Dear Dr. Royko:

On January 24, 2014, the National Institute for Occupational Safety and Health (NIOSH) received a request for a health hazard evaluation (HHE) from the union representing employees at the Cook County Marriage and Family Counseling Department. The request concerned exposure to mold. The Cook County Marriage and Family Counseling Department is located on the 10th floor of a high-rise building in Chicago, Illinois. This letter summarizes our evaluation and provides recommendations to address the concerns and improve the indoor environmental quality.

Background

The HHE request stated that an employee with symptoms had medical testing interpreted as colonization with *Aureobasidium/Hormonema*, and elevated levels of tricotoxins and ochratoxin (which are toxins produced by fungi and are known as mycotoxins). This led to an investigation of the employee’s office by two consultants, one hired by the building management agency and one hired by the employee. Other employees in the office heard of the medical testing and environmental results and became concerned about workplace conditions. Some of these employees reported nonspecific symptoms, and began attributing them to the workplace. The requestor reported that the response to a fire in the building about 10 years ago resulted in significant water damage. The requestor reported that only the lower half of the drywall was replaced during remediation, and postulated that water damage to the upper portion of the drywall may have led to mold proliferation.

Evaluation

We spoke with you, the union requestor, the ill employee, two consultants, and three representatives of the building management firm to learn more about the concerns and actions taken. We reviewed photographs taken during the destructive testing (removal of drywall, carpet, and ceiling tiles) of the employee’s office, the consultants’ reports, and medical records from the ill employee.
The ill employee reported developing a myriad of diverse symptoms and, after receiving the results of the medical tests noted above, attributed them to working in the Marriage and Counseling Department work space. The symptoms involved multiple organ systems, and had an acute onset upon returning to work after an extended absence. The employee reported no signs of fungal contamination of the office, including musty odors. The ill employee reported having urine tests that were interpreted by the lab and by the clinic as indicating colonization with *Aureobasidium/Hormonema*; the lab noted “unusual” levels of tricothecenes and ochratoxin mycotoxins.

Results and Discussion

*Aureobasidium* and *Hormonema* are two types of fungi that can be difficult to tell apart. They are common and widespread in nature, and rarely cause disease in humans. All animals, including humans, have microorganisms (including bacteria and fungi), called a microbiome, that live on and in the skin, mucous membranes, and the gastrointestinal tract. The National Institutes of Health has an initiative, called the Human Microbiome Project, whose goal is identifying and characterizing the microorganisms found in humans. Researchers at the National Institutes of Health published findings showing the diversity of fungi on human skin (press release available at [http://www.nih.gov/news/health/may2013/nhgri-22.htm](http://www.nih.gov/news/health/may2013/nhgri-22.htm)). They found over 80 types of fungi, including *Aspergillus*, *Penicillium*, *Malassezia*, *Alternaria*, *Chaetomium*, and *Cladosporium* [Findley et al. 2013]. Finding a small number of fungal or bacterial colonies in urine is not unusual and can be due to contamination of the specimen because these organisms are ubiquitous in the environment. Therefore, laboratories and physicians generally set a cut-off for deciding if the results indicate an infection or contamination. Colony counts of 100 or less are considered contamination [Kratz et al. 2004; Wilson and Gaido 2004]. The employee’s specimen had less than 100 colonies.

Mycotoxins are secondary metabolites of fungi that can be toxic. The primary source of mycotoxin exposure in humans is ingestion of contaminated foods [IARC 2012]. Ochratoxins, one type of mycotoxin, are produced by *Aspergillus* and *Penicillium* and contaminate wheat, barley, pork, coffee, cocoa, dried fruit, and corn, among other things [Peraica et al. 1999; Gilbert et al. 2001; IARC 2012]. Ochratoxin A (OTA) is the most common ochratoxin found in food. The main target organ of OTA is the kidney [Peraica et al. 1999; Duarte et al. 2011]. OTA has been detected in 3%–100% of human blood samples [Peraica et al. 1999; Duarte et al. 2011], and in 6%–100% of urine samples from healthy people around the world [Ahn et al. 2010; Duarte et al. 2011].

Tricothecene mycotoxins are mainly produced by *Fusarium*, although other fungi can produce tricothecenes [Peraica et al. 1999]. There are over 100 tricothecenes, and two of the most common contaminants of food are deoxynivalenol (DON) and nivalenol [Peraica et al. 1999]. Tricothecenes have also been detected in the urine of healthy people around the world. DON was
detected in 98.7% of urine of 300 healthy adults, and urinary DON significantly correlated with dietary intake of cereal grains [Turner et al. 2008]. Researchers then restricted wheat intake in the study subjects by more than 90% for four days, then measured urinary DON again, which was reduced by more than 90% also.

Therefore, it is not unusual to find either tricothecenes or ochratoxin in the urine of any individual. In the case of the ill employee, they were found at concentrations only slightly above the limit of detection. However, the laboratory interpretation stated that this was an “unusual level of that mycotoxin(s) present in your body.”

Destructive testing of the employee’s office was performed, removing all drywall, carpet, and ceiling tiles. Neither the photographs taken during the testing nor the consultants’ reports showed significant fungal contamination or visible evidence of water damage on any surface (drywall, concrete deck above ceiling tiles, or ceiling tiles). If the upper part of the drywall had been wet and had not been replaced after the fire, water stains on the upper part would have been visible. The drywall was uniform in appearance from floor to ceiling, which indicates it was installed at the same time.

Both consultants’ airborne fungal counts were low, as were counts in surface samples taken from the ceiling tiles and supply duct. The employee’s consultant found 3,700 spore elements per swab of Chaetomium globosum on the induction unit and 115,478 spore elements per swab of Chaetomium globosum on the back of the drywall. The building manager’s consultant’s sample collected in the same area did not document Chaetomium contamination. Neither the carpet dust sample nor any air samples contained Chaetomium globosum, even though the induction unit was running at the time the air and dust samples were taken.

Carpet dust samples were analyzed by the environmental relative moldiness index (ERMI) test. The ERMI is determined from analysis for 26 mold species associated with water damage and 10 mold species not associated with water damage in homes [Meklin et al. 2004; Vesper et al. 2006]. The ERMI scale ranges from about -10 to 20, from lowest to the highest. The closer the result is to 20, the greater the mold burden, indicating that there is likely to be significant water damage in that environment [Vesper et al. 2007]. The ERMI of the carpet dust sample taken by the building manager’s consultant was 3. Although the ERMI was not intended for use in commercial buildings, the results do not indicate a serious fungal contamination problem in this office.

After going through the evidence presented to us, we do not think that there is a need to be concerned about the ill employee’s laboratory results, nor the environmental sampling results, both of which we believe were misinterpreted. We do not think that the employee’s symptoms should be attributed to an abnormal occurrence or exposure in the building. Although a few other employees related their own symptoms to the workplace after hearing about the ill employee’s medical test results and consultant’s findings, it is common for building occupants to report
nonspecific symptoms related to the building. The U.S. EPA conducted a systematic survey of 100 randomly selected office buildings without known indoor environmental quality (IEQ) complaints in the United States to develop baseline data about U.S. office buildings [Brightman et al. 2008]. The most common work-related symptoms reported 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. Forty-five percent of the employees in the randomly selected buildings reported at least one work-related symptom.

Care must be taken when attributing common symptoms to particular exposures, because the association is as likely to be coincidental as to be causal. Symptoms are influenced by cognitive (thought) processes [Bogaerts et al. 2010]. Symptoms have been demonstrated to be more common when pollution or health threats are perceived [Watson and Pennebaker 1989; Williams and Lees-Haley 1993], and can be affected by fears, emotional triggers, and litigation [Lees-Haley and Brown 1992].

Of the general population, 86%–95% 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 to 6 days [Barsky and Borus 1995]. Lipscomb et al. reported 1-year symptom prevalence rates from three populations in California [Lipscomb et al. 1992]. The top 10 symptoms were sinus congestion or sneeze, irritated eyes, allergies or asthma, headaches, fatigue, difficulty sleeping, numbness or tingling in limbs, and skin problems, with rates ranging from 9.1% to 30.4%. A similar study in Australia found the top 10 symptoms were stuffy nose, headaches, fatigue, cough, itchy eyes, sore throat, skin rash, wheezing, trouble breathing, and nausea, with rates ranging from 10.1% to 46.2% [Heyworth and McCaul 2001]. These symptoms are rarely caused by serious illness. In fact, 15%–50% of primary care visits are for what is termed “medically unexplained symptoms” [Kroenke 2001; Kirmayer et al. 2004; Jackson et al. 2009; Bogaerts et al. 2010]. Medically unexplained symptoms are those for which no cause is found, even after thorough medical evaluation.

The lack of a ready explanation for all symptoms can lead people to seek nonstandard medical care, as it did in this case. It is important that employees seek appropriate medical care; such care could include a proper medical evaluation concerning work-relatedness of symptoms. Inappropriate attribution of these symptoms to the workplace can lead to delays in diagnosis and treatment or to harm from inappropriate treatment.

Conclusion

The testing results have been misinterpreted and there is no evidence of a problem in the building. There is no evidence that this employee was exposed to above background levels of fungi at work, or that this employee suffers from illness due to fungal exposure.
Recommendations

- Encourage employees with health concerns to seek evaluation and care from a physician who is residency trained and board certified in occupational medicine and is familiar with the types of exposures employees may have and their health effects. These physicians can be located through a variety of sources, including the Association of Occupational and Environmental Clinics, at www.aoec.org, and the American College of Occupational and Environmental Medicine, at www.acoem.org. Two programs in Chicago are listed below.

  o John H Stroger, Jr. Hospital of Cook County
    Occupational and Environmental Medicine
    1900 W. Polk, Rm. 917
    Chicago, Illinois 60612

  o University of Illinois - Chicago
    Occupational Medicine Program
    835 S. Wolcott M/C 684
    Chicago, Illinois 60612
    Phone: (312) 996-7420

- Start an IEQ management program to address any IEQ issues that arise. An IEQ manager or administrator with clearly defined responsibilities, authority, and resources should be selected. This individual should have a good understanding of the buildings' structure and function, and should be able to effectively communicate with occupants. An employee representative should assist with communication and should be included in the IEQ management program. Although no comprehensive regulatory standards specific to IEQ have been established, guidelines have been developed by organizations such as NIOSH and the U.S. EPA. The NIOSH/U.S. EPA document, “Building Air Quality: A Guide for Building Owners and Facility Managers” may be helpful [http://www.epa.gov/iaq/largebldgs/pdf_files/iaq.pdf]. A companion NIOSH/U.S. EPA guide, “Building Air Quality Action Plan,” can serve as a checklist for developing and assessing an IEQ management program [http://www.epa.gov/iaq/largebldgs/pdf_files/baqactionplan.pdf]. The ASHRAE document ‘Indoor Air Quality Guide: Best Practices for Design, Construction and Commissioning” is also a good resource [http://iaq.ashrae.org/GetSubscription.aspx]. The U.S. EPA document “Moisture Control Guidance for Building Design, Construction and Maintenance,” can also be used to address moisture problems [http://www.epa.gov/iaq/pdfs/moisture-control.pdf].

This letter closes our file on this HHE request. NIOSH recommends that employers post a copy of this letter for 30 days at or near work areas of affected employees. A copy of this letter is
being provided to the OSHA Region 5 Office, and the Chicago Department of Public Health. If you have any questions, please do not hesitate to call Dr. Page at (513) 458-7144 or Dr. Burton at (513) 841-4323.

Sincerely yours,

Elena H. Page, M.D., M.P.H.
Medical Officer

Nancy C. Burton, PhD, MPH, MS, CIH
Senior Industrial Hygienist
Hazard Evaluations and Technical Assistance Branch
Division of Surveillance, Hazard Evaluations and Field Studies

cc:
Occupational Safety and Health Administration Region 5 Offices
Chicago Department of Public Health
Union requestor
References


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bcc:
B. Bernard (word and signed PDF)
T. Seitz (word and signed PDF)
E. Page (word and signed PDF)
N. Burton (word and signed PDF)
J. Riley (word and signed PDF)
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