



CONSTRUCTION **HAZARDOUS MATERIALS** COMPLIANCE GUIDE

Mold Detection, Abatement and Inspection Procedures

R. Dodge Woodson



Construction Hazardous Materials Compliance Guide

Mold Detection, Abatement, and Inspection Procedures

R. Dodge Woodson



ELSEVIER

AMSTERDAM • BOSTON • HEIDELBERG • LONDON
NEW YORK • OXFORD • PARIS • SAN DIEGO
SAN FRANCISCO • SINGAPORE • SYDNEY • TOKYO

Butterworth-Heinemann is an imprint of Elsevier



Butterworth-Heinemann is an imprint of Elsevier
225 Wyman Street, Waltham, MA 02451, USA
The Boulevard, Langford Lane, Kidlington, Oxford, OX5 1GB, UK

© 2012 Elsevier Inc. All rights reserved.

No part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying, recording, or any information storage and retrieval system, without permission in writing from the publisher. Details on how to seek permission, further information about the Publisher's permissions policies and our arrangements with organizations such as the Copyright Clearance Center and the Copyright Licensing Agency, can be found at our website: www.elsevier.com/permissions

This book and the individual contributions contained in it are protected under copyright by the Publisher (other than as may be noted herein).

Notices

Knowledge and best practice in this field are constantly changing. As new research and experience broaden our understanding, changes in research methods, professional practices, or medical treatment may become necessary.

Practitioners and researchers must always rely on their own experience and knowledge in evaluating and using any information, methods, compounds, or experiments described herein. In using such information or methods they should be mindful of their own safety and the safety of others, including parties for whom they have a professional responsibility.

To the fullest extent of the law, neither the Publisher nor the authors, contributors, or editors, assume any liability for any injury and/or damage to persons or property as a matter of products liability, negligence or otherwise, or from any use or operation of any methods, products, instructions, or ideas contained in the material herein.

Library of Congress Cataloging-in-Publication Data

Application submitted.

British Library Cataloging-in-Publication Data

A catalogue record for this book is available from the British Library.

ISBN: 978-0-12-415840-5

For information on all Butterworth-Heinemann publications
visit our Web site at <http://store.elsevier.com>

Printed in the United States

12 13 14 15 16 10 9 8 7 6 5 4 3 2 1

Working together to grow
libraries in developing countries

www.elsevier.com | www.bookaid.org | www.sabre.org

ELSEVIER

BOOK AID
International

Sabre Foundation

*This book is dedicated to Afton and Adam
for always being there for me.*

Introduction

Contractors often encounter mold. It is common in all types of buildings. Not all contractors know how to deal with toxic mold. They should be aware that mold can cause serious health hazards for some people. Whether you are called to solve a mold problem or on a job for another reason and discover a mold problem, you need to be informed on the subject.

The laws, regulations, and rules governing working with mold are set forth by both federal and state agencies. The requirements are far less structured than they are for other types of toxic conditions, but they do exist. Any failure to comply with the requirements detailed by governing authorities can result in stiff fines and potential lawsuits.

R. Dodge Woodson's name is synonymous with professional reference books. Woodson is the author of many bestselling books and has written dozens of valuable texts for the building trades. In this book he provides invaluable insight and guidance in working with mold. There is a broad mix of information available here at your fingertips, ranging from Woodson's field experience to rules, regulations, and laws on both state and federal levels.

If you are someone who has any chance of encountering toxic mold in your work, you need this invaluable guide to keep you informed and safe. Look at the Table of Contents. Thumb through the pages. You will see quickly that this is a comprehensive guide for all types of contractors. Do not let yourself be taken off guard. Read this book and prepare yourself for dealing with mold hazards in future job sites.

► ACKNOWLEDGMENTS

I want to thank the U.S. Occupational Safety and Health Administration, the State of Texas, the Centers for Disease Control and Prevention, the U.S. Environmental Protection Agency, and the states of Connecticut and Minnesota for information used in the preparation of this book.

► **ABOUT THE AUTHOR**

R. Dodge Woodson was a career contractor with more than 30 years of experience. He has been a master plumber, builder, and remodeling contractor since 1979. The Woodson name is synonymous with professional reference books. R. Dodge Woodson has written numerous bestselling books over the years.

Basics about Mold

1

This chapter provides basic information about mold, sources of mold, and building-related illnesses. Brief discussions are included on building design considerations for healthy indoor air, as well as building evaluation and sampling for mold. However, detailed information about indoor air-quality diagnostic studies (e.g., normal vs. abnormal levels) and the design and execution of exposure sampling strategies is not included as this information is beyond the scope of this book.

For approaches to remediation of moldy areas and the appropriate response based on the degree of the contamination, the reader should consult OSHA's Safety and Health Information Bulletin (SHIB 03-10-10) "A Brief Guide to Mold in the Workplace." Additional information on mold is available through OSHA's "Molds and Fungi" safety and health topics webpage at www.osha.gov/SLTC/molds/index.html, which contains a collection of hyperlinks to various sources of information regarding mold.

The Occupational Safety and Health Association's guidance document is not a standard or regulation, and it creates no new legal obligations. It is advisory in nature, informational in content, and is intended to provide relevant information to building owners, managers, and occupants regarding mold prevention and remediation in buildings. Contractors and other professionals (e.g., environmental consultants and health or safety professionals) who respond to mold and moisture situations in buildings, as well as members of the general public, also may want to refer to these guidelines.

Employers are required to comply with hazard-specific safety and health standards as issued and enforced by either the federal Occupational Safety and Health Administration (OSHA), or an OSHA-approved State Plan. In addition, Section 5(a)(1) of the *Occupational Safety and Health Act*, the General Duty Clause, requires employers to provide their employees with a

workplace free from recognized hazards likely to cause death or serious physical harm. Employers can be cited for violating the General Duty Clause if there is such a recognized hazard and they do not take reasonable steps to prevent or abate the hazard. However, failure to implement these guidelines is not, in itself, a violation of the General Duty Clause. Citations can only be based on standards, regulations, and the General Duty Clause.

In 1994, OSHA published in the *Federal Register* a comprehensive proposed rule on indoor air quality (IAQ), which addressed adverse health effects attributable to environmental tobacco smoke (ETS) and other indoor pollutants, including bioaerosols (59 FR 15968). During the IAQ rulemaking, the agency received comments and scientific and technical information on indoor mold exposures associated with building-related illnesses (BRIs). While the indoor air quality proposed rule was withdrawn in its entirety in December 2001 (66 FR 64946), the agency retained the voluminous docket (consisting of approximately 120,000 documents), which contains valuable information on ETS and other indoor pollutants, such as chemicals, bacteria, and molds.

In preparing the guide OSHA reviewed the IAQ docket and recent scientific literature pertaining to mold exposures. As a result of this review, it is clear that the entrance of water (i.e., incursion) into buildings that are damaged, poorly designed, or improperly maintained, is the main source of mold-associated building-related illness. Consequently, the focus of the review was directed toward preventive measures to reduce potential environments for mold growth at the source.

The purpose of the guide is to help owners, managers, and occupants understand and prevent building-related illnesses associated with mold problems in offices and other indoor workplaces. It is not the intent of the guide to address the special considerations of building designers, developers, and similar building professionals; however, they may find certain general information helpful. In addition, health care professionals, maintenance workers, custodians, and others who have a role in the prevention and correction (i.e., remediation) of mold problems in buildings may derive benefit from the information and recommendations outlined here.

► MOLD

Molds are the most common forms of fungi found on the earth. Fungi are classified as neither plants nor animals, and include yeasts, mildews, puffballs, and mushrooms. Most molds reproduce through the formation of spores, tiny microscopic cells that float through the indoor and outdoor air on a continual basis. We are all exposed to mold spores in the air we breathe on a daily basis, both indoors and outdoors. See [Box 1.1](#). When mold spores land on a moist surface indoors, they may begin to grow and digest the surface. Left unchecked, molds can eventually destroy the surfaces they grow on. Molds can be any color.

Molds, their fragments, and metabolic by-products have been associated with adverse health effects. Some diseases are known to be caused by specific molds. However, in many occupational settings health conditions suspected to be mold-related cannot be linked to a specific mold as the only possible cause. In a well-known case an initial finding that *Stachybotrys chartarum* (also known as *S. atra*) was linked to acute pulmonary hemorrhage/hemosiderosis in infants living in a water-damaged environment in Cleveland, Ohio, was subsequently disproved. See [Box 1.2](#).

Box 1.1 What Are Molds?

Molds are fungi that can be found both indoors and outdoors. No one knows how many species of fungi exist but estimates range from tens of thousands to perhaps 300,000 or more. Molds grow best in warm, damp, and humid conditions, and spread and reproduce by making spores. Mold spores can survive harsh environmental conditions, such as dry conditions, that do not support normal mold growth.

Box 1.2 How Common Is Mold, Including *Stachybotrys chartarum*?

Molds are very common in buildings and homes and will grow anywhere indoors where there is moisture. The most common indoor molds are *Cladosporium*, *Penicillium*, *Aspergillus*, and *Alternaria*. We do not have precise information about how often *Stachybotrys chartarum* is found in buildings and homes. While it is less common than other mold species, it is not rare.

► WHERE MOLDS ARE FOUND

Molds are found almost everywhere in our environment, both outdoors and indoors. Their spores float continually in the air we breathe. Molds can grow on just about any substance, as long as moisture and oxygen are available. The following are some common indoor molds:

- *Cladosporium*
- *Penicillium*
- *Alternaria*
- *Aspergillus*

Mold growth may occur when excessive moisture accumulates in buildings or on building materials including carpet, ceiling tile, insulation, paper, wallboard, wood, surfaces behind wallpaper, or in heating, ventilation, and air conditioning (HVAC) systems.

► THE CAUSES OF MOLDS IN BUILDINGS

It is impossible to eliminate all molds and mold spores in the indoor environment. However, moisture control is the most important strategy for reducing indoor mold growth. Common sources of moisture in buildings include plumbing, roof, and window leaks; flooding; condensation on cold surfaces (e.g., pipe sweating); poorly maintained drain pans; and wet foundations due to landscaping or gutters that direct water into or under the building. Water vapor from unvented or poorly vented kitchens, showers, combustion appliances, or steam pipes can also create conditions that promote mold growth.

Mold can grow wherever there is dampness. Damp or wet building materials and furnishings should be cleaned and dried within 24 to 48 hours to prevent the growth of mold. See [Box 1.3](#).

► MOLD CONCERNS

Building owners and managers, among others, make numerous decisions about design, operation, and maintenance throughout the life cycles of their buildings. Structural damage to buildings from mold growth is one concern for building owners and managers. If sources of moisture are not controlled, mold, which is always present to some degree, can spread and cause damage to building materials, finishes, and furnishings. Additionally, some molds can cause structural damage to wood.

Box 1.3 Mold Prevention Tips

- Keep the humidity level in your home between 40% and 60%. Use an air conditioner or a dehumidifier during humid months and in damp spaces, such as basements.
- Be sure your home has enough ventilation. Use exhaust fans that vent outside your home in the kitchen and bathroom. Make sure your clothes dryer vents outside your home.
- Fix any leaks in your home's roof, walls, or plumbing so mold does not have moisture to grow.
- Clean up and dry out your home thoroughly and quickly (within 24–48 hours) after flooding.
- Add mold inhibitors to paints before painting.
- Clean bathrooms with mold-killing products.
- Remove or replace carpets and upholstery that have been soaked and cannot be dried promptly. Consider not using carpet in rooms or areas such as bathrooms or basements that may have a lot of moisture.

Structural damage, however, is not the only concern. Large amounts of mold growth in buildings can create odors and may trigger health effects, such as allergic reactions, in some individuals. Illnesses that are associated with mold exposures in buildings are described in this chapter. The results show that, in general, relationships between poor indoor air quality due to the presence of mold and building-related illnesses (BRIs) are unclear. This stems, in part, from the lack of standardized and meaningful methods by which to measure mold exposures and their effects on occupants. However, widespread symptoms related to a building can lead to environmental investigation, mitigation activities, relocation of occupants, and loss of tenants or property value. Problems that follow an onset of health complaints associated with buildings may impact employers located in buildings and sometimes the building owners who may have to bear high costs to resolve the underlying issues.

Information on indoor mold exposures is constantly changing. As new and critical information develops, building professionals and occupants who access the information will be able to incorporate the information into successful resolution of any existing building mold problems.

Building-Related Illnesses

The term *building-related illness* (BRI) is used to describe illnesses characterized by objective clinical findings related to specific exposures in the indoor environment. BRIs are

diagnosed by evaluation of signs and symptoms by physicians or other licensed health care professionals. Mold-related BRIs result from mold contamination that has occurred in buildings under specific conditions. All BRIs are preventable by eliminating and controlling the conditions that can lead to the harmful exposures.

How Sick Building Syndrome Differs from BRI

Terms such as *sick building syndrome* (SBS) have been used to describe situations in which building occupants experience a variety of symptoms that, unlike BRIs, appear to be linked to time spent in a building, but no specific illness or cause can be identified. Symptoms often disappear after occupants leave the building.

BRIs Linked to Mold Exposure

The health effects of concern from exposure to mold contamination in an indoor environment can be common allergic BRIs such as allergic rhinitis, allergic asthma, and hypersensitivity pneumonitis (also known as extrinsic allergic alveolitis), and infections such as histoplasmosis and cryptococcosis. Mycotoxins can also produce toxin-mediated adverse health effects. The following discussions of selected mold-related BRIs are not intended to be comprehensive, that is, the descriptions do not include diagnostic tests or medical treatments. Rather, the discussions are informational and focused on common BRIs.

Mold-Related Illnesses

Most people experience no health effects from exposure to the molds present in indoor or outdoor air. However, some individuals with underlying health conditions may be more sensitive to molds. For example, individuals who have other allergies or existing respiratory conditions such as asthma, sinusitis, or other lung diseases may be more easily affected. Similarly, persons who have a weakened immune system tend to be more sensitive to molds.

A person's immune system can be weakened if the individual has conditions such as pregnancy, diabetes, autoimmune disease, leukemia, or AIDS; if the individual is recovering from recent surgery, receiving chemotherapy, or in long-term treatment with steroids; or if the individual is the recipient of a recent organ or bone-marrow transplant. In addition, infants, children, and

the elderly have been shown to be more susceptible to health problems attributable to molds.

The most common health effects associated with mold exposure include allergic reactions similar to common pollen or animal allergies. Symptoms include sneezing, runny nose, eye irritation, coughing, congestion, aggravation of asthma, and skin rash. These symptoms are also common reactions to other agents that cause allergies, and it is not always possible to single out the specific cause. More severe health reactions, such as hypersensitivity pneumonitis, can occur in susceptible individuals. The three types of adverse health effects in humans caused by mold are allergy, infection, and toxin-mediated conditions.

► PREVENTIVE MAINTENANCE

The key to mold prevention is moisture control. The most important initial step in prevention is a visual inspection. Regular checks of the building envelope and drainage systems should be made to assure that they are in working order. Identify and, to the extent possible, eliminate sources of dampness, high humidity, and moisture to prevent mold growth. Wet or damp spots and wet, nonmoldy materials should be cleaned and dried as soon as possible (preferably within 24 to 48 hours of discovery).

Moisture due to condensation may be prevented by increasing the surface temperature of the material where condensation is occurring, or by reducing the moisture level in the air (humidity). To increase the material's surface temperature, insulate it from the colder area or increase air circulation of warmer air. To reduce the moisture level in the air, repair leaks, increase ventilation (if outside air is cold and dry), or dehumidify (if outside air is warm and humid). Indoor relative humidity should be maintained below 70% (25–60%, if possible).

All buildings should be checked routinely for water leaks, problem seals around doors and windows, and visible mold in moist or damp parts of the building. Any conditions that could be causes of mold growth should be corrected to prevent future mold problems.

Other prevention tips include venting moisture-generating appliances, such as dryers, to the outside where possible; venting kitchens (cooking areas) and bathrooms according to local code

requirements; providing adequate drainage around buildings and sloping the ground away from the building foundations; and pinpointing areas where leaks have occurred, identifying the causes, and taking preventive action to ensure that they do not reoccur.

Preventing Mold and Bacterial Growth in Ventilation Systems

Ventilation systems should be checked regularly, particularly for damp filters and overall cleanliness. A preventive maintenance plan should be put into place for each major component of the building's ventilation system. Contact your equipment supplier or manufacturer for recommended maintenance schedules and operations and maintenance manuals. Components that are exposed to water (e.g., drainage pans, coils, cooling towers, and humidifiers) require scrupulous maintenance to prevent microbial growth and the entry of undesired microorganisms or chemicals into the indoor air stream.

Cleaning Air Ducts

Air duct cleaning generally refers to the cleaning of various heating and cooling system components of forced air systems. The components of these systems may become contaminated with mold if moisture is present within the system, resulting in the potential release of mold spores throughout the building. All components of the system must be cleaned. Failure to clean a component of a contaminated system can result in recontamination of the entire system. Water-damaged or contaminated porous materials in the ductwork or other air-handling system components should be removed and replaced. Ventilation system filters should be checked regularly to ensure that they are seated properly. Filters should be replaced on a routine schedule.

► PROTECTING OCCUPANTS DURING RENOVATIONS OR REMODELING

The best strategy is to isolate the building area(s) undergoing renovations from occupied areas. Isolating the renovated area(s) usually means erecting barriers made of either plywood or polyethylene sheeting. Supply and return ducts should be covered in the area under renovation to prevent the spread of odors

and construction dust. Air-handling units serving areas under renovation should also be turned off if they serve only the area being renovated. Air-handling units that are being serviced as part of the renovation should be locked out while they are being serviced. Ensure that the renovated area is under negative or neutral pressure in relation to adjacent occupied space. Evaluate work areas for potential harm to workers and relocate occupants as needed; prevent contamination from spreading to occupied areas.

When undertaking renovations that break the integrity of the building envelope, such as roofing work, regular checks should be made for water intrusions at the breaks in the envelope. Water damage and standing water should be cleaned up immediately.

► BUILDING EVALUATION

If you suspect that your building has mold problems, you should look for and eliminate the source of moisture problems in the building. As stated, moisture problems can have many sources, including uncontrolled humidity, roof leaks, and landscaping or gutters that direct water into or under the building. Unvented combustion appliances and standing water following a flood are other sources.

In addition, you should remove all visible mold. Visible mold on external surfaces, especially on the walls of a building, may be an indicator of more severe contamination beneath the surface. However, mold removal without also the correction of the underlying water/moisture problem would not be effective since the mold would just grow back. If a greater problem is suspected, or a moisture problem has resulted in extensive fungal growth, an environmental investigation with emphasis on physical inspection is recommended. An experienced professional should be consulted to evaluate the situation and recommend or supervise the proper corrective action.

► SELECTING QUALIFIED PROFESSIONALS

Occupational safety and health professionals are typically able to evaluate a building for mold, whereas occupational health care professionals are qualified to assess and treat illnesses and injuries.

OSHA Publication 3160, *The Occupational Health Professional's Services and Qualifications: Questions and Answers*, provides a thorough discussion of the roles of occupational health physicians, occupational health nurses, industrial hygienists, industrial engineers, safety professionals, and other occupational health professionals. This document is available at www.osha.gov/Publications/osha3160.pdf.

Occupational physicians must have completed additional training in occupational medicine beyond the qualifications necessary for medical doctor or doctor of osteopathy licensure. Physicians may be certified in the field after meeting rigorous qualifying standards and successfully completing the examination in occupational medicine given by the American Board of Preventive Medicine. The American College of Occupational and Environmental Medicine (www.acoem.org) maintains a directory of some 6000 physicians and other health professionals specializing in occupational and environmental medicine. Your general practice physician may be able to refer you to a specialist from this list.

The American Industrial Hygiene Association (www.aiha.org) and the American Society of Safety Engineers (www.asse.org) maintain lists of consulting firms for occupational safety and health. Certified Industrial Hygienists (CIHs) and Certified Associate Industrial Hygienists (CAIHs) must have at least a bachelor's degree with a concentration in the sciences, have five years professional experience, and pass a rigorous certification examination. The American Board of Industrial Hygiene (www.abih.org) maintains a complete listing of all CIHs and CAIHs in good standing with the organization.

Certified Safety Professionals (CSPs) also must meet academic requirements, have at least four years of experience, and pass a rigorous certification examination. A roster of CSPs is maintained by the Board of Certified Safety Professionals. Both CIHs and CSPs are required to attend continuing education courses to stay current in their field of practice.

► SAMPLING FOR MOLD

Where visible mold is present, cleanup can proceed on the basis of the visual inspection. Sampling for molds and other bioaerosols is not usually necessary. There are currently no governmental

or professional recommendations for airborne concentrations of mold, mold spores, mycotoxins, and other bioaerosols with which to compare any sampling results. However, sampling for mold may be considered in the following situations:

- When the medical diagnosis is consistent with mold-associated illness
- To delimit the outer boundaries of severely contaminated areas before and during a mold cleanup project
- After a cleanup, to show that the types and concentrations of mold in the area are similar to background levels

Sampling for mold, mold spores, mycotoxins, and other bioaerosols are not part of a routine building evaluation.

Mold Sampling Strategies

Sampling and analysis of mold are complex and can become expensive. There is a lack of standard procedures for sampling and analysis. Sampling should be undertaken only after careful delineation of the sampling goals. For assistance with mold sampling, consult an experienced health and safety professional. Health and safety professionals, working closely with an accredited environmental microbiology laboratory, can determine and document the details concerning the necessary sampling strategy, including when and where to sample.

Standardized methods, such as ACGIH, AIHA, NIOSH, and OSHA methods, should be followed where available. Accredited laboratories that participate in the AIHA Environmental Microbiology Proficiency Analytical Testing (EMPAT) Program are listed on the AIHA website at www.aiha.org.

Mold Sampling Results that Are in CFU/m² and CFU/m³

Sampling results for viable (living) microorganisms are presented as concentrations, and the units used will vary depending on the sample collection methods. Air sampling results are reported as colony-forming units per cubic meter of air (CFU/m³). Specialized sampling is reported in terms of the entity collected, that is, if only spores were sampled, the results would be reported as spores/m³. Bulk samples may be reported as colony-forming units per gram (CFU/g) of dust or material or colony-forming units per milliliter (CFU/ml) of stagnant water or slime. Wipe sample results are reported as colony-forming

units per surface area such as CFU/m² or CFU/ft². These units represent the culturable portion of mold concentrations only and do not quantify the fragments and by-products of mold that may also exist.

► MOLD CONTROL AND REMEDIATION

The purpose of mold remediation is to identify and correct the water or moisture problem, remove or clean all contaminated materials, prevent the spread of contamination to other areas, and protect the health and safety of the building occupants. During any remediation, the health and safety of remediation workers must also be a priority. In every case of microbial contamination, including mold contamination, the underlying cause of the contamination must be rectified or the growth will recur.

These are the basic principles of mold remediation. For more thorough discussions of methods, recommendations, and remediation approaches for various levels of contamination, see OSHA's Safety and Health Information Bulletin entitled, "A Brief Guide to Mold in the Workplace" (SHIB 03-10-10), (1) which is available at: www.osha.gov/dts/shib/shib101003.html.

In particular, see discussions concerning:

- Additional measures for cleaning contaminated ductwork
- Biocides vs. antimicrobial agents
- Informing building occupants about mold remediation
- Informing remediation employees about the hazards of mold
- Personal protective equipment (PPE) for remediation employees

► WHAT TO DO ABOUT MOLD IN THE WORKPLACE

There are no standards that say how much mold is hazardous to your health. However, there should not be visible mold growth or objectionable moldy odors in your workplace. If you see or smell mold, or if you or others are experiencing mold-related health problems, report the problem to your employer so the problem can be investigated. If you believe that there is a mold hazard, you have the right to file a complaint with Federal OSHA or, in states with OSHA-approved state plans, the state occupational safety and health agency. You can contact your local Area Office of Federal OSHA or state occupational safety

and health office or file a complaint online at www.osha.gov/asa/opa/worker/complain.html.

Links to the addresses and telephone numbers of the various state occupational safety and health agency offices are available online at www.osha.gov/fso/osp/index.html. In addition, assistance with filing complaints, receiving workplace health and safety information, and requesting OSHA publications, among other types of information, are available by calling OSHA's toll-free number at 1-800-321-6742.

► GETTING MORE INFORMATION FOR MOLD-RELATED PROBLEMS

The following sources provide links to additional programs and information regarding mold:

Occupational Safety and Health Administration (OSHA); www.osha.gov

Search “indoor air quality” or “molds and fungi” to link to sources of information related to Indoor Air Quality (IAQ) and mold.

Environmental Protection Agency (EPA); www.epa.gov/iaq/pubs/
Indoor Air Quality Information Clearinghouse (IAQ Info), P.O. Box 37133, Washington, DC 20013-7133; 1-800-438-4318; iaqinfo@aol.com

National Institute for Occupational Safety and Health (NIOSH); www.cdc.gov/niosh

Education and Information Division, Publications Dissemination, 4676 Columbia Parkway, Cincinnati, OH 45226-1988; 1-800-35-NIOSH 1-800-356-4674; pubstaft@cdc.gov

International Facility Management Association; www.ifma.org
1 E. Greenway Plaza, Suite 1100, Houston, TX 77046-0194; 713-623-4362

American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE); www.ashrae.org

1791 Tullie Circle, N.E., Atlanta, GA 30329; 1-800-527-4723

Relevant Publications

Relevant publications used as references for public documents were located through a PubMed (National Library of Medicine) search. PubMed was selected because of its broad scope of publications: Medline (National Library of Medicine), other life sciences journals, and links to sites providing full-text articles. Keywords used to execute the search included mold, epidemiology, BRI,

hypersensitivity pneumonitis, farmer's lung, air conditioner or humidifier lung, mycotoxins, and respiratory illness.

The size of the search results was managed, where appropriate, by limiting searches to the English language and human studies. Single word and Boolean logic operators (AND, OR, and NOT) were used to link words and phrases for more precise searches which yielded summary abstracts (from a choice of display formats). Search summaries were quickly reviewed and further refined for useable selections.

Articles were obtained either directly from online sources or through the OSHA Technical Data System and were reviewed both by the Occupational Safety and Health Association staff and contractors. Similar searches of the OSHA IAQ Docket (H-122) were made through the Intra-OSHA Document Management System (DMS). This system contains the entire IAQ docket in a format that allows full-text selection of documents and returns a list of exhibit numbers that contain the term(s) of interest, which can then be viewed for usefulness and retrieved as desired.

Articles were chosen for their subject matter and relevance to workplace building-related illness and were reviewed by OSHA and its contractors. Not all papers reviewed were used.

► ADVERSE HEALTH EFFECTS

Molds can cause three types of adverse health effects in humans: allergy, infection, and toxin-mediated conditions. These adverse health effects are discussed in more detail next.

Allergic Rhinitis

Allergic rhinitis has several signs and symptoms. The symptoms of allergic rhinitis include sneezing; itchy eyes, nose, and throat; a stuffy or runny nose; sore throat; cough; watery eyes; headache; and fatigue. These symptoms may be worse in indoor environments and may peak in hot and humid seasons. Common physical findings include red or bloodshot eyes, a runny nose, watery eyes, and thickened nasal mucous membranes. Multiple airborne allergens other than molds (e.g., pollens, animal dander, and dust mites) may be involved. However, when a person is also sensitized to mold, an indoor environment contaminated with mold spores may aggravate the signs and symptoms of allergic rhinitis.