

This Health Hazard Evaluation (HHE) report and any recommendations made herein are for the specific facility evaluated and may not be universally applicable. Any recommendations made are not to be considered as final statements of NIOSH policy or of any agency or individual involved. Additional HHE reports are available at <http://www.cdc.gov/niosh/hhe/reports>

**HETA 96-0241-2634**  
**Maricopa County Sheriff's Office**  
**Phoenix, Arizona**

---

**Nancy Clark Burton, M.P.H., M.S., C.I.H.**  
**Yvonne Boudreau, M.D., M.S.P.H.**

## PREFACE

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

The Hazard Evaluations and Technical Assistance Branch also provides, upon request, 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 the National Institute for Occupational Safety and Health.

## ACKNOWLEDGMENTS AND AVAILABILITY OF REPORT

This report was prepared by Nancy Clark Burton of the Hazard Evaluations and Technical Assistance Branch, Division of Surveillance, Hazard Evaluations and Field Studies (DSHEFS) and Yvonne Boudreau of the Denver Field Office. Field assistance was provided by Caroline Portmann. Desktop publishing was provided by Ellen Blythe.

Copies of this report have been sent to employee and management representatives at Maricopa County Sheriff's Office and the OSHA IX Regional Office. This report is not copyrighted and may be freely reproduced. Single copies of this report will be available for a period of three years from the date of this report. To expedite your request, include a self-addressed mailing label along with your written request to:

NIOSH Publications Office  
4676 Columbia Parkway  
Cincinnati, Ohio 45226  
800-356-4674

After this time, copies may be purchased from the National Technical Information Service (NTIS) at 5825 Port Royal Road, Springfield, Virginia 22161. Information regarding the NTIS stock number may be obtained from the NIOSH Publications Office at the Cincinnati address.

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

**Health Hazard Evaluation Report 96-0241-2634**  
**Maricopa County Sheriff's Office**  
**Phoenix, Arizona**  
**April 1997**

**Nancy Clark Burton, M.P.H., M.S., C.I.H.**  
**Yvonne Boudreau M.D., M.S.P.H.**

---

## SUMMARY

In August 1996, the National Institute for Occupational Safety and Health (NIOSH) received a request from employees of the Maricopa County Sheriff's Office in Phoenix, Arizona, for a health hazard evaluation (HHE) of the evidence drying room. The HHE requesters expressed concern over employees' exposures to potential biological health hazards, including blood-borne pathogens, and odors related to the storage and handling of evidence for criminal investigations. In response, NIOSH personnel conducted a site visit at the Sheriff's Office on September 24 and 25, 1996. A walk-through evaluation of the evidence drying room was conducted, and ventilation measurements were made using a thermoanemometer. Airflow patterns were visualized using smoke. Confidential interviews were conducted with three detectives.

The steel-lined evidence drying room is used by approximately 70 employees, including about 60 detectives and 10 laboratory technicians. Evidence placed in this room includes blood and body-fluid soaked articles of clothing, objects such as clothing found in sewers, and items used to cover decedents (such as blankets or sleeping bags). Detectives reported that personal protective equipment (PPE), including respirators, goggles, Tyvek® suits, and vinyl and latex gloves, is available for use in the field and in the evidence drying room, and that employees who work in the room receive training on precautions against blood-borne pathogen exposure. The evidence drying room is located in the basement of the criminal court system complex and there have been complaints of the same foul odors in other sections of the complex, including judges' chambers. There was no set schedule for preventive maintenance of the ventilation system or cleaning of the evidence room. Initial airflow measurements showed very low ventilation rates (about three air changes per hour [ACH]). These measurements were repeated after the maintenance staff removed the heavily soiled charcoal/fiberglass filters and increased the fan speed to the maximum level. The ventilation rates increased to approximately 45 ACH and there was a noticeable reduction in the foul odor.

There are potential risks of exposure to blood-borne pathogens such as human immunodeficiency virus (HIV) and hepatitis B virus (HBV), especially in the field while gathering evidence. Precautions, such as the use of PPE including gloves and protective clothing such as suits, aprons, faceshields and/or masks, and shoe coverings, should be taken to prevent contact with the blood and/or body fluid contaminated materials. Recommendations to improve or redesign the ventilation system for the evidence drying room are offered at the end of this report.

Keywords: SIC Code 9221 (Police Protection), evidence drying room, blood-borne pathogens, decaying organic material, personal protective equipment, ventilation.

# TABLE OF CONTENTS

Preface .....	ii
Acknowledgments and Availability of Report .....	ii
Summary .....	iii
Introduction .....	2
Background .....	2
Methods .....	2
Ventilation Assessment .....	2
Confidential Interviews .....	3
Literature Review .....	3
Results .....	3
Ventilation Assessment .....	3
Observations .....	4
Confidential Interviews .....	4
Discussion/ Conclusions .....	4
Recommendations .....	4
References .....	5

## INTRODUCTION

In August 1996, the National Institute for Occupational Safety and Health (NIOSH) received a request from employees of the Maricopa County Sheriff's Office in Phoenix, Arizona, for a health hazard evaluation (HHE) of the evidence drying room. The HHE requesters expressed concern over employees' exposures to potential biological hazards, including blood-borne pathogens, and odors related to the storage and handling of evidence for criminal investigations. In response, NIOSH personnel conducted a site visit at the office on September 24 and 25, 1996. An interim letter explaining site visit activities and initial findings was issued in November 1996.

## BACKGROUND

The Maricopa County Sheriff's Office evidence drying room is used by about 70 employees, including approximately 60 detectives from departments such as homicide, traffic accident, and general crime, and 10 evidence/laboratory technicians. Evidence placed in this room can include blood and body-fluid soaked articles of clothing, objects such as clothing found in sewers, and items used to cover decedents (such as blankets or sleeping bags). Each detective is responsible for the collection of evidence in cases in which they are the lead investigator. The evidence is packaged in paper or plastic and transported, at room temperature, to the evidence drying room from the field. Occasionally, the detectives will examine the evidence in a building adjacent to their offices before taking it to the evidence drying room. Detectives reported that personal protective equipment (PPE), including paper masks, goggles, Tyvek® suits, and vinyl and latex gloves, is available outside the entrance to the evidence drying room, and that most employees don this equipment prior to entering the room and handling the evidence. Employees also carry PPE, including NIOSH-approved disposable High-Efficiency Particulate Air (HEPA) respirators (3M-9970) to protect against particulates, in their

vehicles and use it in the field while collecting evidence. They also reported that employees who work in the evidence drying room receive training on precautions against blood-borne pathogen exposure. Immunization with hepatitis B vaccine is offered to employees who have the potential for work-related exposure to blood or other body fluids. After drying, which varies from about one week to several months, the evidence is placed in plastic bags and stored in a freezer. The evidence/laboratory technicians use laboratory hoods when examining this evidence closely.

The evidence drying room is steel-lined with two exhaust vents which are connected to a dedicated fan that exhausts air directly to the outside at ground level under a stairwell that leads into the building. The evidence is placed on metal racks and on the floor. Make-up air is provided through a grille in the wooden door which opens into the small room where the PPE is kept. The small room has no mechanical ventilation system and contains two other solid secured doors — one of which leads into the parking garage and the other into the property room. There is a floor drain that reportedly leads into the sewer drainage system. There was no schedule for preventive maintenance of the ventilation system or cleaning of the evidence room. According to maintenance staff, there should be three fiberglass filters containing charcoal in the ductwork before the fan to remove odors.

## METHODS

### Ventilation Assessment

A walk-through evaluation of the evidence drying room was conducted. Ventilation measurements were made in the evidence drying room using a TSI VelociCalc Plus Model 8360® thermoanemometer. This instrument measures air velocity by detecting the cooling effect of air as it passes over a heated (hot-wire) filament at the end of the probe. The airflow is determined by multiplying the average air velocity by the surface area of the exhaust. Airflow patterns were visualized using smoke. The

ventilation plans were not available at the time of the site visit. According to the facilities manager who was present during the site visit, the plans were the original drawings and had probably not been updated when the evidence drying room was renovated (new exhaust ventilation and a steel–lining had been added

in about 1990).

Air changes per hour were calculated for the evidence drying room using the following formula:

$$\text{Air Changes per Hour (ACH)} = \frac{\text{Air Flow Rate (cubic feet per meter [CFM])} \times 60 \text{ minutes per hour}^1}{\text{Room Volume (cubic feet [ft}^3\text{])}.}$$

## Confidential Interviews

At the time of the NIOSH site visit, the detectives were informed by their sergeant that NIOSH representatives were available for private interviews. Three detectives volunteered to be interviewed. Other detectives participated in informal interviews.

## LITERATURE REVIEW

There are no specific guidelines which address the handling of evidence that has been contaminated by blood and other body fluids.<sup>2</sup> Potential infectious hazards associated with the handling of human cadavers include tuberculosis, Group A streptococcal infection, gastrointestinal organisms, Hepatitis B and C viruses (HBV and HBC), human immunodeficiency virus (HIV), and possibly meningitis and septicaemia (especially meningococcal).<sup>3,4,5,6,7</sup> Of these potential infectious hazards, criminal justice personnel would be most likely exposed to the blood–borne viruses HBV or HIV during searches and evidence handling. Laboratory studies have shown that drying HIV reduces the viral amounts by 90 to 99 percent.<sup>4</sup> HBV may survive for an extended period of time in dried blood. However, when in a dried state, the virus is not readily transmissible.<sup>8</sup>

The aridity of central Arizona can effect the rate of decomposition of the bodies and the biological material on the evidence.<sup>9</sup> Decaying bodies and the articles surrounding them (clothing, blankets, etc.) would most likely contain organisms which are part of the body flora and from the surrounding

environment.<sup>7</sup> Adipocere is a waxy or greasy decomposition product formed from the hydrolysis and hydrogenation of tissue fats. It is stable and will adhere to clothing and other items that the decomposing body contacts.<sup>10</sup> Adipocere may be responsible for the articles that “do not dry” in the evidence drying room.

There are currently no ventilation specifications that address evidence drying rooms. However, the American Society for Heating, Refrigerating, and Air–Conditioning Engineers (ASHRAE) has developed recommendations for nonrefrigerated body holding rooms and soiled workrooms/holding rooms for diagnostic/treatment areas which are similar in application to the evidence drying room. These holding rooms should have at least 10 or 12 ACH, respectively; all air should be exhausted to the outside; there should be no recirculation of air within the rooms; and the rooms should be at negative pressure to the adjacent areas (air flows into the room).<sup>11</sup>

## RESULTS

### Ventilation Assessment

Airflow through the exhaust vents was initially evaluated under existing ventilation conditions with the door to the evidence drying room closed. The exhaust vent closest to the door had an airflow rate of about 60 CFM. The other vent did not have any measurable air velocity — this was confirmed using smoke. Assuming a room volume of 1120 ft<sup>3</sup> (10 feet [ft.] by 14 ft. by 8 ft.), approximately three ACH

would be expected. After the maintenance staff removed the charcoal and fiberglass filters, which were heavily soiled and not replaced for the measurements, and increased the fan speed to the maximum level, the exhaust vent next to the door had an airflow rate of approximately 431 CFM and the other vent had 404 CFM, with the door closed. This resulted in approximately 45 ACH and a reduction in the foul odor. Both sets of measurements were made with the security door to the parking garage open, allowing replacement air to enter the evidence drying room.

## Observations

During a walk-through inspection of the evidence drying room, a strong odor of decaying organic animal matter was noted. The evidence was located on metal racks and on the floor of the room. Remnants of maggot larvae and soil were visible on the floor. PPE, including Tyvek® suits, vinyl and latex gloves and paper masks, was located in the small room outside of the evidence room. This small room is also where detectives don and remove their PPE. According to detective representatives, the paper masks are not used. Individuals bring disposable HEPA respirators (3M-9970) with them (that are provided to use in the field) to protect against dust and remove some of the odors. There was no respiratory protection program. Detective representatives also reported that some pieces of evidence take several months to dry under current environmental conditions. The maintenance staff reported that there have been complaints of foul odors in other sections of the court house complex, including judges' chambers.

## Confidential Interviews

Three detectives volunteered to be privately interviewed. None of those interviewed reported any specific health problems, but all reported being concerned about exposure to any unknown pathogens in the evidence drying room. The interviewed employees all reported wearing PPE when working in the evidence room, but that they

were still able to smell the foul odor even when wearing the disposable HEPA respirators. They reported that some employees did not wear Tyvek® clothing and masks or respirators when entering the evidence room. The employees also reported having received periodic video-tape training about blood-borne pathogens.

## DISCUSSION/ CONCLUSIONS

Employees at this facility are concerned about potential hazards of handling evidence that has been contaminated with blood and other body fluids, and the foul odor associated with the evidence drying room. The evidence drying room ventilation system showed low ventilation rates when initially evaluated and there was minimal replacement air. There were complaints of foul odors in other parts of the criminal court system complex. At the time of the site visit, the evidence drying room was crowded with contaminated evidence which made it difficult for the evidence to dry in a timely manner. Since there are potential risks of exposure to blood-borne pathogens such as HIV and HBV, especially in the field, precautions, such as the use of PPE including gloves, Tyvek® clothing, booties, and face shields and/or masks, should be taken to prevent contact with the contaminated materials. The disposable HEPA respirators that are used would be effective for filtering particulate matter but not for odorous gases and vapors.

## RECOMMENDATIONS

(1) If the current evidence drying room is used, a routine preventive maintenance program for the ventilation system should be established to keep the exhaust system working as designed. The room needs to be under negative pressure and additional replacement air should be introduced. The evidence room should be cleaned with a biocide on a routine basis to prevent the build-up of contaminants and debris. As an option, there are commercially

available forensic evidence cabinets for the storage of evidence. These contain particulate pre-filters,

These units would require a comprehensive preventive maintenance program to ensure that they continue to work properly.

Another option would be to build a new evidence drying room in a separate location which is larger and more convenient, and would eliminate the need to carry contaminated evidence into an occupied building. In accordance with recommendations for rooms with similar uses such as nonrefrigerated body holding rooms, this new installation should have a dedicated non-recirculating ventilation system which maintains the room at negative pressure, provides at least 10 ACH, and exhausts filtered air directly to the outside, away from occupied areas.<sup>11</sup> There should be separate rooms for the donning and removal/disposal of PPE. The rooms should be easily cleaned and disinfected.

(2) The Maricopa Sheriff's Office should provide periodic training and education about bloodborne-pathogen exposure prevention to all employees who have the potential to come into contact with blood and/or body-fluid soaked items during the course of their work. The need for wearing personal protective equipment whenever handling items contaminated with blood and/or body fluids should be stressed.<sup>12</sup> Tyvek® aprons could be used for protection in hot weather. If respirators are used, they must be supported by a respiratory protection program, including required elements such as training, selection of the appropriate respirator, and medical determination that the employee is fit to wear a respirator, as mandated by the Occupational Safety and Health Administration (OSHA) in 29 CFR 1910.134 (Respiratory Protection).<sup>13</sup> Information on respirators and respiratory protection programs can also be found in the NIOSH respiratory protection guides.<sup>14,15</sup>

(3) Any employee experiencing an occupational exposure to blood or body fluids should be referred to a health care provider trained to deal with such

HEPA filters, and carbon filters to remove odors.

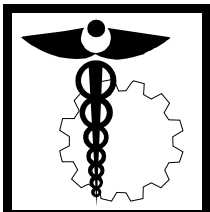
exposures. All information regarding this exposure and the health care provided for it should remain confidential.

## REFERENCES

1. ACGIH [1992]. Industrial ventilation: A manual of recommended practice. 21st edition. Cincinnati, OH: American Conference of Governmental Industrial Hygienists.
2. CDC [1989]. Guidelines for prevention of transmission of Human Immunodeficiency Virus and Hepatitis B Virus to health-care and public safety workers. *Morbidity and Mortality Weekly Report*; June 23, 1989; vol. 38, No. S-6, pp. 1-37.
3. Henry K, Dexter D, Sannerud K, Jackson B, Balfour, H Jr [1989]. Recovery of HIV at autopsy. *The New England Journal of Medicine* 321(26):1833-1834.
4. Resnick L, Veren K, Salahuddin SZ, Tondreau S, Markham PD [1986]. Stability and inactivation of HTLV-III/LAV under clinical and laboratory environments. *JAMA* 255(14):1887-1891.
5. Douceron H, Deforges L, Gherardi R, Sobel A, Chariot P [1993]. Long-lasting postmortem viability of human immunodeficiency virus: a potential risk for forensic medicine practice. *Forensic Science International* 60:61-66.
6. Healing TD, Hoffman PN, Young SEJ [1995]. CDR Review: the infection hazards of human cadavers. *Communicable Disease Report* 5(rev.5):R61-R68.
7. Young SEJ and Healing TD [1995]. The infection hazards of human cadavers. *Communicable Disease Report* 5(rev.5):R69-R73.



8. Bond WW, Favero MS, Petersen NJ, et al. [1981]. Survival of hepatitis B virus after drying and storage for one week. *Lancet* II 550–551.
9. Galloway A, Birkby WH, Jones AM, Henry TE, Parks BO [1989]. Decay rates of human remains in an arid environment. *Journal of Forensic Sciences* 34(3):607–616.
10. Mellon PFM, Lowry MA, Micozzi MS [1993]. Experimental observations on adipocere formation. *Journal of Forensic Sciences* 38(1):91–93.
11. ASHRAE [1991]. Health facilities. In: *ASHRAE Applications Handbook*. Atlanta, GA: American Society for Heating, Refrigerating, and Air-Conditioning Engineers, Chapter 7.
12. Code of Federal Regulations [1996]. 29 CFR 1910.1030 (Bloodborne Pathogens). Washington, DC: U.S. Government Printing Office, Federal Register.
13. Code of Federal Regulations [1993]. 29 CFR 1910.134 (Respiratory Protection). Washington, DC: U.S. Government Printing Office, Federal Register.
14. NIOSH [1987]. NIOSH guide to industrial respiratory protection. Cincinnati, OH: U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication No. 87–116.
15. NIOSH [1996]. NIOSH guide to the selection and use of particulate respirators certified under 42 CFR 84. Cincinnati, OH: U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication No. 96–101.



**NIOSH**

Delivering on the Nation's promise:  
Safety and health at work for all people  
Through research and prevention