



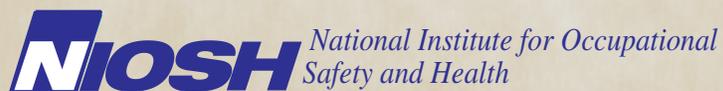
Evaluation of Histoplasmosis Concerns at a United States Post Office

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Health Hazard Evaluation Report
HETA 2007-0216-3056
United States Postal Services
Apply Valley, California
February 2008

DEPARTMENT OF HEALTH AND HUMAN SERVICES
Centers for Disease Control and Prevention



The employer shall post a copy of this report for a period of 30 calendar days at or near the workplace(s) of affected employees. The employer shall take steps to insure that the posted determinations are not altered, defaced, or covered by other material during such period. [37 FR 23640, November 7, 1972, as amended at 45 FR 2653, January 14, 1980].

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ABBREVIATIONS

ANSI	American National Standards Institute
APWU	American Postal Workers Union
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
AVPO	Apple Valley Post Office
cfm	Cubic feet per minute
CO	Carbon monoxide
CO ₂	Carbon dioxide
EPA	Environmental Protection Agency
ft ²	Feet squared
<i>H. capsulatum</i>	Histoplasma capsulatum
HEPA	High-efficiency particulate air
HHE	Health hazard evaluation
HIV	Human immunodeficiency virus
HVAC	Heating, ventilating, and air-conditioning
IEQ	Indoor environmental quality
m ³	Cubic meter
MSDS	Material safety data sheet
NALC	National Association of Letter Carriers
NIOSH	National Institute for Occupational Safety and Health
PPE	Personal protective equipment
ppm	Parts per million
RH	Relative humidity
USPS	United States Postal Service

HIGHLIGHTS OF THE NIOSH HEALTH HAZARD EVALUATION

The National Institute for Occupational Safety and Health (NIOSH) received a union request for a health hazard evaluation (HHE) at the United States Postal Service Office in Apple Valley, California. The request concerned workers at the post office potentially being exposed to pigeon droppings from pigeons roosting in the building's heating, ventilating, and air conditioning (HVAC) units. NIOSH investigators conducted an investigation in July 2007.

What NIOSH Did

- We performed confidential medical interviews with employees regarding their health symptoms.
- We inspected the building's ventilation system and reviewed the system's design.
- We took indoor environmental quality measurements (temperature, relative humidity, and carbon dioxide [CO₂]).
- We reviewed the building ventilation schematics, relevant health and safety records, and past sampling reports.

What NIOSH Found

- We found no specific occupational or environmental exposure that explains the health symptoms the post office employees reported.
- We found that comfort parameters at the post office were within acceptable guidelines except for elevated CO₂ levels measured in some work areas, possibly indicating inadequate outdoor air intake or uneven mixing of air.
- We found that the rooftop HVAC units had bird netting in place to prevent pigeon entry.
- We found no evidence of birds or any other animals in the HVAC units.

What Managers Can Do

- Managers should maintain netting protection around the HVAC units to keep birds out.
- Managers should ensure that outdoor air dampers are not completely closed to allow adequate outdoor air intake.
- Managers should ensure that regular housekeeping activities are performed on a regular basis to reduce the amount of particulate matter in the building.
- Managers should have a test and balance of the ventilation system done to determine whether the HVAC system is performing as designed.

What Employees Can Do

- Employees should promptly report any concerns they have regarding building conditions to management.
- Employees should talk with their physicians regarding any symptoms they believe to be work-related.

The symptoms reported by employees can be caused by a variety of health conditions and illnesses and could not be attributed to a specific workplace exposure. After inspecting the HVAC units, performing medical interviews, and taking into account the environmental requirements of *H. capsulatum* spores, we deemed that the potential for employees to contract histoplasmosis was very low. Therefore, we do not recommend general testing for all AVPO employees for histoplasmosis. However, employees with persistent symptoms should contact their physician on a case-by-case basis to determine if individual testing is appropriate.

On April 17, 2007, NIOSH received a request from NALC for an HHE on behalf of workers at the USPS in Apple Valley, California. NALC representatives filed the HHE request because workers at the post office were potentially exposed to pigeon droppings from pigeons roosting on the roof and in the building's HVAC units. Some workers reported experiencing dizziness, breathing difficulties, cough, and weakness, and were concerned that these symptoms resulted from exposure to *H. capsulatum*, a fungus that causes histoplasmosis, a fungal lung infection. A dead-animal odor in the building was reported by employees and added to their concerns. The NALC specifically asked that NIOSH conduct or recommend medical testing for all AVPO employees to determine whether these symptoms were related to exposure to *H. capsulatum*, and conduct any additional site evaluations deemed necessary to ensure the health and safety of the postal workers.

On July 11-13, 2007, NIOSH representatives made a site visit to the AVPO. NIOSH investigators held opening and closing conferences with union representatives (NALC), management of AVPO, the safety manager, representatives from the USPS San Diego district office, and an industrial hygiene contractor who previously performed environmental sampling. We took IEQ measurements (temperature, RH, and CO₂) and held confidential medical interviews with USPS employees. We also reviewed available environmental testing reports and maintenance records.

We found no direct relationship between current health symptoms reported by AVPO employees and specific occupational or environmental exposures. Perceived odor and building ventilation issues likely contributed to these symptoms. We found that the potential for employees to contract histoplasmosis was low and this potential was further minimized by cleaning and installing nets around the HVAC units. We do not recommend testing AVPO employees for histoplasmosis. However, if individual employees feel that they should be tested due to their symptoms, they should discuss their symptoms and concerns with their physician.

At the time of our investigation, we found comfort parameters at the post office to be within acceptable guidelines recommended by ASHRAE except for elevated CO₂ levels in some work areas, possibly indicating inadequate outdoor air intake or uneven mixing of air. All pigeon fecal matter had been cleared from the units we

SUMMARY (CONTINUED)

examined and, overall, the bird netting appeared intact. Although we saw two bird feathers in one of the HVAC units, we found no evidence that birds were entering or still living in the unit.

Keywords: NAICS 491110 (Postal Service), histoplasmosis, pigeons, fecal matter, postal workers, indoor environmental quality, IEQ, ventilation, odors

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INTRODUCTION

On April 17, 2007, NIOSH received a request from the NALC for an HHE on behalf of workers at the USPS in Apple Valley, California. NALC representatives filed the HHE request because workers at the post office were concerned about pigeon droppings from pigeons roosting on the roof and in the building's HVAC units. Workers reported experiencing dizziness, breathing difficulties, cough, and weakness, and were concerned that these symptoms resulted from exposure to *H. capsulatum*, a fungus that causes histoplasmosis, a fungal lung infection. A dead-animal odor in the building was reported by employees and added to their concerns. The NALC specifically asked that NIOSH conduct or recommend medical testing for all AVPO employees to determine whether these symptoms were related to exposure to *H. capsulatum*, and conduct any additional site evaluations deemed necessary to ensure the health and safety of the postal workers.

The AVPO is located in the desert about 2 hours east of Los Angeles in San Bernardino County. The building is a one-story 28,000 ft² warehouse-like structure built in 1988. AVPO employs 96 employees, 67 of whom are letter carriers and 29 of whom are clerks, custodians, or supervisors. Customer post boxes and mail services are located at the front of the building. The back of the building houses the distribution center, where clerks and letter carriers sort incoming mail, and truck drivers pick up outgoing mail.

Typically, mail clerks start their shift at 3:30 a.m. and separate incoming mail by routes for the letter carriers. Letter carriers begin their shifts at 8:00 a.m. and sort the mail for their routes in a "case," which is a three-walled booth with standing-room only space. Each wall has shelves of holding slots where the letter carriers organize mail. Letter carriers leave the building to deliver mail at approximately 10:30 a.m. and return around 5:00 p.m. They average 3.5 to 4 hours in the building and 5 or 6 hours on their routes. Some letter carriers also work overtime to a maximum of 10 hours of total work per day. Clerks, custodians, and supervisors spend the majority of their working hours in the building.

Management reported that facility maintenance employees dust high areas on a quarterly basis. However, they do not keep records of who dusted, or when. The AVPO uses an independent contractor for pest control, who sets traps and sprays for pests quarterly.

AVPO employees are represented by two unions, the NALC and the APWU. Letter carriers are represented by the NALC, and custodians and clerks are represented by the APWU. Complaints or concerns of safety issues can be brought to the attention of the union chief stewards, who notify management; alternatively, employees can fill out a Report of Hazard, Unsafe Condition or Practice (1767) form that they may anonymously submit to management. Management is required to respond to the employee on the corrective action taken, either directly or through a meeting of all employees (in the case of anonymous submittal) within the same work tour.

The AVPO has a Safety and Health Committee composed of volunteer employees and management. Management and union representatives have stated that they have missed some meetings and would like to resume regular committee meetings and activities.

In January 2006, a group of AVPO employees perceived a dead-animal odor in and immediately outside the building. This odor was reportedly associated with symptoms such as nausea, dizziness, headaches, light-headedness, cough, and breathing difficulty. Upon finding that pigeons had been living and nesting in the rooftop HVAC units, management procured a proposal from a cleaning and sanitizing company to remove the pigeon debris, dead animals, and nesting material, and install bird netting for all of the HVAC units. This proposal was not approved because it was deemed too expensive by the prior AVPO management.

On March 6, 2006, AVPO contracted an HVAC contractor to eliminate the odor problem. The contractor found evidence of nesting in one of the HVAC units; in addition, filters on two of the units needed to be changed. The contractor removed the bird debris and replaced the filters. However, employees reported that the odor persisted.

On May 11, 2006, the HVAC contractor returned to the post office to service the supply unit for the employee break room, men's locker room, and bathroom; areas where the odor was reportedly worst. They found and fixed a broken vent pipe, which was thought to be the source of the smell. They also reported closing the outdoor air damper. The odor was reportedly less noticeable over time after these changes were made.

INTRODUCTION (CONTINUED)

On September 28, 2006, the budget was approved to clean and remove bird debris and install bird netting around two HVAC units located in the recessed area on the rooftop (proposal was submitted in January 2006, by the original cleaning and sanitizing company). Two of the rooftop HVAC units are completely encased with netting in a cage-like structure. The other seven units have netting that is attached to the bottom of the units and weighted to the roof, preventing bird access into the unit via the outdoor air dampers. Management reported that the company took several weeks to pressure-wash the area; remove nests, bird fecal material, and debris; and install the netting. Although the contract agreement we reviewed specified netting for only two of the HVAC rooftop units, management stated that all the units were netted at that time.

In January 2007, several employees raised concerns that health symptoms they had been experiencing may be attributed to exposure to *H. capsulatum* in the bird droppings. In response to employee concerns, management hired an independent environmental consultant on March 6, 2007, who took two ambient air and one bulk sample (fecal matter) to test for avian-borne pathogens (*H. capsulatum*, *Cryptococcus neoformans*, and *Chlamydophila psittaci*). Air samples were collected onto 37-millimeter polycarbonate filters using high-flow vacuum pumps calibrated at 10 liters per minute and analyzed by polymerase chain reaction. Both air samples were reported below the detection limit of 100 organisms/filter or <88 organisms/m³, and no pathogens were detected in the bulk sample.

On May 23, 2007, a USPS building engineer reported that one of the HVAC units was again infested with pigeons. On May 30, 2007, the HVAC contractor removed feathers, pigeon debris, and dead pigeons from inside the HVAC unit. The other units had no signs of bird activity or roosting. The contractor's work log indicated that they cleaned the economizers and cooling coils, and resealed any possible areas of pigeon entry.

ASSESSMENT

On July 11-13, 2007, we made a site visit to the AVPO. NIOSH investigators held an opening conference with NALC representatives, AVPO management, the safety manager, representatives from the USPS San Diego district office, and an industrial hygiene contractor who performed the previous

environmental sampling. We also directly addressed all the employees to inform them of the hazard evaluation and our proposed activities. We took IEQ measurements (temperature, RH, and CO₂) and held confidential medical interviews with USPS workers. In addition to observing the work area, we reviewed the building ventilation schematics, an air sampling report, MSDSs, work orders pertaining to the HVAC units, and Report of Hazard Logs. We held a closing conference on the morning of July 13 to discuss preliminary findings and recommendations.

RESULTS AND DISCUSSION

Medical Interviews

On July 11 and 12, 2007, we interviewed thirty-seven employees who were interested in private and confidential interviews. All interviewed employees reported perceiving a dead-animal odor that was worse on the east side of the building. Nine employees reported no symptoms. Of the remaining 28 employees, 13 reported frequent headaches, 10 reported episodic transient dizziness, and 10 reported having frequent episodes of common cold, flu, or bronchitis. Other symptoms reported were sinus problems by nine employees; shortness of breath by seven employees; musculoskeletal complaints such as neck, back, and shoulder pain and muscle spasm by six employees; and fatigue by five employees. Nausea, hernia, and palpitations were each reported by two employees. About half of those with symptoms reported no improvement away from work including during vacation. All but two employees noted that the odor subsided when the area around the HVAC units was cleaned of pigeon droppings, and some noted considerable improvement or resolution of their symptoms after the HVAC units were cleaned. Some of the employees interviewed noted that their delivery routes are dirt roads and thought that some of their symptoms may be due to exposure to dust.

The symptoms reported at AVPO can be caused by a variety of illnesses and environmental conditions. These conditions and illnesses could include the perception of unpleasant odors [Dalton 1999; Shusterman 1992; Bruvold et al. 1983; Ames and Stratton 1991], poor indoor air quality [Lindgren and Norback 2005; Erdmann and Apte 2004; Skyberg 2003; Nagda and Hodgson 2001; Crandall and Sieber 1996], the common cold, or histoplasmosis. Because the symptoms are frequently associated

RESULTS AND DISCUSSION

(CONTINUED)

with so many types of illnesses, we cannot use symptoms alone to pinpoint the exact cause of the workers' concerns. Instead, we use symptoms and the other factors described in this report to determine the probability of a work-related exposure.

Employees may have been exposed to *H. capsulatum* at AVPO, but this possibility is very low, and we do not recommend testing of all employees for histoplasmosis for the following reasons:

- Histoplasmosis is not endemic or prevalent in California. The conditions that favor the growth of *H. capsulatum* in soil are a mean temperature of 71°F to 84°F, an annual precipitation of 35 to 50 inches, and a relative humidity of 67% to 87% [Deepe 2004; Zeidberg et al. 1955]. Because the prevailing climate in Apple Valley is not favorable for the growth of *H. capsulatum*, the potential for exposure to *H. capsulatum* among AVPO employees is very low.
- Although some of the symptoms reported by several employees have also been reported by persons with histoplasmosis, the constellation of symptoms reported did not suggest that employees had active histoplasmosis.
- Because of inherent problems in the various clinical tests for histoplasmosis such as false positivity (positive test result in the absence of histoplasma infection), false negativity (negative test result in persons with histoplasma infection), and the inability of some of the tests to differentiate past from current infection, a reasonable degree of pretest probability (the likelihood of having histoplasmosis) is needed to support community testing in order to overcome inherent errors in these tests.

Other medical conditions that have been associated with exposure to pigeon fecal material and pigeon proteins are psittacosis, cryptococcosis, and hypersensitivity pneumonitis. Persons with psittacosis (infection due to *Chlamydophila psittaci*) usually have symptoms of high fever with chills, severe cough, and non-specific symptoms such as headache, joint, and muscle aches [Schlossberg 2004]. Persons with psittacosis may have chest pain with shortness of breath [Schlossberg 2004]. Although lung symptoms may occur in persons with cryptococcosis (disease caused by *Cryptococcus neoformans*), it is uncommon and presents as fever, cough, chest pain and malaise. The common presentation is cryptococcal meningitis, whose symptoms are fever, confusion, headache, neck

RESULTS AND DISCUSSION (CONTINUED)

stiffness, and in severe cases, coma [Perfect 2004]. Based on our interviews of employees, we do not think that employees of AVPO currently have these conditions and do not recommend testing of all employees for these diseases. Employees with persistent symptoms should consult their physicians to determine if testing is appropriate on a case-by-case basis.

Hypersensitivity pneumonitis is caused by the body's immune response to exposure to organic particles, in this case, pigeon proteins (antigens). Acute disease usually manifests as flu or atypical pneumonia and is typically self-limiting if exposure ceases [Rose 2005]. Subacute and chronic diseases may cause progressive shortness of breath, cough, malaise, fatigue, weight loss and decreased lung function [Rose 2005]. Our interview of employees at AVPO did not suggest that employees currently have hypersensitivity pneumonitis.

The potential for employees to be exposed to the causative agents of these medical conditions has been eliminated as a result of the cleaning and the netting installed around the rooftop HVAC units. The potential for exposure should not occur as long as the integrity of the nets is maintained and pigeon roosting is eliminated. For more information on histoplasmosis, refer to Appendix A at the end of this report and the NIOSH document "Histoplasmosis: Protecting workers at risk," [NIOSH 2004], which can also be found at <http://www.cdc.gov/niosh/docs/2005-109/>.

Facility Survey

The AVPO has nine HVAC units on the roof. Until recently, the USPS San Bernadino maintenance employees were responsible for changing air filters for several different postal office buildings in the area. AVPO management said that these maintenance employees replaced air filters quarterly at their facility, but did not keep written records of these activities. On May 30, 2007, AVPO established a maintenance agreement with an independent HVAC contractor to maintain their HVAC units, including four yearly preventive maintenance check-ups, including filter change-outs, although the San Bernadino Facilities Department still supplies the replacement air filters.

During the building walk-through, we opened and inspected two of the HVAC units on the roof and examined the filters, outdoor

RESULTS AND DISCUSSION

(CONTINUED)

air dampers, cooling coils, and bird netting. In one of the units, we found a pigeon feather in the front of the air filter and another feather behind the filter on the cooling coils. Given the proper positioning of the filters at the time of inspection, the feather should not have been in this area. We speculated that the feathers may have been left after the cleaning process or had been knocked off the air filters onto the coil during filter change-out. No pigeon fecal matter was found in any of the HVAC units, and bird netting looked intact around all the units, although some netting located in areas where the unit and ductwork joined had small gaps big enough for a pigeon to enter. Also, we found fresh bird droppings near two of the exhaust vents. Management surmised that the pigeons were attracted to the warm air exhausting from those vents and is currently looking into installing bird spikes to discourage pigeons from gathering around the vents.

While investigating the histoplasmosis concerns, NIOSH investigators performed an IEQ evaluation to identify any potential issues by taking thermal comfort measurements and looking at the ventilation system. One of the most common deficiencies in the indoor environment is the improper operation and maintenance of ventilation systems and other building components [Rosenstock 1996]. NIOSH investigators have found that correcting HVAC problems often reduces reported symptoms. Most studies of ventilation rates and building occupant symptoms have shown that ventilation rates below 20 cubic feet per minute per person, are associated with one or more health symptoms [Seppanen et al. 1999]. When conducting an IEQ survey, NIOSH investigators often measure thermal comfort indicators, such as CO₂, temperature, and RH to provide information relative to the functioning and control of HVAC systems. Maintaining these parameters at recommended levels has often been shown to result in resolution or symptomatic improvements in occupants. Thus, improved HVAC operation and maintenance, higher ventilation rates, and comfortable temperature and RH can all potentially serve to improve symptoms without ever identifying any specific cause-effect relationships. We have included additional information on IEQ parameters in Appendix B.

CO₂ is a normal constituent of exhaled breath and it is not considered a building air pollutant. It is an indicator of whether sufficient quantities of outdoor air are being introduced into an occupied space. ANSI and ASHRAE recommend that the indoor CO₂ concentration be within 700 ppm of the outdoor

RESULTS AND DISCUSSION (CONTINUED)

concentration for comfort (odor) reasons [ANSI/ASHRAE 2007]. Elevated CO₂ concentrations suggest that other indoor contaminants may also be increased. If CO₂ concentrations are elevated, the amount of outdoor air introduced into the ventilated space may need to be increased. ASHRAE's ventilation standard, ANSI/ASHRAE 62.1-2007: *Ventilation for Acceptable Indoor Air Quality*, recommends a combined outdoor air rate of 17 cfm/person for office spaces, and area outdoor air rates of 0.12 cfm/ft² for shipping/receiving areas and 0.06 cfm/ft² for warehouses, as long as stored materials have no potentially harmful emissions [ANSI/ASHRAE 2007].

We monitored the work area for temperature, RH, CO, and CO₂ using a Q-TRAK Plus Indoor Air Quality Monitor, Model 8554 (TSI Incorporated, Shoreview, Minnesota). CO was measured because it is a common component of vehicle exhaust. Mail carrier trucks are located in a parking lot about 30 feet from a set of double doors. Trucks that bring incoming mail unload four different times at a separate loading dock between 3:30 a.m. and 8:30 a.m. and load three separate times to remove outgoing mail from 1:30 p.m. until 6:00 p.m. No CO was detected when trucks were leaving or returning from their routes.

We took CO₂ measurements on July 11 after the building walk-through when the building was at low occupancy, and on the morning of July 12 during high occupancy. On average, CO₂ measurements were under 1064 ppm (average daily outside CO₂ measurement + the ASHRAE recommended guideline of 700 ppm). However, when the facility was at high occupancy, we found CO₂ levels that exceeded 1064 ppm in pockets around the main work area. Refer to Table 1 for measurement ranges and averages.

Table 1*. Environmental condition measurements taken at AVPO					
<i>Date</i>	<i>Location</i>	<i>Temp. (°F)</i>	<i>RH (%)</i>	<i>CO₂ (ppm)</i>	<i>CO (ppm)</i>
July 11, 2007	Outside	86.7	17.8	330	0
	Mail sorting area (low occupancy)				
	PM	Range	70-74	25.5-30.5	547-745
	Average	72	28	611	0
July 12, 2007	Outside	78	23.4	364	0
	Mail sorting area (high occupancy)				
	AM	Range	69-71	26.1-32.3	633-1215
	Average	71	29	875	0

* See Table B1 in Appendix B for ANSI/ASHRAE recommended thermal environmental condition levels.

RESULTS AND DISCUSSION

(CONTINUED)

We observed the use of 2-inch medium-efficiency filters in the HVAC units. Prefilters, which preserve the integrity of the main filter, were observed in only some of the units. During our inspection, we were unable to tell if all the filters were installed correctly because the directional arrows on the filter frames were not always visible. Due to the position of the outdoor air dampers and panels in the HVAC units, we could not tell if the dampers were completely closed. Closed or nearly closed outdoor air dampers limit the amount of outdoor air brought into the building.

We released small puffs of smoke into the air and observed the direction smoke flowed to determine the general air mixing and flow dynamics in the area. This smoke test was done at breathing zone level throughout the building and we observed that, overall, the building was under positive pressure, which means air moves from inside to outside the building. Several areas appeared to have low air flow. The women's restroom was determined to be under negative pressure (air flows from work area into bathroom, then is vented through the roof) which is recommended by ASHRAE, but the men's restroom was under positive pressure (air in bathroom flows out to the work area).

We inspected two air supply ducts and diffusers, one on the ceiling of the main working area, the other in an office. Black particles had collected around the diffuser deflectors in a pattern of the air flow. We did not observe any black particles inside the duct. The black particulate may be generated inside the work area or drift into the work area from the outside, where it is then impacted onto the diffusers by the supply air. As long as filters are installed correctly and the HVAC system is working properly, the amount of particles entering the room from the ductwork should be reduced, because air is passed through filters before reentering the supply duct.

It was reported that AVPO maintenance employees may have removed and cleaned the pigeon fecal matter themselves before the cleaning and sanitizing company was hired. If any infectious agents are present in the feces, it would be possible for aerosolization to occur during cleaning activities.

During our walk-through of the building, we observed several loose light fixtures and stained or sagging ceiling tiles. The sharps box in the men's bathroom had fallen off the wall and had been

RECOMMENDATIONS (CONTINUED)

insecurely reattached with tape. We also observed numerous insects (black bugs) in the men's room. Workers reported that insects had been present in offices and other locations of the building for a considerable period of time.

CONCLUSIONS

Based upon medical interviews with workers and an assessment of environmental conditions at the AVPO, we conclude that no direct relationship exists between current health symptoms reported by AVPO employees and specific occupational or environmental exposures. Perceived odor and building ventilation issues likely contributed to these symptoms. We found that the potential for employees to contract histoplasmosis was low and this potential was further minimized by cleaning and installing nets around the HVAC units. We do not recommend that AVPO employees be tested for histoplasmosis. However, if individual employees feel that they should be tested due to their symptoms, they should discuss this with their physician.

We found comfort parameters at the post office to be within acceptable ASHRAE guidelines except for elevated CO₂ levels in some work areas during high occupancy, possibly indicating inadequate outdoor air intake (possibly due to closed or mostly closed outdoor air dampers) or uneven mixing of air. All pigeon fecal matter had been cleared from the units we examined and, overall, the bird netting appeared intact. At the time of our investigation, we saw two bird feathers in one of the HVAC units, but no evidence that birds were entering or still living in the unit.

RECOMMENDATIONS

Based on the observations and findings of this evaluation, the following recommendations are provided in the interest of enhancing health and safety conditions at the AVPO.

1. Testing of all AVPO employees for histoplasmosis is not necessary and need not be conducted because the potential for contracting such is very low. Employees with health problems should seek care with their physician for appropriate management.
2. Even in the absence of infectious agents, any employee who will be remediating animal feces should be provided with hazard communication information and appropriate PPE. Hazard communication information should include a warning that individuals with compromised

RECOMMENDATIONS (CONTINUED)

cell-mediated immunity (e.g., an individual with HIV infection, the lymphoma-leukemia-Hodgkin's group of malignancies [cancers], or those on steroid therapy or other immunosuppressive agents) are at greater risk of clinical disease should infection occur. Individuals with compromised cell-mediated immunity should be advised to consult their personal physician concerning the need to avoid exposure to materials (such as large accumulations of old pigeon feces) possibly contaminated with infectious microorganisms. One method of hazard communication includes posting signs in appropriate areas to remind workers of the bird feces problem.

3. Continue to monitor the bird netting for damage or holes to ensure that birds are not able to nest in the HVAC units. Any gaps that are identified should be sealed immediately.
4. The HVAC contractor's work order noted that they had closed the outdoor air dampers. To allow adequate intake of outdoor air, dampers should not be completely closed. Use ANSI/ASHRAE guidelines to determine minimum amounts of outdoor air that should be delivered into the work areas [ANSI/ASHRAE 2007].
5. Several high CO₂ measurements may indicate insufficient outdoor air being brought into the building, which may improve if dampers are opened. Based on the CO₂ measurements and smoke tube results showing areas of little air movement, a test and balance of the ventilation system should be performed. The company performing the testing and balancing should be certified by the National Environmental Balancing Bureau (www.nebb.org) or other recognized organization.
6. The restroom exhaust fans should be evaluated to ensure that restrooms are under negative pressure so that any odors are exhausted away from working areas. ANSI/ASHRAE standard 62.1 recommends that public restrooms have a minimum exhaust rate of 70 cfm per unit (water closet and/or urinal) where periods of heavy use are expected to occur, otherwise a rate of 50 cfm/unit is acceptable [ANSI/ASHRAE 2007].
7. Use prefilters to extend the life of the main HVAC air filters. Also ensure that the filters are placed in the correct direction in relation to air flow. Filters should be placed so that flow direction arrows are clearly visible, thereby making it easier to observe whether filters are properly installed.

RECOMMENDATIONS (CONTINUED)

8. Due to the dusty and windy conditions of the desert, consider installing a pressure-sensing device, such as a manometer or Magnehelic gauge to provide an accurate and objective way of knowing when to change air filters. By comparing the readings of a pressure-sensing device when the filter is new versus heavily loaded (ready to be changed), along with the filter manufacturer's information on pressure drop characteristics, you will be able to replace the filters when needed [NIOSH 2003]. More information on Filtration and Air-Cleaning Systems can be found in the NIOSH document, "Guidance for Filtration and Air-Cleaning Systems to Protect Building Environments from Airborne Chemical, Biological, or Radiological Attacks" at <http://www.cdc.gov/niosh/docs/2003-136/default.html#toc>.
9. Perform regular housekeeping, including dusting of supply and exhaust vents and regular general dusting to minimize particulate matter. When vacuuming, use an industrial-type vacuum cleaner installed with a HEPA filter. We recommend following the green or sustainable building practice, which aims to create a healthier and more resource-efficient models of maintenance. Additional information on Green Buildings can be found at the EPA website <http://www.epa.gov/greenbuilding/>. Information on environmental and health-friendly cleaning supplies and resources may be found at <http://www.epa.gov/oppt/epp/pubs/products/cleaner.htm>.
10. Schedule regular pest inspection of the building, and spray insecticide only when needed and when the building is not occupied. This will allow pest elimination while minimizing employee exposure to insecticides.
11. Continue to communicate with building occupants to discuss issues and secure occupants' cooperation when resolving issues or concerns. It is important to continue recording, responding to, and resolving health and safety issues in a timely manner to prevent them from becoming major health or comfort problems. The Health and Safety Committee members can help with this issue.
12. Replace stained or sagging ceiling tiles and reattach loose, hanging lighting fixtures.
13. The sharps box in the men's room should be securely fixed to the wall to prevent accidental sharp injuries.

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Histoplasmosis

Histoplasmosis is an infectious disease caused by inhaling the spores of a fungus called *Histoplasma capsulatum*. Histoplasmosis is not contagious; it cannot be transmitted from an infected person or animal to someone else. *H. capsulatum* grows in soils throughout the world. The proportion of people infected by *H. capsulatum* is higher in central and eastern states (especially along the valleys of the Ohio, Mississippi, and St. Lawrence rivers) and in an area near the Rio Grande. The fungus seems to grow best in soils with high nitrogen content, especially those enriched with bird manure or bat droppings. Fresh bird droppings on surfaces such as sidewalks and windowsills have not been shown to present a health risk for histoplasmosis because birds themselves do not appear to be infected by *H. capsulatum*. Rather, bird manure is primarily a nutrient source for the growth of *H. capsulatum* already present in soil [NIOSH 2004].

Histoplasmosis primarily affects a person's lungs, and its symptoms vary. The vast majority of infected people are asymptomatic (have no apparent ill effects), or they experience symptoms so mild they do not seek medical attention and may not even realize that their illness was histoplasmosis. If symptoms do occur, they usually start within 3 to 17 days after exposure, with an average of 10 days. Histoplasmosis can appear as a mild, flu-like respiratory illness and has a combination of symptoms, including malaise (a general ill feeling), fever, chest pain, dry or nonproductive cough, headache, loss of appetite, shortness of breath, joint and muscle pains, chills, and hoarseness. Rarely, a more severe type of histoplasmosis occurs; persons who get the more severe type of histoplasmosis require antifungal medications to treat the disease [NIOSH 2004].

Symptoms from Indoor Environmental Quality

The symptoms reported by building occupants associated with indoor environmental concerns have been diverse and usually are not suggestive of any particular medical diagnosis or readily associated with a causative agent. Reports demonstrate closer associations of symptom occurrence with occupant perceptions of the indoor environment rather than with any measurement of indoor contaminants or conditions [NIOSH 1991; Berglund and Cain 1989]. A typical spectrum of reported symptoms includes headaches, fatigue, itching or burning eyes, irritation of the skin, nasal congestion, dry or irritated throat, and other respiratory symptoms. These symptoms are also often experienced by people outside of the workplace and could be related to a number of different causes, such as respiratory infections, allergies, discomfort due to temperature and humidity, and stress. Some studies have shown that psychological, social, and organizational factors may modify individuals' and organizations' responses to concerns in the office environment [Boxer 1990; Ooi 1997; Baker 1989]. Typically, workers suspect a workplace cause because their symptoms appear to be worse while at work and better when away from work.

Less often, illnesses and reactions may be found to be related to specific exposures in certain building environments. Hypersensitivity pneumonitis, Legionnaires' disease, Pontiac fever, and CO poisoning are all caused by specific agent(s) that have been found in some building environments. The first three of these conditions can be caused by microorganisms.

APPENDIX B: ADDITIONAL INFORMATION ON IEQ ISSUES

Temperature and RH measurements are often collected as part of an IEQ investigation because these parameters affect the perception of comfort. The ANSI/ASHRAE Standard 55-2004: *Thermal Environmental Conditions for Human Occupancy*, specifies conditions in which 80% or more of the occupants are expected to find the environment thermally acceptable [ANSI/ASHRAE 2004]. Temperatures recommended by ANSI/ASHRAE range from 68.5°F to 77.0°F in the winter, and 75.0°F to 81.5°F in the summer (see Table B1 below). The difference is largely due to seasonal clothing selection. ANSI/ASHRAE also recommends that RH be maintained at or below 65%. The United States EPA recommends maintaining indoor RH between 30%–50%. Values outside these ranges have been found to produce symptoms. RH below 30% has been shown to be associated with symptoms [Wolkoff et al. 2006; Nagda and Hodgson 2001], which may contribute to some of the symptoms experienced by the occupants. More specific information on IEQ issues, guidance tools for managing IEQ, and ventilation and control studies of large, commercial buildings may be found at the EPA website, <http://www.epa.gov/iaq/largebldgs/index.html>.

Table B1. ANSI/ASHRAE recommended thermal environmental conditions.

<i>Relative Humidity (%)</i>	<i>Winter Temperatures (°F)</i>	<i>Summer Temperatures (°F)</i>
30	69.5 to 77.0	75.5 to 81.5
40	69.0 to 76.5	75.5 to 81.0
0	68.5 to 76.0	75.0 to 80.5

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APPENDIX B: ADDITIONAL INFORMATION ON IEQ ISSUES (CONTINUED)

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ACKNOWLEDGEMENTS AND AVAILABILITY OF REPORT

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Recommended Citation for this report.

NIOSH [2008]. Health Hazard Evaluation Report: Evaluation of Histoplasmosis Concerns at a United States Post Office, Apple Valley, California. 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, NIOSH HETA No. 2007-0216-3056.



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