



Evaluation of Potential Occupational Exposures to Narcotics in a County Evidence Room

HHE Report No. 2018-0150-3340

March 2019



**Centers for Disease Control
and Prevention**
National Institute for Occupational
Safety and Health

Authors: Karl D. Feldmann, MS, CIH

Sarah Hatcher, PhD

Desktop Publisher: Jennifer Tyrawski

Editor: Cheryl Hamilton

Logistics: Donald Booher, Kevin Moore

Medical Field Assistance: Loren Tapp

Keywords: North American Industry Classification System (NAICS) 922130 (Legal Counsel and Prosecution), Illinois, Narcotics, Evidence, Evidence Room, Evidence Locker, Evidence Storage, Evidence Vault, Indoor Environmental Quality

Disclaimer

The Health Hazard Evaluation Program investigates possible health hazards in the workplace under the authority of the Occupational Safety and Health Act of 1970 (29 U.S.C. § 669(a)(6)). The Health Hazard Evaluation Program also provides, upon request, technical assistance to federal, state, and local agencies to investigate occupational health hazards and to prevent occupational disease or injury. Regulations guiding the Program can be found in Title 42, Code of Federal Regulations, Part 85; Requests for Health Hazard Evaluations (42 CFR Part 85).

Availability of Report

Copies of this report have been sent to the employer, employees, and union at the plant. The state and local health departments and the Occupational Safety and Health Administration Regional Office have also received a copy. This report is not copyrighted and may be freely reproduced.

Recommended Citation

NIOSH [2019]. Evaluation of potential occupational exposures to narcotics in a county evidence room. By Feldmann KD, Hatcher S. Cincinnati, OH: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, Health Hazard Evaluation Report 2018-0150-3340, <https://www.cdc.gov/niosh/hhe/reports/pdfs/2018-0150-3340.pdf>.

Table of Contents

Main Report

Introduction	1
Our Approach	2
Our Key Findings.....	2
Our Recommendations	3

Supporting Technical Information

Section A: Workplace Information.....	A-1
Building.....	A-1
Employee Information	A-1
Background	A-2
Process Description	A-2
Section B: Methods, Results, and Discussion	B-1
Methods: Environmental Assessment.....	B-1
Results: Environmental Assessment.....	B-1
Methods: Employee Health Assessment	B-3
Results: Employee Health Assessment	B-3
Discussion	B-4
Limitations.....	B-8
Conclusions	B-8
Section C: Tables.....	C-1
Section D: References.....	D-1

This page left intentionally blank

Introduction

Request

The manager of an investigations bureau within a county state's attorney's office was concerned about potential employee exposures to narcotics in their evidence rooms.

Workplace

The investigations bureau was on the 14th floor of a 15-story building. The evidence room on the 14th floor provided temporary storage of drug, biological material or DNA, and other evidence for active court cases. Another evidence room located in the sub-basement was used to store evidence from older or inactive cases.

Drug evidence included marijuana, cocaine, phencyclidine, narcotic prescription and nonprescription opioids, and other illicit drugs. Biological and DNA evidence included garments contaminated with bodily fluids and buccal (cheek) swabs from relevant persons. Other evidence included firearms or other weapons, and additional objects from crime scenes.

At the time of our evaluation, 48 employees worked for the investigations bureau and spent time on the 14th floor. During our visit, 45 employees were present. All employees worked an 8-hour shift, Monday through Friday. Work activities included

- Three full-time evidence room technicians worked in both the 14th floor evidence room and sub-basement evidence room.
 - Work activities in the 14th floor evidence room included intake, inventory, storage, retrieval, signing out of evidence, and identifying and repackaging evidence approved for destruction. Work activities in the sub-basement included organizing stored evidence and repackaging evidence for destruction.
- The remaining 45 employees worked in offices adjacent to the evidence room or in the field. These employees included administrative assistants, investigators, sergeants, commanders, and senior leadership staff. One sergeant also served as a regular back-up evidence room technician.
 - Work activities included interviewing victims and witnesses, collecting buccal swabs from relevant persons, serving court subpoenas, performing administrative tasks in the office, and management or supervisory activities. These employees rarely spent time in the evidence rooms but were available to assist evidence room technicians as needed.

To learn more about the workplace, go to [Section A in the Supporting Technical Information](#)

Our Approach

We visited the location on September 11 and 12, 2018. During this site visit we

- Walked through and observed the work environment of the 14th floor evidence room, sub-basement evidence room, and surrounding areas.
- Inspected the ventilation system serving the 14th floor evidence room and surrounding areas.
- Measured temperature, relative humidity, carbon monoxide, and carbon dioxide on the 14th floor in the evidence room and in the adjacent administrative and field investigators' office areas.
- Interviewed 18 investigations bureau employees, including evidence room technicians, investigators, sergeants, commanders, and senior leadership staff, about their work and their health. Interview topics included job tenure, job tasks, relevant medical history, and health symptoms and concerns.
- Observed work practices and procedures in the 14th floor evidence room.
- Discussed housekeeping practices with housekeeping staff and inspected their cleaning equipment.

To learn more about our methods, go to [Section B in the Supporting Technical Information](#)

Our Key Findings

The evidence rooms did not have their own ventilation systems

- This means air could be recirculated from the evidence rooms into other areas by the ventilation systems. However, the evidence rooms were under negative air pressure relative to the surrounding areas. This is a preferable ventilation design that minimizes the migration of airborne contaminants from their source.
- Employees opened or repackaged evidence without using local exhaust ventilation.

Personal protective equipment was available but not required

- Written policies for personal protective equipment use were not available.
- N95 filtering facepiece respirators were available for voluntary use in the evidence room, but management had not provided Appendix D of the Occupational Safety and Health Administration's (OSHA) Respiratory Protection Standard to employees.
- Employees sometimes wore powder free latex gloves when handling evidence.

Employees reported health symptoms that could be related to both workplace and nonworkplace exposures

- Ten employees reported health symptoms during the last six months that improved when they were away from work.
- Employees attributed the health symptoms they reported to dust or dry air at work, poor ventilation, drug odors, and seasonal allergies.

To learn more about our results, go to [Section B in the Supporting Technical Information](#)

Our Recommendations

The Occupational Safety and Health Act requires employers to provide a safe workplace.

Benefits of Improving Workplace Health and Safety:

- | | |
|--|--|
| ↑ Improved worker health and well-being | ↑ Improved image and reputation |
| ↑ Better workplace morale | ↑ Better products, processes, and services |
| ↑ Better employee recruiting and retention | ↑ Could increase overall cost savings |

The recommendations below are based on the findings of our evaluation. For each recommendation, we list a series of actions you can take to address the issue at your workplace. The actions at the beginning of each list are preferable to the ones listed later. The list order is based on a well-accepted approach called the “hierarchy of controls.” The hierarchy of controls groups actions by their likely effectiveness in reducing or removing hazards. In most cases, the preferred approach is to eliminate hazardous materials or processes and install engineering controls to reduce exposure or shield employees. Until such controls are in place, or if they are not effective or feasible, administrative measures and personal protective equipment may be needed. Read more about the hierarchy of controls at <https://www.cdc.gov/niosh/topics/hierarchy/>.



We encourage the investigations bureau to use a health and safety committee to discuss our recommendations and develop an action plan. Both employee representatives and management representatives should be included on the committee. Helpful guidance can be found in *Recommended Practices for Safety and Health Programs* at <https://www.osha.gov/shpguidelines/index.html>.

Recommendation 1: Ensure the evidence rooms meet the ventilation recommendations of the International Association for Property and Evidence (IAPE) and the American National Standards Institute (ANSI)/ASHRAE.

Why? Any area that is used for storing narcotics should be independently ventilated so that noxious odors are removed and not recirculated into the building's ventilation system. A separate ventilation system protects employees in other parts of the building. Local exhaust ventilation systems protect employees from exposure to hazardous substances by containing or capturing them at the emission point.

How? At your workplace, we recommend these specific actions:



Provide dedicated ventilation systems for the evidence rooms.

- IAPE property room standards specify that areas used for storing drugs should be “independently ventilated.”
 - Adding ventilation systems or modifying existing ones can be complicated and expensive.
- Additionally, IAPE recommends that evidence room ventilation systems change the air approximately 10–12 times per hour. Find these standards here:
http://home.iape.org/resourcesPages/IAPE_Downloads/IAPE_Resources/IAPE-Professional-Standards/IAPE_Stand_2_6-2016.pdf.
- In the interim, consider supplementing evidence room ventilation system(s) with benchtop ventilation hood(s) and use them when handling or repackaging evidence.
 - Choose hoods that filter both particulate and organic vapors and are large enough to handle all evidence handling tasks.
 - Develop a comprehensive preventive maintenance program to ensure that hoods continue to work properly.

Recommendation 2: Provide appropriate personal protective equipment to employees who handle evidence and develop guidance for its use.

Why? Personal protective equipment can help reduce employees' risk of exposure to drugs in the evidence room. The IAPE recommends that protective supplies and equipment are provided and available for use by employees.

How? At your workplace, we recommend these specific actions:



Decide if evidence room employees must wear respirators when they are working.

- If respirators are required, implement a written respiratory protection program consistent with the OSHA respiratory protection standard:
<https://www.osha.gov/Publications/3384small-entity-for-respiratory-protection-standard-rev.pdf>.
- If respirators are voluntary, a written program is not needed, but employees must be provided with Appendix D of the OSHA respiratory protection standard:
<https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.134AppD>.
- Ensure that employees do not have facial hair that can interfere with the sealing surface of tight-fitting respirators.



Replace latex gloves with powder-free nonlatex (e.g., nitrile or vinyl) gloves.

- Train employees on proper glove wear. Show them the visual signs that glove material is worn out, so that they recognize when they need new gloves.
- Additional information on the occupational hazards associated with latex exposure can be found in the *NIOSH Alert: Preventing Allergic Reactions to Natural Rubber Latex in the Workplace*, available at <http://www.cdc.gov/niosh/docs/97-135/>.

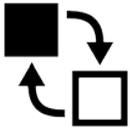
Recommendation 3: Address other health and safety issues we identified during our evaluation.

Why? A workplace can have multiple health hazards that cause worker illness or injury. Similar to the ones identified above, these hazards can potentially cause serious health symptoms, lower morale and quality of life for your employees, and costs to your business. Although they were not the focus of our evaluation, these hazards could cause harm to your workers' health and safety and should be addressed. We found the following potential issues at your workplace:

- The floor of the 14th floor evidence room floor was carpeted. The sub-basement evidence room floor was vinyl tile. Porous materials are more difficult to clean than smooth, nonporous surfaces in the event of a spill.
- The vacuum used by housekeeping was in a poor state of repair and was not equipped with a high efficiency particulate filter. Vacuums not equipped with a high efficiency particulate filter can spread more dust than they collect.

Although they were not the focus of our evaluation, these hazards could cause harm to your workers' health and safety and should be addressed.

How? At your workplace, we recommend these specific actions:



Replace the carpet in the 14th floor evidence room with a nonporous surface to aid in routine cleaning and cleaning up after a spill.



Purchase a vacuum specifically for evidence room use.

- Ensure this vacuum is equipped with a high efficiency particulate air filter for cleaning evidence room spills.
- Develop a comprehensive preventive maintenance program to ensure that the vacuum continues to work properly.



Purchase a separate vacuum equipped with a high efficiency particulate air filter for housekeeping use outside of the evidence rooms.

Supporting Technical Information

Evaluation of Potential Occupational Exposures to
Narcotics in a County Evidence Room

HHE Report No. 2018-0150-3340

March 2019

Section A: Workplace Information

Building

- Fifteen story building, about 89 years old, owned and managed by the city.
- Two evidence storage locations in the building:
 - The 14th floor evidence room was used to store evidence from active investigations.
 - The sub-basement evidence room stored old evidence from inactive criminal cases and evidence designated for permanent storage or destruction.
- Mechanical penthouse with the heating, ventilating, and air-conditioning (HVAC) system on the 15th floor served the 14th floor: this was independent of the rest of the building's HVAC systems. HVAC systems for the remaining floors were on the 6th floor.
- Chilled/heated water for cooling and heating the entire building was provided by an adjacent building.
- Part of 14th floor was renovated in 2017 because of a flood on the 15th floor in 2012. We were told that this renovation did not involve the evidence room.

Employee Information

- Forty-eight investigations bureau employees worked in the office during our site visit. These included evidence room technicians, administrative assistants, investigators, sergeants, commanders, and senior leadership staff.
- Evidence room technicians' work activities in the 14th floor evidence room included intake, inventory, storage, retrieval, and signing out of evidence, and identifying evidence approved for permanent storage or destruction. In the sub-basement evidence room, evidence room employees organized and repackaged evidence designated for permanent storage or destruction.
- Non-evidence room employees worked in offices adjacent to the evidence room or in the field. Administrative assistants never spent time in the evidence room. Investigators and supervisory staff reported only spending time in the evidence room as needed. For example, they might go into the evidence room, if asked, to fill in for an evidence room technician or to help locate evidence.
- Other activities performed by non-evidence room employees included office-based preparation for investigative field work, such as researching witnesses and gathering information for assistant states' attorneys. In addition, non-evidence room employees performed administrative tasks, such as completing and filing paperwork and performing management or supervisory tasks.
- Outside of the office, investigators interviewed and collected buccal swabs from relevant persons, and served court subpoenas.

- Employees were represented by the Fraternal Order of Police Sergeant Union and the Fraternal Order of Police Investigator Union.
- Work shift was eight hours per day, Monday through Friday.
- Median employee age was 53 (range: 35–70 years).
- Median job tenure was 6 years (range: 1 month–28 years).

Background

During 2018, management and employees began updating evidence room policies and procedures, including updating inventories, organizing material in both evidence rooms, and preparing old evidence for final disposition (e.g., permanent off-site storage, destruction). Management requested a health hazard evaluation to investigate potential evidence room exposures and to learn how to prevent employee exposures in the evidence rooms.

Additional concerns were raised during discussions with management and employees, including potential health effects associated with past flooding of the basement storage room and areas of the 14th floor. Therefore, our evaluation expanded to include general indoor environmental quality (IEQ) concerns among investigations bureau employees on the 14th floor, in addition to potential evidence room exposures and related health outcomes.

Process Description

Employees reported that evidence arrived in an envelope sealed by the submitting jurisdiction or the laboratory that had performed testing on the evidence. “Sealing” is a procedural step used to maintain a chain of custody as the evidence moves through different jurisdictions and does not necessarily mean that the evidence is in an airtight package. An evidence room technician then sealed the evidence in a plastic bag, assigned it an inventory number, and stored it in the 14th floor evidence room. Evidence coming back from trial was sometimes opened for viewing by the jury. In this case, evidence room technicians repackaged and resealed the evidence before returning it to the evidence room.

Employees reported that biological and DNA evidence also arrived from the submitting jurisdiction or forensics laboratory in a sealed paper bag. Biological and DNA evidence cannot be stored in plastic; therefore, the evidence room technician assigned the evidence an inventory number and stored it as it was received (e.g., in a cardboard box, paper bag).

Section B: Methods, Results, and Discussion

Our objectives were to

- Evaluate the ventilation of the evidence rooms and surrounding work areas
- Identify the work activities that could potentially expose employees to controlled substances and other hazards in the evidence rooms
- Investigate the health concerns and work-related health symptoms of investigations bureau employees
- Assess housekeeping practices in the investigations bureau office

Methods: Environmental Assessment

We visually inspected the HVAC system for the 14th floor. We spoke with facilities staff about the 14th floor and 6th floor HVAC systems, the type of air filters used, and regular maintenance procedures. Requests to facilities management for additional ventilation details (e.g., test and balance reports, blueprints, etc.) received no response.

We used ventilation smoke tubes to determine if the evidence rooms were under positive or negative air pressure relative to adjacent workspaces. We used TSI® Q-Traks to record temperature, relative humidity, carbon dioxide (CO₂), and carbon monoxide (CO) measurements in the 14th floor evidence room and in two adjacent office areas. We compared these measurements to IAPE standards and ANSI/ASHRAE guidelines.

We observed evidence room practices, procedures, and conditions and spoke with evidence room technicians. We also spoke with housekeeping staff and inspected their equipment.

Results: Environmental Assessment

Both evidence rooms appeared to be repurposed office space, not built specifically for the purpose of evidence storage. The 14th floor evidence room was previously two offices (each about 10-feet wide and 20-feet deep) connected by one doorway. This space was now divided into three rooms, with one secure door to the hallway. The front area of the first room was about 10-feet wide and 8-feet deep. It held a desk used by technicians and a table with a heat sealer. A metal security cage and lockable filing cabinets for storing evidence sat in the remaining first room space. Technicians processed evidence at a desk within the caged area. Only evidence handling activities were performed at these desks. Technicians each had a desk outside of the evidence room for other office activities.

The second room had shelving along two walls and rolling shelving units in the middle. The acoustical suspended ceiling had been removed. Evidence was in stacks over eight-feet high in the second office. A ladder was available for technicians' use to reach the evidence on the top shelves. The 14th floor evidence room had three supply diffusers and one ducted air return. The entire 14th floor evidence room was carpeted.

The sub-basement evidence room was about 12-feet wide and 14-feet deep. Evidence was stored on shelving and in lockable metal cabinets. There were two supply diffusers with no ducted air return. A stack of cardboard boxes obstructed one diffuser. The acoustical suspended ceiling had been removed, and the floor was covered with vinyl tile.

We confirmed that both evidence rooms were under negative air pressure relative to adjacent areas, a preferred design. However, the evidence rooms did not have independent HVAC systems; this meant that air could be recirculated from the evidence rooms into other areas. Evidence room technicians reported that they performed housekeeping activities such as disposing of trash in both evidence rooms on an as-needed basis. They did not have a vacuum available to clean up spills or to clean the carpet in the 14th floor evidence room.

The mechanical penthouse on the 15th floor contained the HVAC system serving only the 14th floor and was independent of the rest of the building's HVAC systems. The 6th floor of the building held HVAC systems for the remaining floors of the building, including the sub-basement evidence room. Chilled/heated water for cooling and heating for the entire building was provided by an adjacent building. The 14th floor had perimeter hot water heating to supplement the HVAC. Many of the perimeter offices had furniture blocking these supplemental heating units.

Table C1 presents the range of temperature, relative humidity, CO₂, and CO levels we measured over a 24-hour period in the 14th floor evidence room and two adjacent office areas. Temperature levels in the storage room ranged from 66°F to 72°F. Temperature levels in the office area ranged from 72°F to 75°F. Humidity levels in the storage room ranged from 55% to 62% relative humidity. Humidity levels in the office area ranged from 50% to 60% relative humidity. Carbon dioxide levels ranged from 395 to 661 parts per million (ppm). Carbon monoxide levels ranged from not detected (< 1) to 3.7 ppm. We did not collect any measurements from outside the building.

Evidence room technicians told us they used a heat sealer to mechanically seal plastic evidence bags for storage. This sealer was on a table in the 14th floor evidence room where evidence with damaged packaging was also handled (opened, repackaged, etc.). This work was performed without benchtop local exhaust ventilation.

We observed powder-free latex gloves, surgical masks, and N95 filtering facepiece respirators available for use in the 14th floor evidence room. We learned that as evidence room policies and procedures were being updated, employees discovered that some of the packaging and labeling of older evidence was damaged. Because they recognized the potential exposure risk, management purchased N95 filtering facepiece respirators for voluntary use by evidence room technicians. However, management had not provided Appendix D of the OSHA Respiratory Protection Standard (29 CFR 1910.134) to employees, nor had they developed a written policy for personal protective equipment (PPE) use.

The floor of the 14th floor evidence room was carpeted. The sub-basement evidence room floor was covered with vinyl tile. The vacuum used by housekeeping was in poor condition and was not equipped with a HEPA filter. Housekeeping employees reported rarely having access to the 14th floor evidence room to perform cleaning activities. We observed no visual evidence of damage from the flood in any of the locations we inspected.

Methods: Employee Health Assessment

We collected information about employees' potential work-related exposures, health symptoms, and concerns through (1) voluntary confidential medical interviews and (2) review of employees' written exposure reports. We invited all 14th floor investigations bureau employees working in the office during the dates of our visit to participate in the interviews. Investigations bureau employees with offices on the 13th floor of the building, but who spent time on the 14th floor, were also invited to participate.

Interviews covered topics including work history and practices, PPE use, work-related exposures and health symptoms, and relevant medical history. Employees were asked if they had experienced any exposures to drug or biological/DNA evidence in the evidence room. Work-related health symptoms were defined as health symptoms that reportedly improved away from work.

Results: Employee Health Assessment

Confidential Medical Interviews

Of the 48 investigations bureau employees who worked in the office, 45 were present during our visit; 18 (40%) of these participated in the confidential medical interviews. Of the 18 interviewed employees, 11 were male, and the median age was 53 years (range: 35–70 years). No employees were current smokers. The 18 interviewed employees represented four job categories: administrative staff (n = 4), evidence room technicians (n = 3), investigators (n = 5), and supervisory staff (n = 6). Supervisory staff included sergeants, commanders, and senior leadership staff.

Interviewed employees reported working in the building a median of 6 years (range: 1 month–18 years). Eleven interviewed employees reported that their primary job location was in a 13th or 14th floor office; three employees reported that their primary work location was in the 14th floor evidence room at the time of our visit. All evidence room employees reported spending 5 days per week and a median of 6 hours per day in the 14th floor evidence room (range: 5–8 hours). Of the 18 interviewed employees, eight (44%) reported that they handled drug evidence at work, and nine (50%) reported that they handled biological or DNA evidence at work.

Evidence room employees' reported work activities included accepting and inventorying evidence, locating and signing out evidence to assistant state's attorneys for trial, and identifying evidence approved for destruction. Non-evidence room employees reported only spending time in the evidence rooms as needed. For example, investigators or supervisory employees might go into the evidence room if asked to fill in for an evidence room technician or to help locate evidence.

Half of the interviewed employees reported ever spending time in the sub-basement evidence storage room. Work activities there included organizing and moving evidence boxes marked for permanent off-site storage or destruction.

Ten employees reported health symptoms during the last 6 months that improved when they were away from work (Table C2). The most common work-related symptoms were eye irritation (n = 4), headache (n = 4), runny or stuffy nose (n = 3), dry or sore throat (n = 3), and cough (n = 2). When asked what they thought caused their symptoms, employees attributed their symptoms to dust or dry air at work, poor ventilation in the file or evidence room, drug odors in the fault, and seasonal allergies. Two

employees reported having hay fever or other allergies (not including allergies to medications) that were worse on work days.

Over half of interviewed employees (n = 10) reported unpleasant odors in the workplace. The most common unpleasant odor description was “drug odors” (n = 8); this description sometimes included specific mention of marijuana, cocaine, and heroin odors.

The majority of interviewed employees reported wearing gloves at work (n = 13); all employees who wore gloves at work, wore them when handling evidence. Employees who reported that they never use gloves at work held positions that did not require evidence handling. Eye protection was less common (n = 5) and was not reported to be used while handling evidence. Rather, employees reported using eye protection when at the shooting range. While no employees reported using a respirator, six reported sometimes using a surgical mask in the evidence room, especially during inspection of evidence when required for the judicial process.

Three employees reported having received online or in-person bloodborne pathogens training within the past year; none of these were full-time evidence room staff.

Employee Exposure Reports

We reviewed the exposure reports for two employees who reported potential exposures while working in the evidence room. Their potential exposures are described below:

- In June 2018, one evidence room employee was researching inventories in the evidence room and discovered a box with nine separate, opened inventory items, each of them with original inventory documentation removed. This included one inventory item containing 0.75 kilograms of heroin. This employee described the packaging as dusty with a strong medicinal odor. During our interview, this employee mentioned that there was “a lot of” powder and dust, but had not experienced any health symptoms as a result of the exposure.
- Another evidence room employee reported a potential exposure in January 2011. When the employee was moving a bag and box of evidence, their left hand came into contact with a “grey dusty substance” that fell off the top of the roller shelves in the evidence room. The technician reported that the back of their left hand was itchy and red. The employee did not report being evaluated by a physician, and the dusty substance was not tested.

Discussion

One of the most common deficiencies we have found over years of health hazard evaluations in nonindustrial indoor environments is the improper design, operation, and maintenance of HVAC systems, resulting in inadequate ventilation. In this evaluation, the evidence rooms did not have independent HVAC systems; consequently, air could be recirculated from the evidence rooms into other areas. However, we confirmed that both evidence rooms were under negative air pressure relative to adjacent areas, a preferred design.

Both IAPE and ANSI/ASHRAE recommend independent HVAC systems for evidence rooms. IAPE property room standards specify that any area used for storing drugs should be “independently ventilated in a manner that noxious fumes are removed from the building, and not recirculated into the

building's HVAC system." The IAPE standards further state that the proper design of a drug storage area should include a "negative pressure" ventilation system [IAPE 2018]. ANSI/ASHRAE also recommends that drug vaults or evidence rooms be kept under negative pressure [ANSI/ASHRAE 2015a]. A separate ventilation system in the evidence room protects employees in other parts of the building by isolating potentially hazardous materials.

In addition, a benchtop local exhaust ventilation hood in the 14th floor evidence room could help protect technicians when handling evidence. The hood should be large enough to perform all required evidence handling tasks and provide both particulate and organic vapor filtration. It is also important to develop a comprehensive preventive maintenance program to ensure that (1) employees know how to operate the hood, and (2) the hood continues to work properly.

IAPE standards recommend that evidence room ventilation systems change the air approximately 10–12 times per hour. ANSI/ASHRAE does not provide specific recommendations for air changes in evidence rooms, but does provide recommendations for chemical storage rooms and chemical laboratories. In a previous NIOSH evaluation, investigators recommended six air changes per hour for an evidence room containing drugs and other chemicals [NIOSH 1999]. This recommendation was based on the ASHRAE guidelines for chemical laboratories [ANSI/ASHRAE 2015b]. For nonindustrial indoor environments, in general, ANSI/ASHRAE recommends 4–10 air changes per hour [ANSI/ASHRAE 2016]. The specific number of air changes recommended depends on the occupancy and size of the office, and an outdoor air supply rate that takes into account people and building-related sources. We did not measure air changes in the evidence rooms or offices, and the additional HVAC specifications that we requested were not provided.

Temperature measurements in the office areas occasionally exceeded the ANSI/ASHRAE recommended comfort guidelines for nonindustrial indoor environments [ANSI/ASHRAE 2017]. The temperature in the evidence room was, at times, below the ANSI/ASHRAE recommended comfort guidelines but within IAPE standards (Table C1). Humidity measurements for both the evidence room and adjacent office areas were above the ANSI/ASHRAE guidelines for nonindustrial indoor environments, but within IAPE standards (Table C1).

In an informative appendix to Standard 62.1, ANSI/ASHRAE notes that indoor CO₂ concentrations no greater than 700 ppm above outdoor CO₂ concentrations will satisfy a substantial majority (about 80%) of occupants with regard to body odor from sedentary building occupants [ANSI/ASHRAE 2016]. Elevated CO₂ concentrations would suggest that other indoor contaminants may also be elevated. If CO₂ concentrations are elevated, the amount of outdoor air introduced into the ventilated space may need to be increased. We found that the CO₂ concentrations in the 14th floor evidence room and adjacent office areas were within ANSI/ASHRAE recommended concentrations.

Employees in this office reported health symptoms that might be work-related, including runny or stuffy nose, eye irritation, cough, dry or sore throat, and headache. However, these symptoms reported by employees are nonspecific and can have workplace or nonworkplace causes. In the scientific literature, most of the symptoms reported in this evaluation have been reported frequently during IEQ investigations of buildings in nonindustrial settings such as schools, hospitals, and office buildings [Brightman et al. 2008; Malkin et al. 1996]. These symptoms can also be found frequently in the general

population: 86%–95% of the general population have one or more common symptoms during any given 2- to 4-week period, and the average adult reports a minimum of one symptom every 4–6 days [Barsky and Borus 1995].

The U.S. Environmental Protection Agency (EPA) conducted a systematic survey of 100 randomly selected office buildings without known IEQ complaints in the United States to develop baseline data about U.S. office buildings [Brightman et al. 2008]. NIOSH conducted a similar study of 80 buildings with IEQ complaints [Malkin et al. 1996]. The rank order of symptoms was the same in both studies, but rates were significantly higher in the buildings with IEQ complaints. The most common work-related symptoms reported in both studies were dry, itching, or irritated eyes; unusual tiredness or fatigue; headache; tension or irritability; pain in back, neck, and shoulders; stuffy or runny nose, or sinus congestion; sneezing; sore or dry throat; and difficulty remembering things or concentrating. These common symptoms in the general population and in office buildings are also among the most common symptoms reported by employees in this office.

An analysis of the published scientific literature showed that nonspecific symptoms such as headache, fatigue, and mucous membrane irritation increase as ventilation rates decrease [Fisk et al. 2009]. Studies in schools and office buildings have found decreased absences due to illness with increased ventilation rates [Mendell et al. 2011; Milton et al. 2000; Shendell et al. 2004]. These studies suggest that improving heating and air conditioning operation and maintenance and increasing ventilation rates can improve symptoms, even without identifying the cause of symptoms.

Typically, employees suspect a workplace cause when their symptoms appear to be worse while at work and better when away from work. In our experience, some of these symptoms may be related to poor IEQ, such as problems with building airflow and temperature, as well as the presence of low levels of chemicals from office furnishings, office machines, cleaning products, personal hygiene products, and structural components of the building [Mendell 1993].

The issues we identified with the design of the HVAC systems and the temperature measurements outside of recommended guidelines could have contributed to employees' symptoms. However, the causes of some symptoms might be medical conditions not related to work, such as respiratory infections and allergies. For these reasons, we cannot specifically attribute the causes of the reported symptoms to workplace exposures.

Another potential explanation for employees' health symptoms is odor. Over half of interviewed employees reported unpleasant odors in the workplace. Odors may produce health symptoms by three mechanisms. First, symptoms can be induced by exposure to odorants at levels that also cause irritation. Therefore, irritation, rather than the odorant, is the cause of the symptoms. Second, health symptoms from odorants at nonirritant concentrations can be due to innate or learned aversions. Third, symptoms may be due to a co-pollutant that is part of an odorant mixture [Schiffman and Williams 2005]. It is possible that employee-reported symptoms could be associated with all three mechanisms or with nonoccupational factors. In persons with existing health problems, such as asthma or chronic respiratory problems, odors can also worsen preexisting symptoms. For example, odors have been found to affect the physiological and psychological responses of individuals with asthma [Beach et al. 1997].

Among employees who reported unpleasant odors, some specifically mentioned marijuana-related odors in and around the evidence room. Terpenes are a large class of hydrocarbons found in essential oils and resins of a wide variety of plants, including marijuana. Because terpenes are volatile and aromatic, they can be smelled in the air at very low concentrations. The terpenes commonly released by marijuana include limonene, alpha-pinene, beta-pinene, beta-myrcene, and beta-caryophyllene [Lai et al. 2008].

Limonene has a reported odor threshold of 10 parts per billion [Leffingwell & Associates 1990]. D-limonene, an isomer of limonene, can also be irritating to the skin and eyes [IPCS INCHEM 1999]. Exposures to monoterpenes (like alpha- and beta-pinene) ranging from 10 to 214 milligrams per cubic meter of air have been related to acute and chronic respiratory affects to employees in some industries [Eriksson et al. 1996; Eriksson et al. 1997]. We did not measure the terpene concentration in the air in or around the evidence room and are unable to determine whether unpleasant odors and employee-reported health symptoms are related to terpenes in the evidence room.

Maintaining or increasing the negative air pressure in the 14th floor evidence room will help minimize the migration of odors to the surrounding offices. However, this will not necessarily reduce the marijuana-related odors within the evidence room because compounds found in marijuana have very low odor thresholds. Isolating marijuana to its own ventilated room or packaging marijuana to contain the off-gassing chemicals would do more to reduce odors within the evidence room than from increasing the general exhaust ventilation. However, employees reported that marijuana and other evidence cannot be reliably stored in air-tight containers.

The availability and use of PPE varied among employees. For example, we were informed that employees wore gloves when handling evidence, and we observed that powder-free latex gloves were available for use in the evidence room. However, latex gloves use may cause skin irritation or skin allergy in some employees. Information on the occupational hazards associated with latex exposure can be found in the [NIOSH Alert: Preventing Allergic Reactions to Natural Rubber Latex in the Workplace](#). Employers should train employees on proper glove wear and how to recognize visual signs that gloves are worn out and should be replaced. Employees reported using respirators they purchased themselves. Management had recently purchased filtering facepiece respirators for voluntary use by employees. However, employees had not been provided with Appendix D of OSHA's Respiratory Protection Standard [29 CFR 1910.134(c)(2)(i)], which is required when respirators are provided for voluntarily use.

Because of evidence security concerns, housekeeping personnel had limited access to the evidence storage rooms. As a result, housekeeping tasks were left to evidence room technicians who did not have the means to perform all these tasks. For example, technicians did not have a dedicated vacuum equipped with a HEPA filter for spill clean-up. Porous material, such as the carpeting in the 14th floor evidence room, is more difficult to clean than smooth, nonporous surfaces like tile. Replacing the carpet with a nonporous surface would aid in everyday cleaning, and in decontamination in the event of a spill. The housekeeping staff should also have a vacuum equipped with a HEPA filter for cleaning carpets in office areas. A comprehensive preventive maintenance program can ensure that the vacuums continue to work properly.

Limitations

Our evaluation had some limitations. First, our assessment can only document conditions on the days of our visit, which may not be representative of conditions and activities occurring during other days. We did not measure air changes in the evidence rooms or offices, and the additional HVAC specifications that we requested were not provided. We did not collect any temperature, relative humidity, CO₂, or CO measurements from outside the building. Second, we did not perform clinical examinations or diagnose any medical conditions; symptoms and medical diagnoses were self-reported by employees. The self-report of symptoms and diagnoses may have been affected by the employees' ability to remember and accurately report them and by employees' ability to access medical care. Third, only 40% of employees participated in our confidential medical interviews. The health symptoms reported by interviewed employees might not be representative of all investigations bureau employees.

Conclusions

We identified ventilation and housekeeping issues in the 14th floor and sub-basement evidence storage rooms that could impact IEQ in the areas surrounding the evidence rooms. The symptoms reported by employees are nonspecific and can have workplace or nonworkplace causes. Ventilation improvements might decrease some employees' symptoms and reduce odor complaints. The employer must provide additional information to employees to meet OSHA requirements for the voluntarily use of respirators.

Section C: Tables

Table C1. Temperature, relative humidity, carbon monoxide, and carbon dioxide measurements, September 2018

Location	Temperature range, °F	Relative humidity, %	Carbon monoxide, ppm	Carbon dioxide, ppm
14th floor evidence room	66–72	55–62	0.0–0.9	407–661
14th floor office area	72–75	50–60	0.0–3.7	395–640
ASHRAE	72–74	30*; 50†	—	≤ 700‡
IAPE	60–75	≤ 60	—	—

*Winter

†Summer

‡ANSI/ASHRAE guideline is for an indoor concentration that is no more than 700 ppm above the outdoor (ambient) concentration.

Table C2. Symptoms reported by interviewed employees in the previous 6 months (n = 18)

Symptom	Employees reporting symptom No. (%)	Employees reporting symptom improves away from work No. (%)
Any symptom	11 (61)	10 (56)
Headache	6 (33)	4 (22)
Runny or stuffy nose	6 (33)	3 (17)
Eye irritation	4 (22)	4 (22)
Dry or sore throat	4 (22)	3 (17)
Cough	3 (17)	2 (11)
Shortness of breath	0 (0)	0 (0)
Rash	0 (0)	0 (0)
Other*	3 (17)	2 (11)

*Other symptoms included acne, sneezing, and loss of sense of smell.

Section D: References

Indoor Environmental Quality

- ANSI/ASHRAE [2015a]. Justice facilities. In: 2015 ASHRAE handbook: heating, ventilating, and air-conditioning applications. Atlanta, GA: ASHRAE.
- ANSI/ASHRAE [2015b]. Laboratories. In: 2015 ASHRAE handbook: heating, ventilating, and air-conditioning applications. Atlanta, GA: ASHRAE.
- ANSI/ASHRAE [2016]. Ventilation for acceptable indoor air quality. American National Standards Institute/ASHRAE standard 62.1–2016. Atlanta, GA: ASHRAE.
- ANSI/ASHRAE [2017]. Thermal environmental conditions for human occupancy. American National Standards Institute/ASHRAE standard 55–2017. Atlanta, GA: ASHRAE.
- Barsky AJ, Borus JF [1995]. Somatization and medicalization in the era of managed care. *JAMA* 274(24):1931–1934, <https://doi.org/10.1001/jama.1995.03530240041038>.
- Brightman HS, Milton DK, Wypij D, Burge HA, Spengler JD [2008]. Evaluating building-related symptoms using the US EPA BASE study results. *Indoor Air* 18(4):335–345, <https://doi.org/10.1111/j.1600-0668.2008.00557.x>.
- CFR. Code of Federal Regulations. Washington, DC: U.S. Government Printing Office, Office of the Federal Register.
- Fisk WJ, Mirer AG, Mendell MJ [2009]. Quantitative relationship of sick building syndrome symptoms with ventilation rates. *Indoor Air* 19(2):159–165, <https://doi.org/10.1111/j.1600-0668.2008.00575.x>.
- IAPE [2018]. Professional Standards Version 2.6. Hot Springs, SD. International Association for Property and Evidence, Inc., http://home.iape.org/resourcesPages/IAPE_Downloads/IAPE_Resources/IAPE-Professional-Standards/IAPE_Standards_2.7.pdf.
- Malkin R, Wilcox T, Sieber WK [1996]. The National Institute for Occupational Safety and Health indoor environmental evaluation experience. Part two: symptom prevalence. *Appl Occup Environ Hyg* 11(6):540–545, <https://doi.org/10.1080/1047322x.1996.10389371>.
- Mendell MJ [1993]. Non-specific symptoms in office workers: a review and summary of the epidemiologic literature. *Indoor Air* 3(4):227–236, <https://doi.org/10.1111/j.1600-0668.1993.00003.x>.
- Mendell MJ, Mirer AG, Cheung K, Tong M, Douwes J [2011]. Respiratory and allergic health effects of dampness, mold, and dampness-related agents: a review of the epidemiologic evidence. *Environ Health Perspect* 119(6):748–756, <http://dx.doi.org/10.1289/ehp.1002410>.
- Milton DK, Glencross PM, Walters MD [2000]. Risk of sick leave associated with outdoor air supply rate, humidification, and occupant complaints. *Indoor Air* 10(4):212–221, <https://doi.org/10.1034/j.1600-0668.2000.010004212.x>.

NIOSH [1999]. State of Iowa Division of Narcotics Enforcement, Des Moines, Iowa. By Burton NC. Cincinnati, OH: U.S. Department of Health and Human Services, Centers for Disease Control, National Institute for Occupational Safety and Health, Health Hazard Evaluation Report 99-0252-2831, <https://www.cdc.gov/niosh/hhe/reports/pdfs/1999-0252-2831.pdf>.

Shendell DG, Prill R, Fisk WJ, Apte MG, Blake D, Faulkner D [2004]. Associations between classroom CO₂ concentrations and student attendance in Washington and Idaho. *Indoor Air* 14(5):333–341, <https://doi.org/10.1111/j.1600-0668.2004.00251.x>.

Odor

Beach JR, Raven J, Ingram C, Bailey M, Johns D, Walters EH, Abramson M [1997]. The effects on asthmatics of exposure to a conventional water-based and a volatile organic compound-free paint. *Eur Respir J* 10(3):563–566, <http://erj.ersjournals.com/content/erj/10/3/563.full.pdf>.

Eriksson KA, Levin JO, Sandström T, Lindström-Espeling K, Lindén G, Stjernberg NL [1997]. Terpene exposure and respiratory effects among workers in Swedish joinery shops. *Scand J Work Environ Health* 23(2):114–120, <https://doi.org/10.5271/sjweh.188>.

Eriksson KA, Stjernberg NL, Levin JO, Hammarström U, Ledin MC [1996]. Terpene exposure and respiratory effects among sawmill workers. *Scand J Work Environ Health* 22(3):182–190, <https://doi.org/10.5271/sjweh.129>.

IPCS INCHEM [1999]. International chemical safety card: d-limonene, <http://www.inchem.org/documents/iarc/vol73/73-11.html>.

Lai H, Corbin I, Almirall JR [2008]. Headspace sampling and detection of cocaine, MDMA, and marijuana via volatile markers in the presence of potential interferences by solid phase microextraction-ion mobility spectrometry (SPME-IMS). *Anal Bioanal Chem* 392(1–2):105–113, <https://doi.org/10.1007/s00216-008-2229-z>.

Leffingwell & Associates [1990]. Odor thresholds, <http://www.leffingwell.com/odorthre.htm>.

Schiffman SS, Williams CM [2005]. Science of odor as a potential health issue. *J Environ Qual* 34(1):129–138, <https://www.ncbi.nlm.nih.gov/pubmed/15647542>.

Delivering on the Nation's promise: Promoting productive workplaces through safety and health research

Get More Information

Find NIOSH products and get answers to workplace safety and health questions:

1-800-CDC-INFO (1-800-232-4636) | TTY: 1-888-232-6348

CDC/NIOSH INFO: [cdc.gov/info](https://www.cdc.gov/info) | [cdc.gov/niosh](https://www.cdc.gov/niosh)

Monthly *NIOSH* eNews: [cdc.gov/niosh/eNews](https://www.cdc.gov/niosh/eNews)