002	0.001
n-Hexane	0.001	ND	0.001	0.001	0.002	ND	0.002	ND
Methylene Chloride	0.002	0.001	0.005	0.001	0.006	0.001	0.001	0.001
4-methyl-2-Pentanone	0.002	ND	0.002	0.022	0.001	ND	0.006	ND
2-Propanol	ND	ND	ND	ND	0.169	ND	ND	ND
Styrene	0.001	ND	0.003	ND	0.001	ND	0.004	ND
Tetrachloroethene	0.003	0.001	0.003	ND	0.005	ND	0.018	0.001
Toluene	0.020	0.032	0.133	0.002	0.068	0.014	0.463	0.034
1,1,2-Trichloroethane	0.001	ND	0.002	ND	0.004	ND	ND	0.001
Trichloroethene	0.003	0.003	0.003	0.003	0.021	0.003	0.003	0.003
1,2,4-Trimethylbenzene	0.005	ND	0.009	ND	0.004	ND	ND	ND
1,3,5-Trimethylbenzene	0.019	ND	0.030	0.001	0.013	ND	0.001	ND
Vinyl Acetate	0.002	0.002	0.004	0.002	0.001	0.001	0.002	0.001
o-, m- & p-Xylene	0.019	0.004	0.025	0.001	0.020	0.002	0.014	0.001

[A]Values are parts compound per million parts air (ppm). ND=below limit of detection (LOD). The LOD and limit of quantitation were 0.00005 ppm. Concentrations given are the maximum for all samples collected at each location.

Table 4

Instantaneous Volatile Organic Compound Sampling Results (in ppm)[A]

First-floor Offices

Compound	Office								
	Treasurer	Register of Wills	Sheriff	Recorder of Deeds	Prothonotary	Clerk of Courts	District Attorney	Controller	Commissioners
Acetonitrile	ND	0.001	ND	ND	ND	ND	0.009	0.001	ND
Acrylonitrile	ND	ND	ND	ND	ND	ND	ND	ND	0.002
Benzene	ND	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
1,3-Butadiene	ND	0.001	ND	0.028	ND	0.002	0.001	0.001	0.004
2-Butanone	0.004	0.003	0.005	0.026	0.006	0.003	0.017	0.007	0.013
Chloroform	0.001	0.002	ND	0.002	0.002	0.004	0.019	0.001	0.041
Chloromethane	ND	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
1,2-Dichloroethane	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003
1,2-Dichloroethene	ND	0.001	0.001	0.001	ND	0.001	0.001	0.001	0.001
1,2-Dichloropropane	ND	0.003	0.003	0.003	ND	0.003	0.003	0.003	0.003
Ethylbenzene	0.001	0.003	0.001	0.001	0.005	0.002	0.003	0.002	0.002
Freon-12	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
n-Hexane	ND	0.002	0.001	0.002	0.005	0.001	0.001	ND	ND
Methylene Chloride	0.001	0.002	0.001	0.002	0.004	0.001	0.005	0.007	0.001
4-methyl-2-Pentanone	0.003	0.007	0.001	0.001	0.013	0.001	0.005	0.005	0.001
2-Propanol	ND	ND	ND	0.066	0.295	ND	ND	ND	ND
Styrene	0.001	0.003	ND	ND	0.001	0.003	0.010	ND	ND
Tetrachloroethene	0.002	0.013	0.003	0.005	0.030	0.001	0.013	0.002	0.002
Toluene	0.062	0.680	0.105	0.196	0.994	0.057	0.406	0.085	0.078
1,1,2-Trichloroethane	ND	0.002	ND	ND	0.003	ND	0.002	0.002	ND
Trichloroethene	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003
1,2,4-Trimethylbenzene	0.001	0.001	ND	ND	0.001	0.009	0.006	0.001	0.001
1,3,5-Trimethylbenzene	0.001	0.001	0.001	0.001	0.002	0.021	0.021	0.001	0.001
Vinyl Acetate	0.001	0.002	0.003	0.013	0.006	0.010	0.004	0.003	0.002
o-, m- & p-Xylene	0.002	0.014	0.005	0.006	0.024	0.031	0.200	0.005	0.007

[A]Values are parts compound per million parts air (ppm). ND=below limit of detection (LOD). The LOD and limit of quantitation were 0.00005 ppm. Concentrations given are the maximum for all samples collected at each location.

Table 5
168-hour Time-Weighted Average (TWA) Volatile Organic Compound Sampling Results (in ppm)[A]

Compound	Office					
	Coroner (Basement office)	District Attorneys (Basement office)	Prothonotary (Basement Storage)	Clerk of Courts (First Floor)	Controller (First Floor)	Recorder of Deeds (First Floor)
Acetonitrile	0.002	0.006	0.001	0.001	0.002	0.001
Acrylonitrile	ND	ND	ND	ND	ND	ND
Benzene	ND	ND	ND	ND	ND	ND
1,3-Butadiene	0.001	0.005	0.004	0.001	0.001	0.001
2-Butanone	ND	ND	ND	ND	ND	ND
Chloroform	ND	ND	ND	ND	ND	ND
Chloromethane	ND	ND	0.001	ND	0.001	ND
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND
1,2-Dichloroethene	0.001	0.001	0.001	ND	0.001	0.001
1,2-Dichloropropane	0.003	0.003	0.003	0.003	0.003	0.003
Ethylbenzene	ND	ND	ND	ND	ND	ND
Freon-12	0.001	0.001	0.001	ND	0.001	ND
n-Hexane	ND	ND	ND	ND	0.001	ND
Methylene Chloride	ND	ND	ND	ND	0.002	ND
4-methyl-2-Pentanone	ND	ND	ND	ND	ND	ND
2-Propanol	ND	ND	ND	ND	ND	ND
Styrene	ND	ND	ND	ND	ND	ND
Tetrachloroethene	ND	ND	ND	ND	ND	ND
Toluene	0.001	0.001	0.001	0.001	0.002	0.001
1,1,2-Trichloroethane	ND	ND	ND	ND	0.001	ND
Trichloroethene	0.001	0.001	0.001	0.001	0.001	0.001
1,2,4-Trimethylbenzene	ND	ND	ND	ND	ND	ND
1,3,5-Trimethylbenzene	ND	ND	ND	ND	ND	ND
Vinyl Acetate	ND	ND	ND	ND	ND	ND
o-, m- & p-Xylene	0.001	0.001	0.002	ND	0.001	ND

[A]Values are parts compound per million parts air (ppm). ND=below limit of detection (LOD). The LOD and limit of quantitation were 0.00005 ppm.

Table 6

Outdoor Instantaneous Volatile Organic Compound Sampling Results (in ppm) for the Afternoon of November 4, 2002[A]

Compound	Near County Jail	Near District Attorney's Office	Near Prothonotary's Reserved Parking	Near Sheriff's Office
Acetonitrile	ND	ND	ND	ND
Acrylonitrile	ND	ND	ND	ND
Benzene	0.001	0.001	0.001	0.001
1,3-Butadiene	ND	ND	ND	ND
2-Butanone	0.002	0.001	0.001	0.001
Chloroform	ND	ND	ND	ND
Chloromethane	ND	ND	ND	ND
1,2-Dichloroethane	0.003	0.003	0.003	0.003
1,2-Dichloroethene	ND	ND	ND	ND
1,2-Dichloropropane	ND	ND	ND	ND
Ethylbenzene	ND	0.001	ND	0.000
Freon-12	0.001	0.001	0.001	0.002
n-Hexane	ND	ND	ND	ND
Methylene Chloride	0.001	0.001	0.001	0.001
4-methyl-2-Pentanone	ND	ND	0.001	ND
2-Propanol	ND	ND	ND	ND
Styrene	ND	ND	ND	ND
Tetrachloroethene	ND	ND	ND	ND
Toluene	0.001	0.001	0.001	0.001
1,1,2-Trichloroethane	ND	ND	ND	ND
Trichloroethene	0.003	0.003	0.003	0.003
1,2,4-Trimethylbenzene	ND	ND	ND	ND
1,3,5-Trimethylbenzene	ND	ND	ND	ND
Vinyl Acetate	0.001	ND	ND	ND
o-, m- & p-Xylene	0.001	0.001	0.001	0.001

[A]Values are parts compound per million parts air (ppm). ND=below limit of detection (LOD). The LOD and limit of quantitation were 0.00005 ppm.

Table 7
Temperature and Humidity Pen Data from the afternoon of October 28, 2002

Location	Temperature (ºF)	Relative Humidity (%)
DA basement suite (front of detectives' room)	72.5	42
DA basement suite (rear of detectives' room)	73.1	42
Back of basement records room near rest room	78.8	53
Sheriff's Reception area	79.0	32

Table 8
Ventilation Measurements

Room	Supply (cfm)[A]	Fresh Air Supply (cfm)[A]	Total Supply (cfm)[A]
Jury Commissioners	91	Not applicable	91
Lower Level Commissioners	1273	Not applicable	1273
Bruce's office	0	Not applicable	0
Judy's office	73	Not applicable	73
Warren's office	185	Not applicable	185
Office next to Warren's	0	Not applicable	0
Ante-room to Warren's	445	Not applicable	445
Main office	570	Not applicable	570
DA Secretary	80	0	80
Assistant DA - Basement Office	497	40	537
Detectives	242	Not applicable	242
File Storage	0	Not Applicable	0
Stairway foyer	0	Not applicable	0
Ante-room	110	40	150
Assistant DA office	145	Not applicable	145
Coroner (Whole Office)	558	96	654
First Room	85	Not applicable	85
Second Room	95	Not applicable	95
Third Room	0	Not applicable	0
Fourth Room	0	Not applicable	0
Fifth Room	90	96	186
Sixth Room	288	Not applicable	288
Snack Room	772	Not applicable	772

[A]cfm - cubic feet per minute

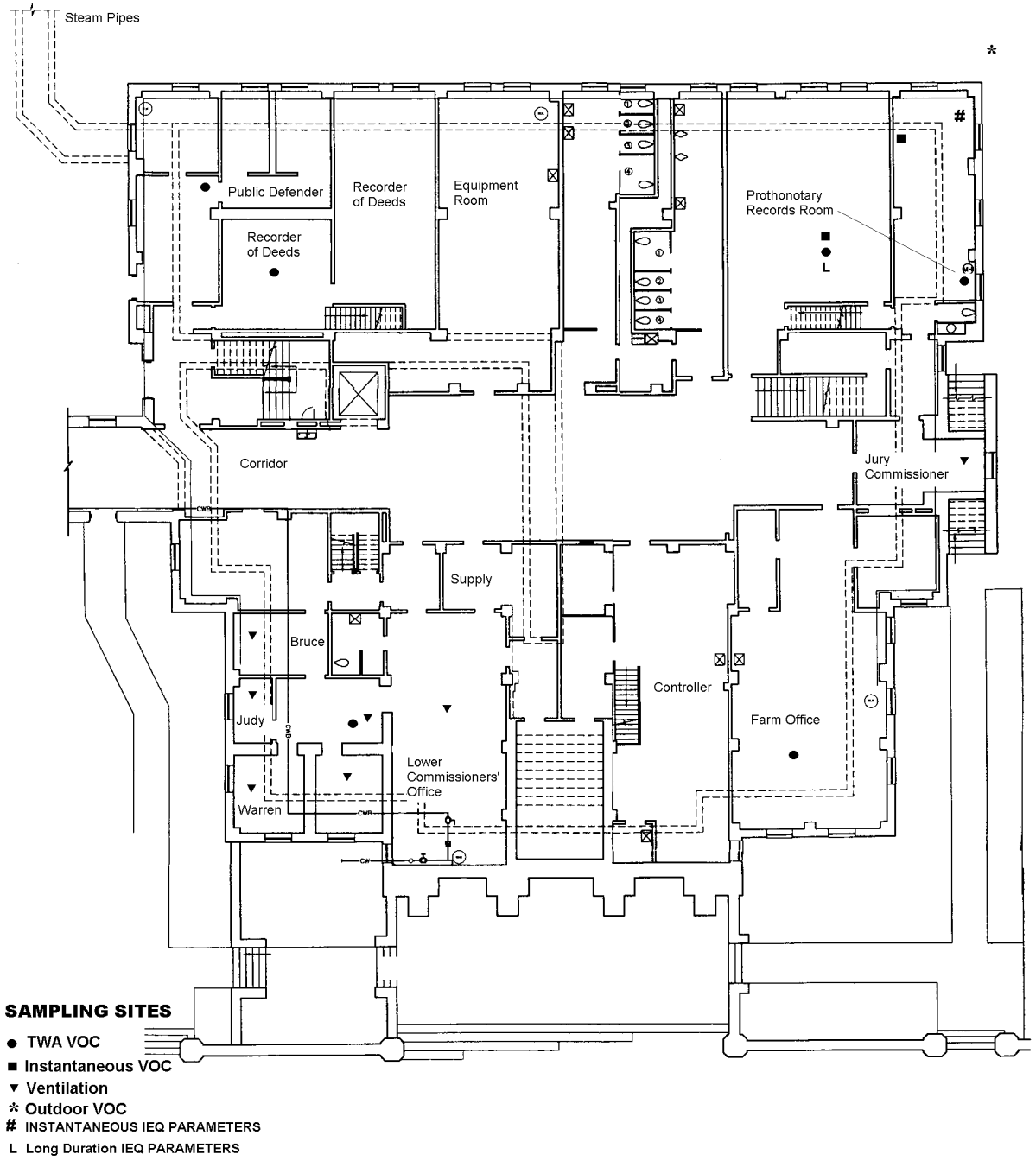

Figure 1. Sampling locations in annex building basement.

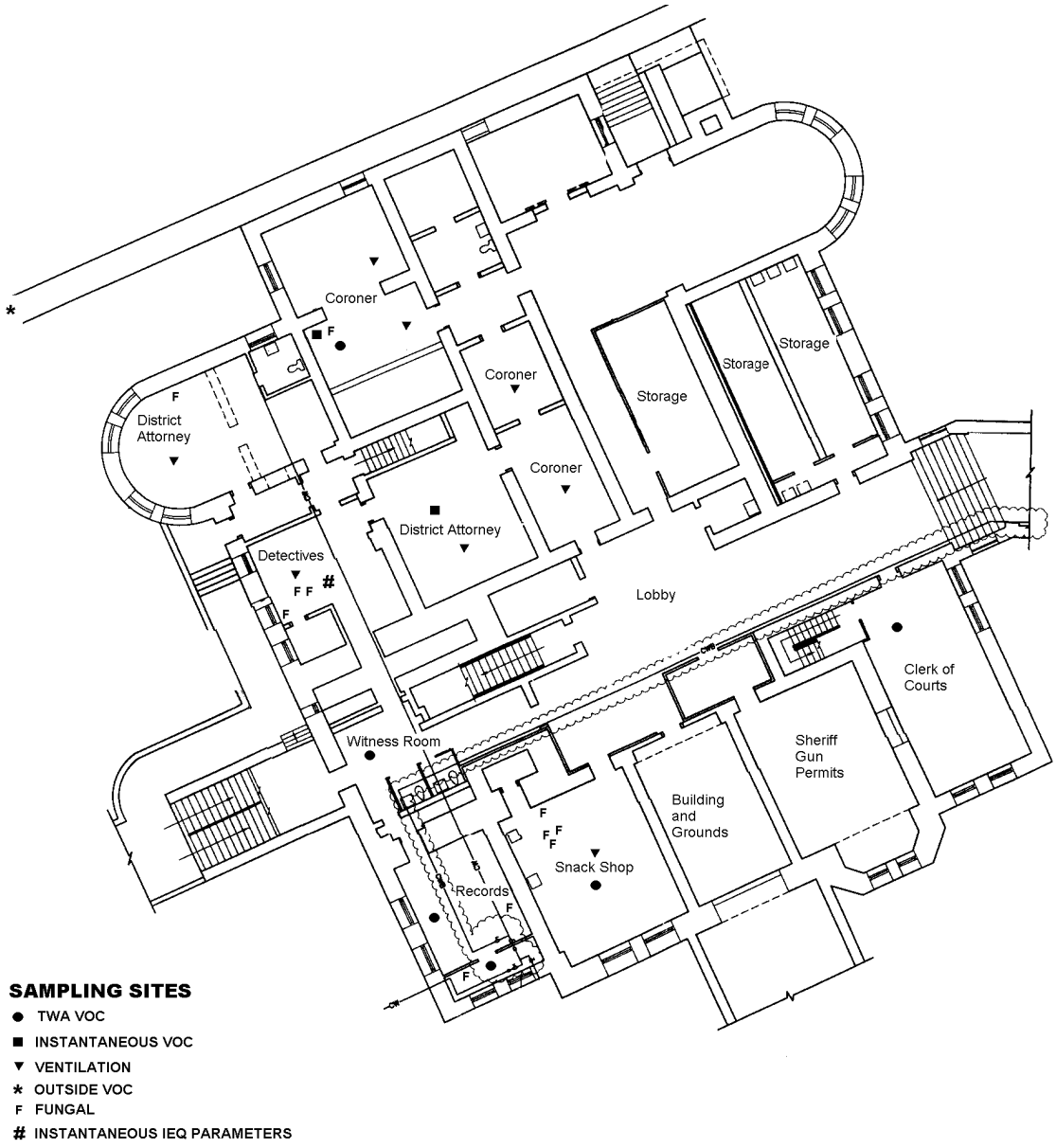

Figure 2. Sampling locations in original courthouse building basement.

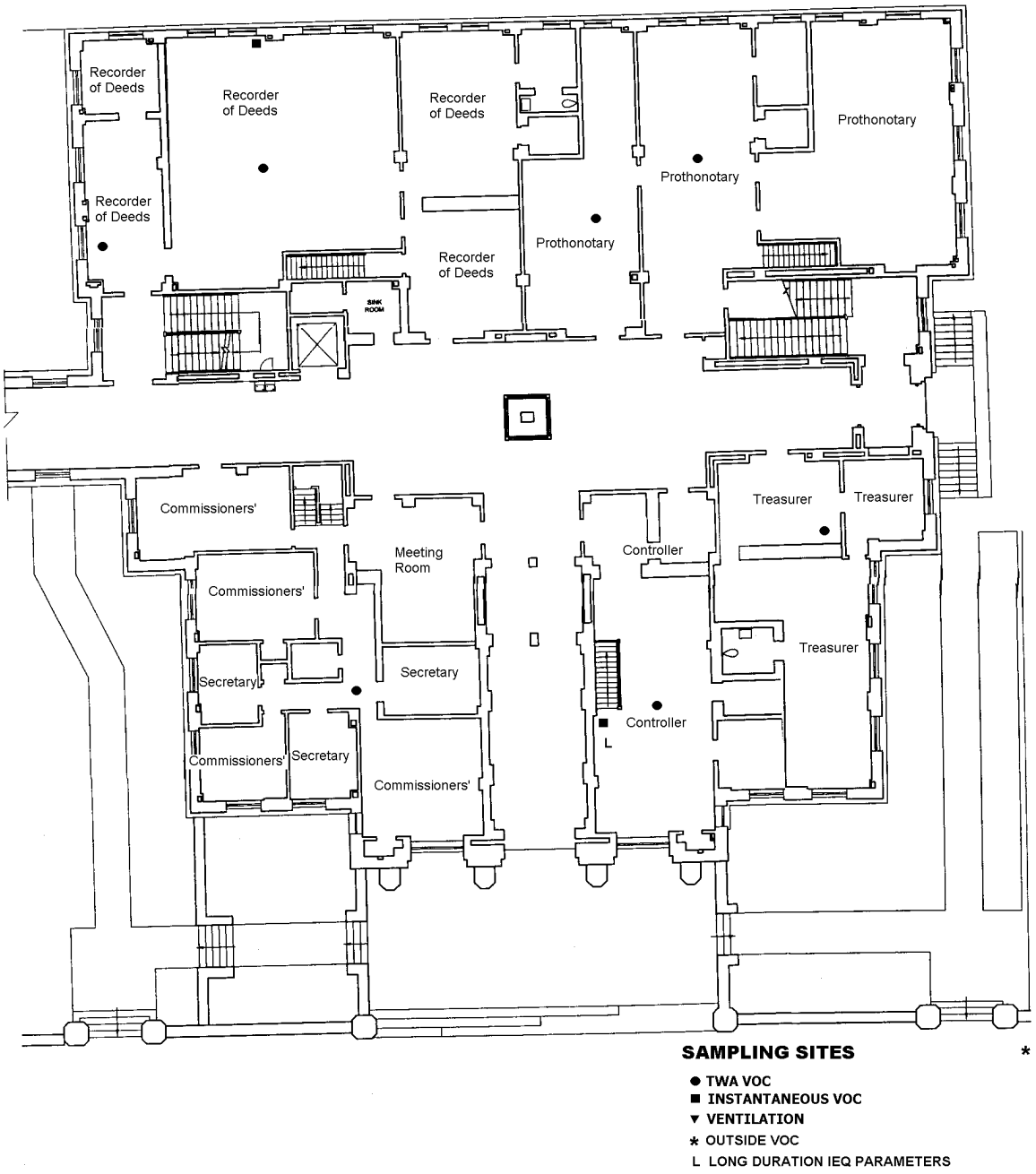

Figure 3. Sampling locations on annex building first floor.

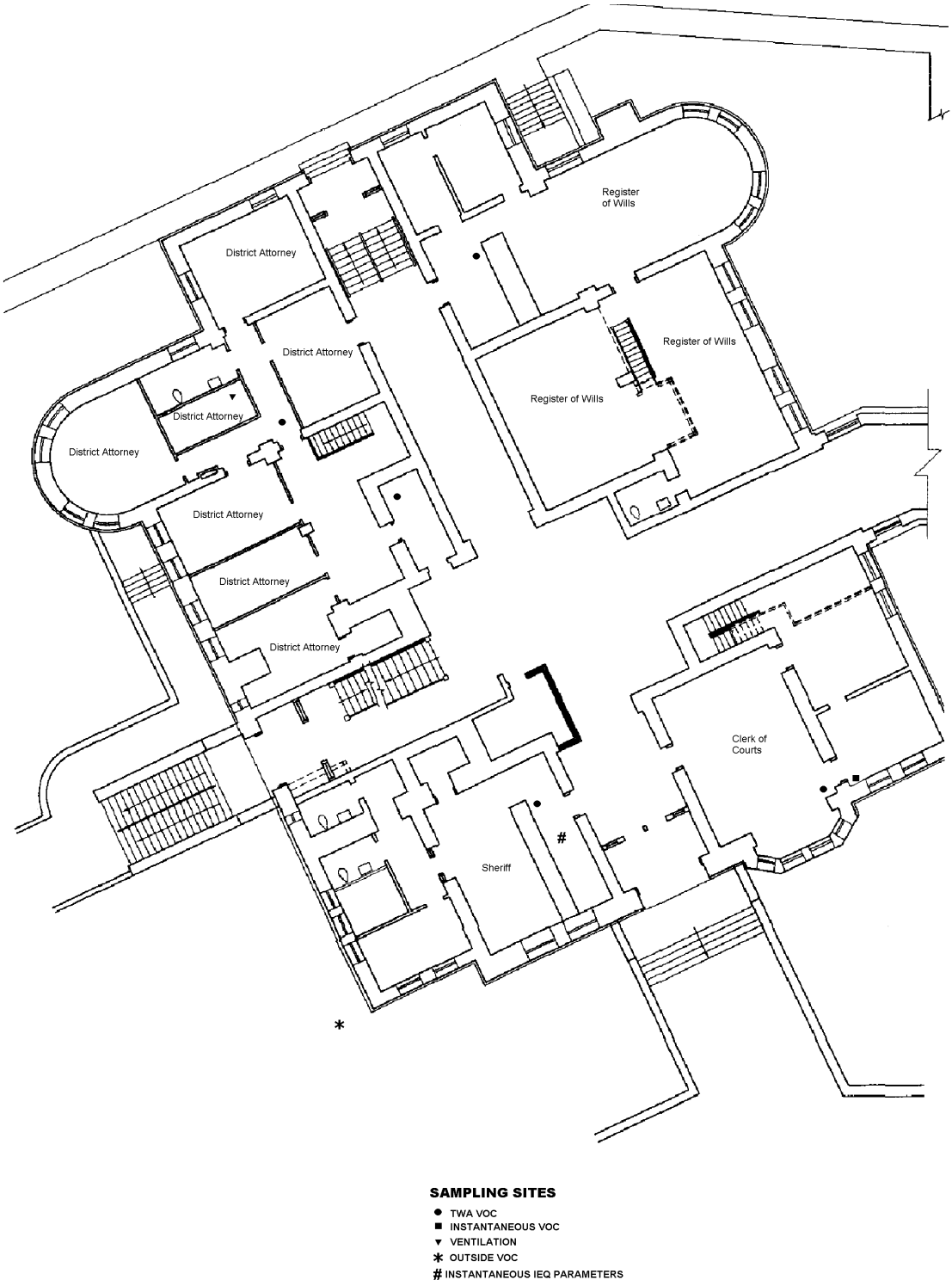

Figure 4. Sampling locations on original courthouse building first floor.

Figure 5. Swab sample being taken from fan-coil in ceiling of snack room.

Figure 6. Ceiling tile in Lower Commissioner's office.

Figure 7. Ceiling tile in Public Defender's office.

Figure 8. Ceiling tile in Sheriff's gun permits office in basement.

Figure 9. Ceiling tile in Witness Waiting Room.

Figure 10. Ceiling tile in Controller's office.

Figure 11. Ceiling tile in Treasurer's office.

Figure12. Vent in lunch room.

Figure 13. Vent in Witness room.

Figure 14. Back of ceiling tile from District Attorney's basement office.

Figure 15. Overhead steam pipes in Clerk of Courts' basement storage room.

Figure 16. Potential mold on wall in Coroner's office.

Figure 17. Possible mold on paneling in Assistant District Attorney's office.

Figure 18. Inside of exterior wall in Clerk of Courts' basement storage area.

Figure 19. Wallpaper coming away from wall behind the door in the Clerk of Courts' office.

Figure 20. Vent in Clerk of Courts' office with white powder from beneath the wallpaper.

Figure 21. View of wall behind bulging wallpaper in Clerk of Courts' office.

Figure 22. Possible mold on back of wallpaper in Clerk of Courts' office.

Figure 23. Possible openings under Clerk of Courts' office windows.

Figure 24. Plugged opening under Clerk of Courts' office window.

Figure 25. Cabinet in front office of the Clerk of Courts.

Figure 26. Covered vent in Witness room.

Figure 27. Hot water tank/storage room.

Figure 28. Record storage area in basement.

Figure 29. District Attorney's storage area in basement.

Figure 30. Boroscope being used to investigate the inside of the arch wall in the Coroner's office.

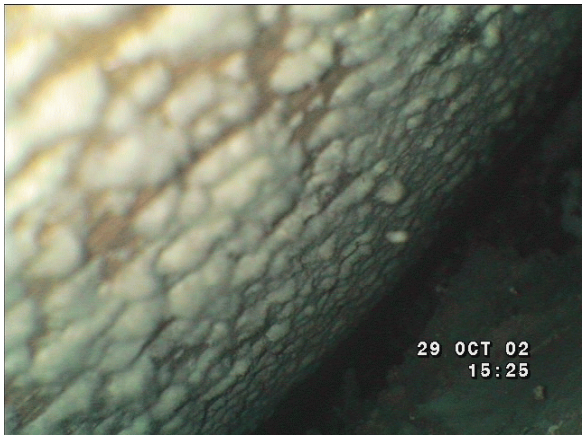

Figure 31. Possible mold inside of arch in Coroner's office.

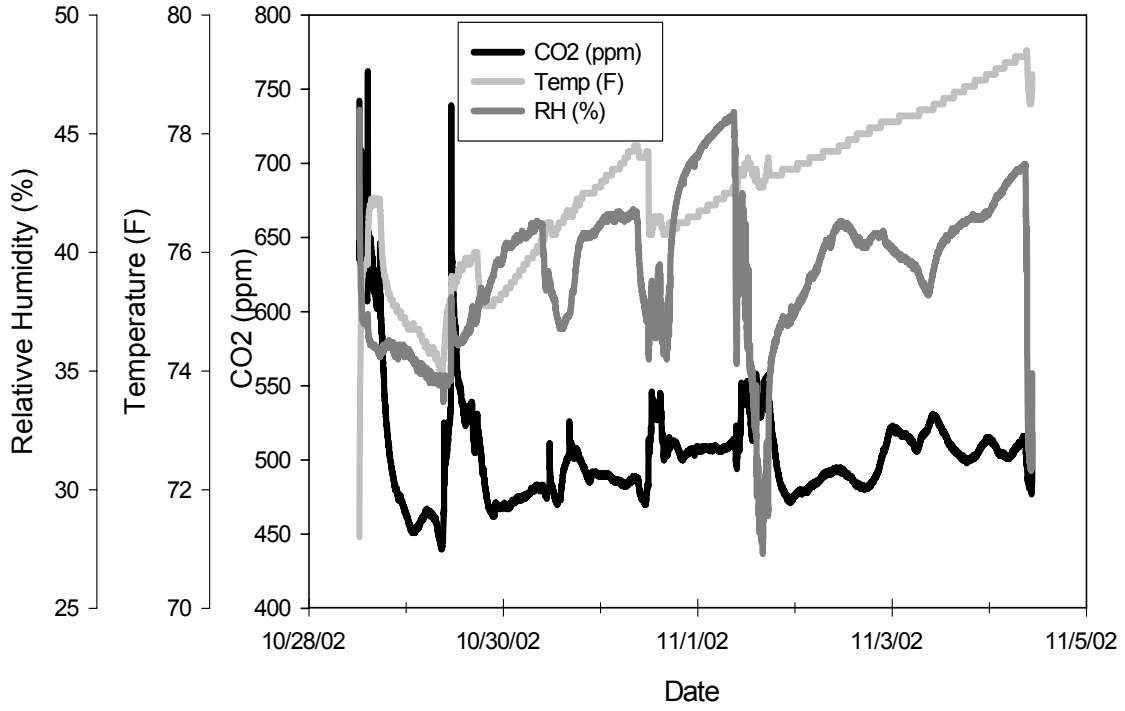

Figure 32. Indoor environmental air parameters measured in the Prothonotary's basement storage area.

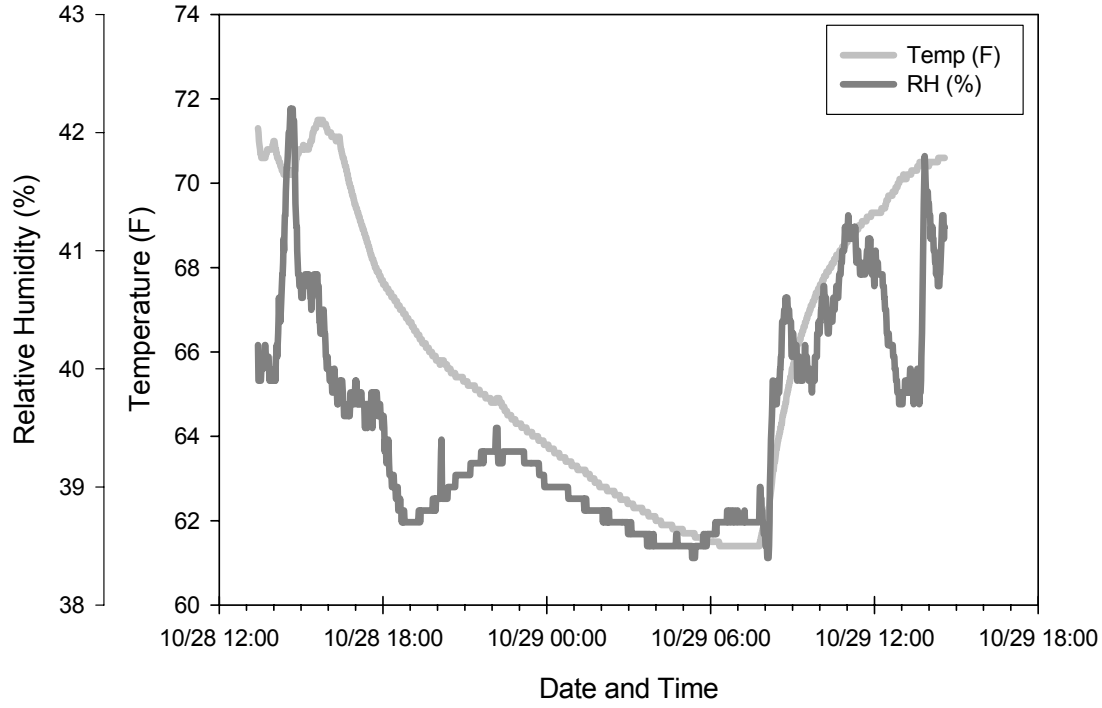

Figure 33. Indoor environmental air parameters measured in the first-floor Clerk of Courts' office.

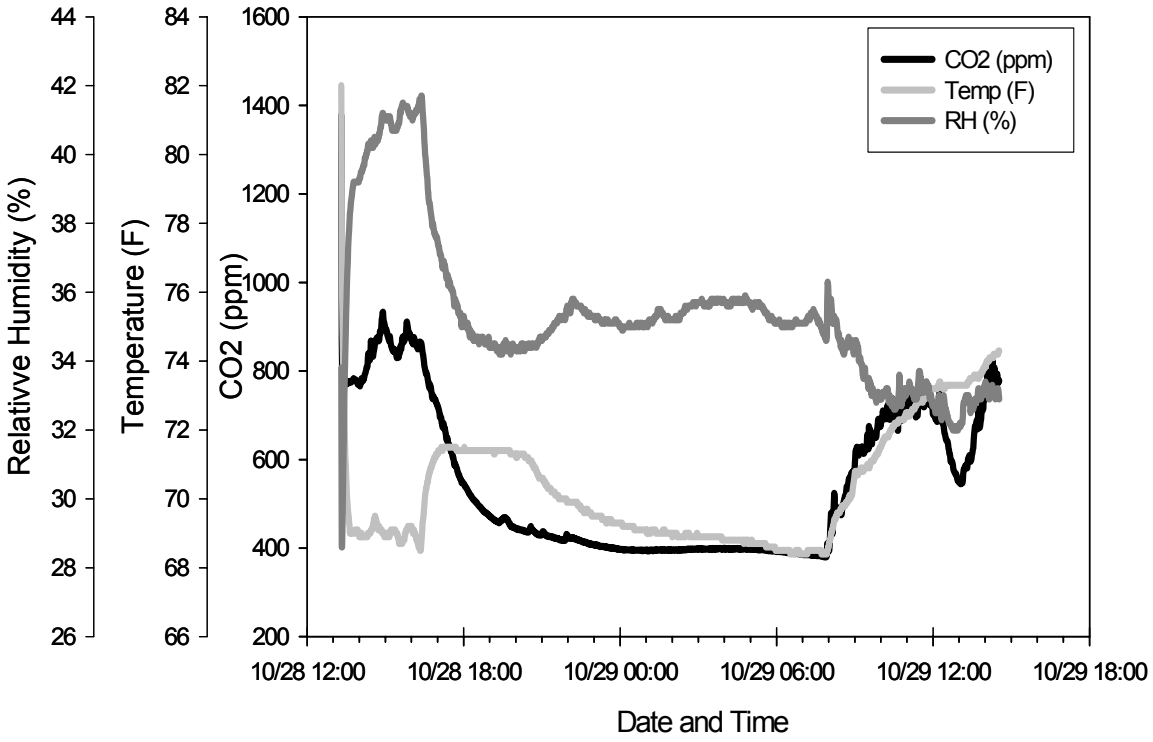

Figure 34. Indoor environmental air parameters measured in first-floor Controller's office.

Figure 35. Snack room fan-coil unit.

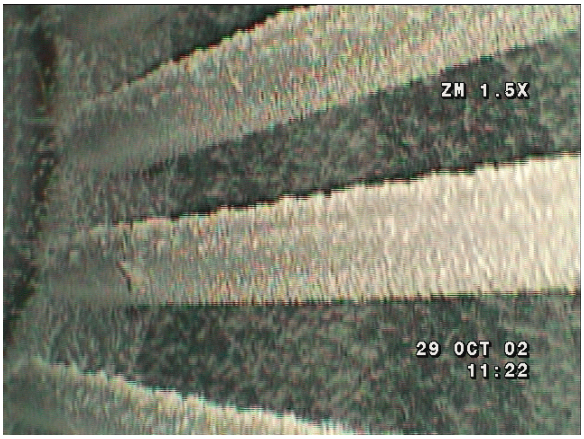

Figure 36. Close-up of dirt on blower in snack room air-handler.

Figure 37. Plastic wrapped around leaking pipe in District Attorney's basement office.

Figure 38. Air-handler unit for first floor located on boiler house.

Figure 39. Air-handler unit for Sheriff's office located in confiscated weapons lock-up room.

Figure 40. Outside/return air controller.

APPENDIX 1

New NIOSH Policy Statement on Potential Occupational Carcinogens[7]

For the past 20 plus years, NIOSH has subscribed to a carcinogen policy that was published in 1976 by Edward J. Fairchild, II, Associate Director for Cincinnati Operations, which called for "no detectable exposure levels for proven carcinogenic substances" (Annals of the New York Academy of Sciences, 271:200-207, 1976). This was in response to a generic OSHA rulemaking on carcinogens. Because of advances in science and in approaches to risk assessment and risk management, NIOSH has adopted a more inclusive policy. NIOSH recommended exposure limits (RELs) will be based on risk evaluations using human or animal health effects data, and on an assessment of what levels can be feasibly achieved by engineering controls and measured by analytical techniques. To the extent feasible, NIOSH will project not only a no-effect exposure, but also exposure levels at which there may be residual risks. This policy applies to all workplace hazards, including carcinogens, and is responsive to Section 20(a)(3) of the Occupational Safety and Health Act of 1970, which charges NIOSH to ". . .describe exposure levels that are safe for various periods of employment, including but not limited to the exposure levels at which no employee will suffer impaired health or functional capacities or diminished life expectancy as a result of his work experience."

The effect of this new policy will be the development, whenever possible, of quantitative RELs that are based on human and/or animal data, as well as on the consideration of technological feasibility for controlling workplace exposures to the REL. Under the old policy, RELs for most carcinogens were non-quantitative values labeled "lowest feasible concentration (LFC)." [Note: There are a few exceptions to LFC RELs for carcinogens (e.g., RELs for asbestos, formaldehyde, benzene, and ethylene oxide are quantitative values based primarily on analytical limits of detection or technological feasibility). Also, in 1989, NIOSH adopted several quantitative RELs for carcinogens from OSHA's permissible exposure limit (PEL) update.]

Under the new policy, NIOSH will also recommend the complete range of respirators (as determined by the NIOSH Respirator Decision Logic) for carcinogens with quantitative RELs. In this way, respirators will be consistently recommended regardless of whether a substance is a carcinogen or a non-carcinogen.

Old Policy Statement

In the past, NIOSH identified numerous substances that should be treated as potential occupational carcinogens even though OSHA might not have identified them as such. In determining their carcinogenicity, NIOSH used the OSHA classification outlined in 29 CFR 1990.103, which states in part:

Potential occupational carcinogen means any substance, or combination or mixture of substances, which causes an increased incidence of benign and/or malignant neoplasms, or a substantial decrease in the latency period between exposure and onset of neoplasms in humans or in one or more experimental mammalian species as the result of any oral, respiratory or dermal exposure, or any other exposure which results in the induction of tumors at a site other than the site of administration. This definition also includes any substance which is metabolized into one or more potential occupational carcinogens by mammals.

When thresholds for carcinogens that would protect 100% of the population had not been identified, NIOSH usually recommended that occupational exposures to carcinogens be limited to the lowest feasible concentration. To ensure maximum protection from carcinogens through the use of respiratory protection, NIOSH also recommended that only the most reliable and protective respirators be used. These respirators include (1) a self-contained breathing apparatus (SCBA) that has a full facepiece and is operated in a positive-pressure mode, or (2) a supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary SCBA operated in a pressure-demand or other positive-pressure mode.

Recommendations to be Revised

The RELs and respirator recommendations for carcinogens listed in the current edition of the Pocket Guide still reflect the old policy. Changes in the RELs and respirator recommendations that reflect the new policy will be included in future editions.

DEPARTMENT OF HEALTH AND HUMAN SERVICES
Centers for Disease Control and Prevention
National Institute for Occupational Safety and Health
4676 Columbia Parkway
Cincinnati, OH 45226-1998

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