

THE TASK FORCE ON MOLD IN LOUISIANA

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LEGISLATIVE SESSION

FOLLOW UP SUMMARY REPORT – APRIL 2016

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The Louisiana Toxic Mold task force, after having convened twice last year to allow for additional information to be added to our original findings, hereby submits the following as it relates to the goals/next steps set forth in our initial summary:

1. As per our original assessment, based upon input from all members of the Task Force, the name of the group should be changed to the “Task Force on Mold in Louisiana”.
2. New regulations are now in effect across the United States, including Louisiana, based upon the revisions to the International Residential Code 2009 and the International Energy Code 2015 that are now being enforced since January 2015 by state and local code enforcement departments. The new codes will allow for much improved selection and efficiency of equipment during installation of HVAC units as well as tighter duct work due to blower door testing, duct leakage testing, and the combined use of the Manual J, S and D computer programs which were created specifically for the Heating and Air Conditioning industry. These programs will eliminate error in matching equipment along with providing for proper duct sizing on new construction and remodeling projects as well as any work that may require replacement of more than 60 percent of the existing equipment and ductwork combined. These new rules also implement more stringent requirements for ventilation equipment which includes hood vents and attic ventilation.
3. As of January 1, 2015, there were 155 Mold Remediation contractors licensed with the State Licensing Board for Contractors. The Board maintains a copy of the Contractors Licensing Law (La. R.S. 37:2150-2192) on its website, at [www.lslbc.louisiana.gov](http://www.lslbc.louisiana.gov), or [www.lacontractor.org](http://www.lacontractor.org), which includes the provisions of Act 880 of the 2003 Louisiana Legislature regarding the licensure Mold Remediation contractors. The Board also maintains on the website information on applying for a Mold Remediation license along with a Mold Remediation license application form and a list of approved Mold Remediation training providers. In addition, the Board provides the required training course on the Unfair Trade and Consumer Protection Act, since most training providers do not have coursework covering this requirement.

Because all contractors (including Mold Remediation contractors) are required to have a qualifying party take and pass a Business and Law examination prior to licensure, the State Licensing Board for Contractors also provides a study guide for the exam, entitled “NASCLA Contractors Guide to Business, Law, and Project Management, Louisiana Edition”, published by the National Association of State Contractors Licensing Agencies (NASCLA). The study guide and examination are intended to help contractors have a basic understanding of principles needed to start and run a contracting business and the requirements of laws that directly affect such businesses. A variation of this study guide is used by 27 contractors licensing Boards in 16 states. This year, the Louisiana State Licensing Board for Contractors is the first Board to offer this publication along with an electronic version with enhanced study aids. The Board also maintains a candidate information bulletin for license applicants with information regarding the study guide, and sample questions to give them an idea of what to expect on the examination.

4. Based upon information received from some of our Task Force members, there has been no increase in violations or enforcement procedures against any contractors, subcontractors or mold remediators since the implementation of the revised federal and state HVAC and ventilation equipment regulations. Currently many of the departments of code enforcement and safety and permits throughout the state are making every attempt to comply with enforcement of the new federal and state regulations mentioned in section (2) above, by properly inspecting all new construction and remodeling projects, as well as projects that require replacement of 60% of the HVAC equipment or duct work. Currently there are several smaller jurisdictions and parishes that are not able to provide proper enforcement due to lack of personnel and or training of inspectors. We are hopeful that this issue will be resolved over time with state and locally funded training, along with pressure and support from local building code officials and homebuilder and realtor organizations from Louisiana. Currently in the metro New Orleans area, there are several organizations that are providing educational seminars for code enforcement officials, HVAC, and general contractors to promulgate better understanding of what is required and expected under the new regulations.

Strong attention should be given by all Code Enforcement Departments to ensure that private businesses and homeowners that are subcontracting their own work comply with all requirements of the new regulations to prevent future issues with mold.

5. Since our Task Force does not have funding, nor does it have available to it all of the resources necessary for it to promulgate literature pertaining to mold, it is suggested that distribution could be obtained by using currently available state departmental services and affiliated websites such as, GOHSEP, the Public Health Training Center, Louisiana Fire Marshal's office, news stations statewide, Louisiana Press Association and Association of Broadcasters, combined with the realtor and homebuilder associations across the state, as well as apartment associations, parish and state enforcement agencies and departments and heating and air/mechanical contractors and mold remediation companies. Additionally, other resources for promulgation of mold information would be public libraries, as well as housing and energy alliances throughout the state which could provide an additional forum for dissemination of information relating to mold causation and prevention that is not as readily available to them today.

A continued effort to monitor mold and its causes and effects should be the goal of all of the entities listed above and, as awareness is increased, there should be broader public understanding of the causes, prevention, and reporting of mold.

Summation:

As new technology and information relative to mold become available to the public and private sector, it is imperative that the state of Louisiana provide a way to disseminate this information through the avenues mentioned in article 5 above or by any other new methods that come available. As the task force is aware, the ability to prevent,

monitor and detect mold is always improving, hence the need to continually update the public and the private sector with up to date information is a necessity.

It is the opinion of the Task Force on Mold in Louisiana that the information we have collected pertaining to mold should be released to the public via the various organizations and entities listed in Addendum 2. We believe that the goals set forth for the Task Force have been met and that the Task Force should be disbanded, unless the legislature finds that there should be a continuation of our efforts beyond the originally intended scope of Legislative Act 258.

## UPDATED SOURCES OF INFORMATION AND REFERENCES

Attached: Addendum (1) a list of the publications relative to mold that were used by the task force for supplementary information and which are available to the public at this time. Some of the information and research contained in these publications may be revised in the future so constant attention should be given to maintaining an up to date library of current data.

Attached: Addendum (2) a document “compiled resources for mold prevention and remediation” that was provided by task force members, Dr. LuAnn White and Dr. Louis Trachtman. This document updates and combines the information and resources from the Environmental Protection Agency, LSU Agricultural Center, National Institute of Occupational Safety and Health, United States Centers for Disease Control and Prevention, and Texas A&M University. Some of these resources were used in our earlier summary and this is an update to those references.

Attached: Addendum (3) Updated information: Environmental Law Institute’s March 2015 database of state indoor air quality laws.

Attached: Addendum (4) 2000-2013 literature review publication (*Indoor Environmental Exposures and Exacerbation of Asthma: An Update to the 2000 Review by the Institute of Medicine. Environmental Health Perspectives January 2015*) citing provisional causal relationships between indoor air allergens, including mold, and exacerbation of asthma in various target populations.

Attached: Addendum (5) Submittal from Task Force guest, Dr. Jocelyn Lewis – A Review of Adult Asthma Hospitalizations in Louisiana, 2006-2011.

Attached: Addendum (6) Compilation of Task Force meeting minutes, September 2014-Present.

We respectfully submit the above information for review by the legislative liaison.

ADDENDUM 1

**EPA Publications:**

Mold Remediation in Schools and Commercial Buildings

<http://www.epa.gov/mold/pdfs/moldremediation.pdf>

A Brief Guide to Mold, Moisture, and Your Home

[www.epa.gov/mold/pdfs/moldguide.pdf](http://www.epa.gov/mold/pdfs/moldguide.pdf)

EPA Mold Web Course

[www.epa.gov/mold/moldcourse](http://www.epa.gov/mold/moldcourse)

Guidance for Clinicians on the Recognition and Management of Health Effects Related to Mold Exposure and Moisture Indoors

[http://doem.uchc.edu/consultation\\_outreach/indoor\\_environments/pdfs/mold\\_guide.pdf](http://doem.uchc.edu/consultation_outreach/indoor_environments/pdfs/mold_guide.pdf)

**LSU AgCenter Publications:**

Mold: Important Questions, Objective Answers

[http://www.lsuagcenter.com/en/family\\_home/home/health\\_safety/indoor\\_air\\_quality\\_mold/Mold+Fact+Sheet.htm](http://www.lsuagcenter.com/en/family_home/home/health_safety/indoor_air_quality_mold/Mold+Fact+Sheet.htm)

Hiring a Mold Remediation Contractor

[http://www.lsuagcenter.com/en/family\\_home/home/health\\_safety/indoor\\_air\\_quality\\_mold/](http://www.lsuagcenter.com/en/family_home/home/health_safety/indoor_air_quality_mold/)

Mold Removal Guidelines for Your Flooded Home

[http://www.lsuagcenter.com/en/family\\_home/home/health\\_safety/indoor\\_air\\_quality\\_mold/Mold+Removal+Guidelines+for+Your+Home.htm](http://www.lsuagcenter.com/en/family_home/home/health_safety/indoor_air_quality_mold/Mold+Removal+Guidelines+for+Your+Home.htm)

Avoiding Mold Hazards in Your Water-damaged Home

[http://fcs.tamu.edu/housing/healthy\\_homes/indoor\\_air\\_quality/avoiding\\_mold\\_hazards.pdf](http://fcs.tamu.edu/housing/healthy_homes/indoor_air_quality/avoiding_mold_hazards.pdf)

**Centers for Disease Control Publications:**

Population-Specific Recommendations for Protection from Exposure to Mold in Flooded Buildings

[http://emergency.cdc.gov/disasters/mold/report/pdf/2005\\_moldtable5.pdf](http://emergency.cdc.gov/disasters/mold/report/pdf/2005_moldtable5.pdf)

**Building Science Corporation**

Mold Remediation in Occupied Homes

[www.nwcleanair.org/pdf/aqPrograms/indoorAir/Mold\\_Remediation.pdf](http://www.nwcleanair.org/pdf/aqPrograms/indoorAir/Mold_Remediation.pdf)

(based on New York City Health Department Guidelines)

**NIOSH (National Institute of Occupational Safety and Health)**

Preventing Occupational Respiratory Disease from Exposures Caused by Dampness in Office Buildings, Schools, and Other Nonindustrial Buildings <http://www.cdc.gov/niosh/docs/2013-102/>

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## ADDENDUM 2



## **Compiled Resources for Mold Prevention and Remediation**

### **RESOURCE: Environmental Protection Agency (EPA)**

Information available from the EPA is geared towards homeowners and renters, persons working in schools, and managers of commercial buildings. Anyone visiting the site can sign up for a free subscription to receive reading materials published by the EPA via email. The subscription can be tailored to deliver subject-specific publications of your choosing, appropriate for either the general public or for health professionals.

Homeowners, renters - Information for the general public is easily navigable and clean. Most information is concise and the verbiage approachable. Potential health consequences of mold exposure are touched upon, by way of highlighting the spectrum of symptoms that may result from exposure. There is an interactive house map available that describes common places mold can collect, and what can be done to combat mold in these locations. Photos of mold on different household objects are included to demonstrate appearance. DIY (Do it yourself) cleanup information is provided for homeowners with less than 10 square feet of space affected by mold. Information on the supplies necessary for cleanup, as well as their cost and where they can be purchased, is included. Regarding prevention, EPA instructions focus on moisture in the home and approaches to altering this risk factor. For homeowners, the EPA advises involvement of a professional only for evaluation of hidden mold in the home, for affected areas greater than 10 square feet, or for flood-related water damage. The EPA advises against sampling as a necessity for mold evaluation and explains this reasoning. If sampling is advised by a professional, the homeowner should request that the sample be analyzed and results interpreted in conjunction with AIHA (American Industrial Hygiene Association) or ACGIH (American Conference of Governmental Industrial Hygienist) guidelines. For those who are not homeowners, the EPA advises contacting a building manager or landlord, followed by the state health department if mold concerns fail to be addressed. There is additional instruction for reporting of related law violations, including descriptions of what constitutes a violation and how this should be addressed. Regional EPA office locations and contact information are provided for further questions regarding mold prevention and cleanup. Information from the EPA on Air Duct cleaning specifically is lengthier and less organized. The EPA states that current knowledge on the harms or benefits associated with air duct cleaning is insufficient to support strong recommendations for or against cleaning. However, details on how to locate potential cleaners and screen for their legitimacy are included, as well as companion checklist in order to aid in the process. There is extensive information available about potential harms associated with use of biocides and sealants by such cleaning contractors, to aid the homeowner in making educated decisions about air duct maintenance. A hotline is available for those who have questions about such services, the process, and associated health risks/benefits. Most information is available in English and Spanish.

Schools and Commercial buildings – A document regarding mold remediation in commercial buildings is also available for contractors, building managers, and involved personnel such as custodians. This document is organized similarly to that available to homeowners. It is easy to navigate, but much more in-depth regarding cleanup guidelines. Common locations for moisture-damage in schools and commercial buildings are provided, as a way for a team to conduct mold surveillance. Steps highlighting how to plan and carry out remediation, as well as companion checklists and diagrams are readily available. Mold remediation tips are organized by material type suffering water damage. PPE (personal protective equipment) is emphasized, and strong recommendations are made for or against available commercial equipment. There is extensive information on how to avoid risking the health of building occupants in mold cleanup. Indoor Air Quality guidelines, policies, and recommendations are abundant and straightforward. These recommendations include mold and other indoor air pollutants and are organized by building type.

Workplace – The EPA refers to OSHA (Occupational Health and Safety Administration) regarding mold containment and laws in the workplace. Remediation guidelines available on OSHA's website are similar to those available through the EPA but are geared more towards professionals with a background in cleanup. The terminology used is less approachable to the general public and proposed remediation guides are more extensive. Business owners and building managers who are concerned about mold can find instruction on how and where to hire a professional for consultation. OSHA offers a free consultation service for small businesses of less than 250 individuals.

Health Professionals – With regards to mold, guidance for clinicians includes aid for classification of molds, criteria for diagnosis, aids for symptom recognition in patients, and example cases highlighting these clinical features. There are reading materials available for health professionals on the matter of Indoor Air Quality specifically. This includes a section on adverse health effects related to mycotoxins and cleaning products, but is concerned primarily with improving awareness and assisting in diagnosis of associated health conditions. There is a "quick reference" version as well as an expanded version of these materials for easier navigation. Some information is provided to that advises when health professionals should recommend a patient to take Remedial Action on indoor air quality concerns.

## **RESOURCE: LSU Ag Center (Louisiana State University Agricultural Center)**

This resource is organized by target audience: Producers, consumers, researchers, and students. Some publications are not readily available on the website or links are broken. However, contact information is included and publications will be delivered via email if requested. There are many individual articles on this website sometimes with overlapping information about mold. This

resource would be easiest to navigate for the person who knows what type of mold information he/she is looking for, rather than searching for general and comprehensive information about mold.

Producers (farming) – It is very easy to find a local department representative to field specific individual concerns. The search engine for local resources is parish-based and contacts are organized by specialty field (i.e. Watersheds, Gardening, etc). There is some advice available regarding fungicides and mold control in plants, as well as contacts for diagnosis of agricultural mold concerns. Mold information here is organized by type, and assumes some individual ability to identify the type of mold present with which to begin. Any remaining information is available in the form of contact information for specialists rather than reading materials published on the website.

Consumers (General Public) – Mold information is geared towards awareness and understanding the basics: how mold affects the home, common areas of involvement, mold prevention, risk factors for growth on appliances, and cleanup. This resource is mostly focused on mold related to flood damage, rather than remediation of smaller-scale projects. Unlike EPA center publications, this website provides advice on how to clean up flood-related house damage, whereas the EPA suggests seeking professional assistance in such a scenario. There is a document instructing the hiring of a remediation contractor specifically for mold. This publication is brief and includes information on how to hire a reputable contractor specifically in Louisiana. It provides phone numbers and links to a search engine that allows easy identification of such licensed contractors. Additionally, there is information available for the interested public on asthma related to mold exposure.

Researchers – Information for researchers is directed at sampling and laboratory identification of molds related to agriculture. There are a variety of links to laboratories which serve different sectors of agriculture research. Little information is available on these pages; most of the content is contact information and is aimed at directing those interested to the right contact person(s).

## **RESOURCE: NIOSH (National Institute of Occupational Safety and Health)**

This agency discusses mold in one publication that addresses employers and building occupants: “Preventing Occupational Respiratory Disease from Exposures Caused by Dampness in Office Buildings, Schools, and Other Nonindustrial Buildings”. This document focuses on prevention. It includes brief descriptions of deleterious health effects of mold and sample cases in the workplace. The value of prevention vs. remediation is discussed, the costs associated with cleanup, and current standards in various states are presented. Recommendations for prevention are made and endorsed by various overseeing organizations. This publication is available in English and Spanish. NIOSH has created several other webpages detailing construction safety,

building ventilation, and renovation practices, although these do not all pertain to mold specifically. Information about taking action in cleanup redirects to EPA resources.

### **RESOURCE: CDC (United States Centers for Disease Control and Prevention)**

The CDC contains information appropriate for clinicians, researchers, public health professionals, and the general public. Unlike other resources, the CDC includes mold-related health statistics available to the public, and IAQ (indoor air quality) programs organized by state. It is very clear how to locate and contact local and state programs for consultation about air quality concerns. There are also public service announcements available in video and radio broadcast format, but these are not readily advertised on the website. Although very thorough, some of the publications from the CDC are quite lengthy for the average person with general concerns. Due to the abundance of information available to different target audiences, it is necessary to spend some time browsing to locate information designed for your target audience. Information is available in English and Spanish.

Health professionals and patients – There is ample information regarding mold, types of mold and the different clinical presentations associated with each. The most recent IOM (Institute of Medicine) report available is from 2004, and categorizes various symptoms as having sufficient, limited, or insufficient evidence when investigating the association of mold with specific health effects. This resource is unique in its aid to clinicians because it provides a platform for the interpretation of symptoms in a clinical context.

General Public and Professionals – Information provided can be reorganized to address the following populations: homeowners, building managers, employers, and persons responding to natural disasters. This information is available in the form of links to various documents and other organizations invested in indoor air quality. It is difficult at first glance to determine which articles will serve your sector of interest. Much of the information provided building managers, employers, and employees redirects to OSHA and NIOSH webpages. Most remediation information for individuals or professionals redirects to the EPA resources. Information originally published by the CDC concerns mostly natural disaster-related water damage. This information is appropriate for updating the general public and improving awareness. Unlike other resources presented in this report, press releases from the CDC are current and useful for both the general public and health professionals.

### **RESOURCE: Texas A&M (Texas Agricultural and Mechanical University)**

This website is slightly cumbersome, and has resources targeted towards both homeowners and professionals in the agricultural sector. However, information and associated resources available

to both of these populations is thorough. Many of the articles published here have overlapping information, so although the numerous links may appear overwhelming there is redundancy within this website. Documents are typically available in English and Spanish.

Homeowners and renters – Information pertains mostly to general home safety, efficiency, and maintenance. Indoor Air Quality is broken down by the type of indoor air pollutant. The information available to homeowners regarding mold and mildew is geared towards improving awareness of mold-related health concerns. This website and associated pages may be best for those who are looking to buy or design a home, as it includes questions that a prospective homeowner or buyer should ask him/herself about structure, humidity, IAQ, and HVAC (Heating, Ventilation and Air Conditioning) systems. Navigation of website resources requires reading through many links to articles and outside agencies.

Agriculture – Available information involves mainly disaster preparedness, prevention, and flood-related mold concerns. There are courses available through this organization for a fee, which concerns mainly accreditation of professionals in the field.

ADDENDUM 3

ENVIRONMENTAL LAW INSTITUTE  
DATABASE OF  
STATE INDOOR AIR QUALITY LAWS

**COMPLETE DATABASE**

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Washington, D.C.

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## About the Database

The following chart includes all of the laws contained in ELI's Database of State Indoor Air Quality Laws. While the database reflects a broad cross-section of IAQ laws, it does not purport to cover all areas of policy that relate directly or indirectly to indoor air quality. The purpose of the database is not to indicate how many laws exist, but rather to provide examples of the different types of policy strategies that states have employed. Following are the general guidelines used to develop the database:

*Document Type:* The database contains **state laws**. In some cases, regulations or guidance documents established pursuant to individual laws are noted. The database does not include federal or local laws, nor does it include legislation that has been proposed but not enacted.

*Time Frame:* The database contains laws enacted **through December 2014**. The abstracts for documents that were added or substantially amended in 2014 appear in **bold** type.

*Scope/Exclusions:* The Database includes laws that address a variety of pollutants, practices, and building types. Given the multi-faceted nature of IAQ issues, the Database cannot include all IAQ-related laws. The purpose of the Database is not to indicate how many laws exist, but rather to provide examples of different types of policy strategies that states have employed. Some types of laws (e.g., lead paint, asbestos, second-hand smoke) are excluded from the database because they are extensive and are documented elsewhere.

ELI provides a variety of reports, briefs, and other materials on state and local IAQ laws, particularly in the areas of radon, school IAQ, and green building. Some of these documents include analysis of state laws, and some are updated more frequently than the Database. To browse and download ELI's IAQ policy materials, please visit our Indoor Environments and Green Buildings Policy Resource Center at [www.eli.org/buildings](http://www.eli.org/buildings).



AL	<b>2007 Alabama House Resolution No. 625</b> Urges the state education agency to adopt EPA’s IAQ Tools for Schools program for use in all public schools. Also urges local school boards to use the EPA program to implement an IAQ inspection and evaluation program.
AK	<b>Alaska Statutes §§ 30.080, .085</b> Requires the Department of Administration to consider the indoor environment, among other factors, when evaluating proposals to lease space or to acquire or improve real property under a lease-purchase agreement.
AK	<b>Alaska Statutes §§ 34.70.010--.200</b> Requires transferors of an interest in residential real property to provide to transferees a written disclosure statement prior to a written offer of transfer, and directs the Alaska Real Estate Commission to establish the form. Form developed by the Commission requires disclosure of knowledge of materials deemed to be environmental hazards, including radon gas, formaldehyde, asbestos, and lead-based paint, as well as knowledge of mold or mildew issues. [See <a href="http://commerce.state.ak.us/dnn/portals/5/pub/rec4229.pdf">http://commerce.state.ak.us/dnn/portals/5/pub/rec4229.pdf</a> .]
AZ	<b>Arizona Revised Statutes § 15-2002</b> Requires the state school facilities board to provide information on improving and maintaining indoor environmental quality to school districts every two years.
AZ	<b>Arizona Revised Statutes §§ 15-2131--2132</b> Requires an environmental site assessment for all school construction projects. Provides that the state shall not approve school construction projects that do not incorporate adequate roof pitch; cannot meet residential environmental site assessment criteria; or do not incorporate IAQ guidelines consistent with SMACNA guidelines. Requires that all new HVAC systems be operated continuously during school activity hours, with stated exceptions.

AR	<p><b>2011 Arkansas Senate Bill 531</b></p> <p>Created the Mold Investigation Advisory Board. Required the Board to study the effects on public health and safety of existing state mold laws and regulations, as well as options for revising state laws. Required the Board to report its findings and proposals for new legislation by December 31, 2012, on which date the Board is abolished. [Board report available at:  <a href="http://plantboard.arkansas.gov/PlantIndustry/Documents/Mold%20Advosiry%20Board%20Final%20Report.pdf">http://plantboard.arkansas.gov/PlantIndustry/Documents/Mold%20Advosiry%20Board%20Final%20Report.pdf</a>.]</p>
AR	<p><b>Arkansas Code § 22-2-108</b></p> <p>Authorizes the Arkansas Building Agency to establish minimum design and construction for capital improvement projects undertaken by state agencies. Regulations adopted by the agency (Ark. Admin. Code 017.00.2-2-800) call on building operators, managers, and designers to plan construction and operation of state buildings as wisely as possible to minimize energy consumption while meeting the operational needs of the facility and promoting a healthy indoor environment. The standards also establish that all energy plans should consider the impact of energy reduction on occupants' health and productivity.</p>
AR	<p><b>Arkansas Code § 26-51-1705</b></p> <p>Authorizes the Arkansas Development Finance Authority to promulgate rules and regulations necessary to administer the federal Low Income Housing Tax Credit program. Rules (Ark. Admin. Code 109.04.4-II) establish habitability standards that must be maintained by housing projects funded through the program, including the requirement that dwelling units and common areas must have proper ventilation and be free of mold.</p>
AR	<p><b>Arkansas Code §§ 6-21-801--814</b></p> <p>Requires school districts to develop six-year facilities master plans, and requires state to conduct random, unannounced inspections of school facilities to ensure compliance with facilities master plans. Requires the state to develop an Arkansas Facilities Custodial, Maintenance, Repair, and Renovation Manual to provide standards and guidance for school districts. Among other things, manual must include training criteria for the use and storage of supplies and equipment, with emphasis given to indoor air quality issues, and a suggested schedule for the sanitary inspection of all school buildings.</p>

CA	<b>California Business &amp; Professions Code § 10084.1</b>
	Requires the state to prepare a booklet to educate consumers about common environmental hazards affecting real property, including radon. Separate law (Cal. Health & Safety Code § 25417.1) requires the state to update the booklet.

CA	<b>California Civil Code §§ 1102--1102.18</b>
	Requires sellers of real property containing up to four residential units to complete a disclosure form indicating the presence of all environmental hazards, including radon gas, formaldehyde, and mold, that are known to the seller. Also requires disclosure of whether property contains a carbon monoxide device. Requires resale of manufactured homes and mobile homes to include disclosure of environmental hazards in the home interior or exterior, including radon, formaldehyde, and lead-based paint, as well as the existence of a carbon monoxide device.

CA	<b>California Education Code §§ 17070.75, 17002(d)(1)</b>
	Requires school districts to establish a facilities inspection system to ensure schools are maintained in good repair, as a condition of receiving state school facility funds. Defines "good repair" to include interior surfaces free from water damage and showing no evidence of mold or mildew and to include functional and unobstructed HVAC systems. Requires state to develop an evaluation instrument consistent with the criteria set in the law. The Facility Inspection Tool developed by the state for use in school inspections includes several IAQ-related items that address ventilation and mold/water damage. [See <a href="http://www.dgs.ca.gov/opsc/Programs/deferredmaintenanceprogram/goodrepairstandards.aspx">http://www.dgs.ca.gov/opsc/Programs/deferredmaintenanceprogram/goodrepairstandards.aspx</a> .]

CA	<b>California Health &amp; Safety Code § 105405</b>
	Requires the state health agency, through its Indoor Air Quality Program, to develop non-binding guidelines for the reduction of exposure to volatile organic compounds from construction materials in newly constructed or remodeled office buildings. [Guidelines available at: <a href="http://www.cal-iaq.org/phocadownload/reducing_occupant_exposure_vocs_guidelines.pdf">http://www.cal-iaq.org/phocadownload/reducing_occupant_exposure_vocs_guidelines.pdf</a> .]

CA	<b>California Health &amp; Safety Code § 105425</b>
	Requires the state health agency to conduct and promote the coordination of research, investigations, experiments, demonstrations, surveys, and studies relating to the causes, effects, extent, prevention, and control of indoor pollution.

CA	<p><b>California Health &amp; Safety Code § 105430</b></p> <p>Authorizes the state health agency to develop radon assessment and mitigation plans for new construction in at-risk areas. Provides that if the department adopts regulations to implement a radon assessment and mitigation plan, local governments may not issue building permits until applicants have demonstrated compliance with those regulatory standards.</p>
CA	<p><b>California Health &amp; Safety Code § 116050</b></p> <p><b>Directs the department of Public Health to establish and enforce regulations pertaining to public swimming pools. Regulations implementing the law (22 Cal. Code Regs. 65531) establish microbiological water quality standards and further provide that "the chemical quality of public pool water and indoor air quality at the public pool site and ancillary facilities shall not cause adverse physiological effects, such as irritation of the eyes, lungs, or skin of the pool users."</b></p>
CA	<p><b>California Health &amp; Safety Code § 39619.6</b></p> <p>Requires the Air Resources Board and the Department of Public Health to conduct a comprehensive study and review of the environmental health conditions in portable classrooms. Directs the study to include a review of design and construction specifications; a review of school maintenance practices; an assessment of IAQ; and an assessment of potential toxic contamination, including mold contamination. Provides that the study shall address the need for modified design and construction standards; emission limits for building materials and classroom furnishings; and other mitigation actions to ensure the protection of children's health. [Report available at: <a href="http://www.arb.ca.gov/research/indoor/pes/pes.htm">http://www.arb.ca.gov/research/indoor/pes/pes.htm</a>.]</p>
CA	<p><b>California Health &amp; Safety Code § 39660.5</b></p> <p>Requires the Air Resources Board, when evaluating the level of potential human exposure to toxic air contaminants, to assess exposure in indoor environments as well as in ambient air conditions. Requires the Board to coordinate with other state agencies.</p>

CA	<p><b>California Health &amp; Safety Code § 39668</b></p> <p>Requires the Air Resources Board to prepare a written report on the availability and effectiveness of toxic air contaminant monitoring options. Requires the report to include, among other things, an analysis of the feasibility and costs of establishing an indoor toxic air contaminant monitoring program. Requires that, if the Board determines additional monitoring capacity to be appropriate and feasible, the Board shall develop guidelines for establishing supplemental toxic air contaminant monitoring networks.</p>
CA	<p><b>California Health &amp; Safety Code § 39930</b></p> <p>Requires the Air Resources Board, in consultation with other agencies, to provide a report to the state legislature summarizing the following: the most recent empirical data on indoor air pollution; the potential adverse effects of indoor air pollution exposure on public health; information about the effects of existing regulations and current industry practices in mitigating exposures; and a listing of work performed by other state or federal entities regarding biological and radiological substances. Requires that the report include a priority ranking of indoor air pollutants; an analysis of the potential health effects of indoor air pollutants; and options for mitigating those health effects in schools, nonindustrial workplaces, homes, and other indoor locations. [Report available at: <a href="http://www.arb.ca.gov/research/indoor/ab1173/finalreport.htm">http://www.arb.ca.gov/research/indoor/ab1173/finalreport.htm</a>.]</p>
CA	<p><b>California Health &amp; Safety Code §§ 106750 et seq.</b></p> <p>Establishes that no person may provide radon services for the general public unless that person has completed the National Radon Measurement Proficiency Program of the National Environmental Health Association or the National Radon Safety Board Certified Radon Professional Program. Requires submission of certificate of completion of either course to the state health agency, and requires the agency to make available to the public a list of individuals so certified.</p>
CA	<p><b>California Health &amp; Safety Code §§ 26101--26157</b></p> <p>Requires the state health agency to consider the feasibility of adopting permissible exposure limits to mold in indoor environments and, if feasible, to adopt such limits. Establishes criteria to consider in adopting standards, and provides that the department may also adopt alternative standards for facilities that serve people at greater risk of adverse health effects. Provides that the law shall be implemented only to the extent that the department determines that funds are available for its implementation. Establishes disclosure and property maintenance requirements for transferors, lessors and tenants of real estate following the department's issuance of standards and guidelines under the law. Authorizes local enforcement of any standards adopted by the department.</p>

CA	<p><b>California Health &amp; Safety Code §§ 26200--26204</b></p> <p>Requires the California Research Bureau, in consultation with the Department of Public Health and with the assistance of a review panel, to perform a study and to publish findings on fungal contamination affecting indoor environments. Requires the study to include information on health effects, assessment, remediation, and hazard communication, among other issues. Requires the California Research Bureau to submit its findings to the legislature and the Director of Public Health. [Report available at: <a href="http://library.ca.gov/crb/06/01/06-001.pdf">http://library.ca.gov/crb/06/01/06-001.pdf</a>.]</p>
CA	<p><b>California Health &amp; Safety Code §§ 39658, 39666</b></p> <p>Requires the Air Resources Board to establish airborne toxic control measures for toxic air contaminants. Pursuant to the law, the ARB has developed an Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products (17 Cal. Code Regs. 93120 et seq.). The measure establishes two phases of formaldehyde emission standards, measured by the ASTM test E 1333-96, for: hardwood plywood with a veneer core (HWPW-VC) and with a composite core (HWPW-CC); particleboard; medium-density fiberboard (MDF); and thin MDF. The measure applies to manufacturers, distributors, importers, and retailers that sell, offer for sale, or supply these materials in California, as well as to fabricators who use these materials to make other goods that are offered for sale or supplied in the state.</p>
CA	<p><b>California Health &amp; Safety Code §§ 41985--41986</b></p> <p>Requires the state to adopt regulations to protect public health from ozone emitted by indoor air cleaning devices used in occupied spaces. Requires the regulations to include ozone emissions standards, testing and certification procedures for the devices, and labeling requirements for the devices. Authorizes the state to ban the sale of non-compliant devices. Regulations adopted under the law (17 Cal. Code Regs. 94800 et seq.) establish certification requirements and testing procedures, as well as labeling, notice, and recordkeeping requirements.</p>
CA	<p><b>California Labor Code § 142.3</b></p> <p>Authorizes the Occupational Safety and Health Standards Board to adopt occupational safety and health standards that are at least as effective as federal standards. Regulations promulgated under the law (8 Cal. Code Regs. 5142, 5143) apply to both private and public workplaces, such as schools. The regulations require HVAC systems to be operated continuously and inspected annually, and HVAC inspection and maintenance records to be made in writing and provided to the state and to employees upon request. Additional regulations governing general sanitation (8 Cal. Code Regs. 3362) provide that when exterior water intrusion, leakage from interior water sources, or other uncontrolled accumulation of water occurs, those conditions must be corrected because of their potential to cause the growth of mold.</p>

CA	<p><b>California Public Resources Code § 25402.8</b></p> <p>Requires that, when assessing energy conservation standards for residential and nonresidential buildings, the Energy Resources Conservation and Development Commission must include in its deliberations the impact that those standards would have on indoor air pollution problems.</p>
CO	<p><b>Colorado Revised Statutes § 12-61-804</b></p> <p>Requires real estate brokers to disclose to prospective purchasers or tenants all adverse material facts actually known by the broker, including any environmental hazards affecting the property that are required by law to be disclosed. Seller's Property Disclosure Form created in State Real Estate Commission requires disclosure of environmental conditions of which seller has current actual knowledge, including the existence of radon, asbestos, methane, solvents, and whether the interior is smoke-free. Form also requires disclosure of presence of a carbon monoxide alarm. [Available at: <a href="http://cdn.colorado.gov/cs/Satellite/DORA-DRE/CBON/DORA/1251614735941">http://cdn.colorado.gov/cs/Satellite/DORA-DRE/CBON/DORA/1251614735941</a> (under "Real Estate Contracts and Forms" --&gt; "Disclosure Documents").]</p>
CO	<p><b>Colorado Revised Statutes § 25-1.5-101</b></p> <p>Authorizes the Department of Public Health to establish and enforce sanitary standards for the operation and maintenance of schools and other institutions. Regulations adopted under the law (6 Col. Code Regs. 1010-6:10-102) require schools to test for radon. Regulations also require that newly-constructed schools undergo radon testing within 19 months of occupancy and that remodeled schools be evaluated by the state to determine the need for radon testing. Regulations require that radon testing be carried out in a manner consistent with EPA guidance and that schools make the test results available.</p>
CO	<p><b>Colorado Revised Statutes § 6-1-105</b></p> <p>Provides that it is a deceptive trade practice to knowingly make a false representation as to the results of a radon test or the need for radon mitigation.</p>
CO	<p><b>Colorado Statutes § 25-1.5-101</b></p> <p>Authorizes Department of Public Health and Environment to establish and enforce sanitary standards for child care facilities. Regulations adopted pursuant to the law (6 Col. Admin. Code 1010-7:4-407) prohibit the use in bathrooms of chemical air fresheners that contain toxic substances.</p>

CT	<p><b>Connecticut General Statutes § 10-220</b></p> <p>Requires local or regional boards of education to adopt and implement an IAQ program that provides for ongoing maintenance and facility reviews, as well as a green cleaning program that provides for the procurement and use of environmentally preferable cleaning products. Requires boards of education to report triennially to the Commissioner of Construction Services on facility conditions and on actions taken to implement their IAQ program, green cleaning program, and long-term school building program. Requires that every five years, boards of education inspect and evaluate indoor air quality in all new and renovated school buildings, and lists 14 separate items to be included in the inspection and evaluation program, including radon levels in the air and potential for exposure to mold. Results of these evaluations must be provided at a board meeting and on the website of the board or individual school.</p>
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CT	<p><b>Connecticut General Statutes § 10-231e</b></p> <p>Requires local and regional school boards to ensure that their HVAC systems are maintained and operated in accordance with the prevailing maintenance standards at the time of installation or renovation of the system, and to operate those systems continuously during the hours of school occupancy. Also requires school boards to maintain records of HVAC maintenance for at least five years.</p>
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CT	<p><b>Connecticut General Statutes § 10-231f</b></p> <p>Authorizes local and regional boards of education to establish an IAQ committee for each school district or facility and provides that such committees must include a maintenance staff member, teacher, school health staff member, and parent of a student. Also prohibits boards of education and school administrators from barring school safety committees from addressing IAQ issues that affect the health of school occupants.</p>
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CT	<p><b>Connecticut General Statutes § 10-231g</b></p> <p>Requires each local and regional board of education to implement a green cleaning program. Requires that cleaning products used in schools meet guidelines or standards set by a national or international environmental certification program approved by the state Department of Administrative Services as minimizing potential harmful impacts on health and the environment. The Department has issued an environmentally-preferable purchasing policy approving products certified through the Green Seal or EcoLogo programs. [Policy available at: <a href="http://das.ct.gov/images/1090/EPP_Cleaning_Policy_072011.pdf">http://das.ct.gov/images/1090/EPP_Cleaning_Policy_072011.pdf</a>.] Requires each board of education to provide a notice, posted on its website and delivered to staff (and parents, upon request), describing the district's green cleaning program. Notice must include the name, location and schedule for environmentally preferable cleaning products being applied in schools, a district contact for the program, and the statement: "No parent, guardian, teacher or staff member may bring into the school facility any consumer product which is intended to clean, deodorize, sanitize or disinfect."</p>
CT	<p><b>Connecticut General Statutes § 10-291</b></p> <p>Requires public school building projects to incorporate the guidelines set forth in the Sheet Metal and Air Conditioning Contractors National Association's publication, "Indoor Air Quality Guidelines for Occupied Buildings Under Construction," or similar publications. Prohibits the Department of Construction Services from approving school building project plans that do not include provisions for training of building maintenance staff in the operation of HVAC systems and indoor air quality. Also requires the preparation of a Phase I environmental site assessment in school building projects, and establishes requirements relating to roof construction or replacement. Prohibits the department from approving school building project plans or sites if the site is in an area of moderate or high radon potential, except where the school building project plan incorporates construction techniques to mitigate radon levels.</p>
CT	<p><b>Connecticut General Statutes § 19a-111L</b></p> <p>Directs the Department of Public Health to publish guidelines establishing mold abatement protocols, including acceptable methods for performing mold remediation or abatement work. [Voluntary guidelines available at: <a href="http://www.ct.gov/dph/lib/dph/environmental_health/eoha/pdf/ct_guidelines_for_mold_abatement_contractors_rev032011.pdf">http://www.ct.gov/dph/lib/dph/environmental_health/eoha/pdf/ct_guidelines_for_mold_abatement_contractors_rev032011.pdf</a>.]</p>
CT	<p><b>Connecticut General Statutes § 19a-14b</b></p> <p>Requires the Department of Public Health to maintain a list of companies and individuals that are included in current lists of national radon proficiency programs that have been approved by the Commissioner of Public Health. Also requires the department to adopt regulations concerning radon in drinking water consistent with federal regulations.</p>

CT	<p><b>Connecticut General Statutes § 19a-37b</b></p> <p>Requires the Department of Public Health to adopt regulations to establish radon measurement requirements and procedures for evaluating radon in indoor air and reducing radon levels in public schools.</p>
CT	<p><b>Connecticut General Statutes § 19a-79</b></p> <p>Requires the Commissioner of Public Health to adopt regulations to assure that child day care centers and group day care homes meet the health, educational and social needs of children utilizing them. Regulations must include physical plant requirements for facilities that serve exclusively school-age children. Regulations promulgated under the law (Conn. Admin. Code 19a-79-3a,7a) require child day care centers and group day care homes that use a basement or first-floor level of a building to conduct at least one radon test during the months of November through April. Regulations require radon mitigation by a service provider who meets state qualifications if radon levels are 4pCi/L or greater.</p>
CT	<p><b>Connecticut General Statutes § 20-327b</b></p> <p>Requires sellers of residential property containing four units or fewer to provide a written residential condition report to the prospective purchaser. Requires that the report contain information concerning environmental matters including, but not limited to, radon and lead. The disclosure form adopted through regulation requires sellers to disclose any radon testing results; the presence of asbestos, lead-based paint, and basement dampness; and information about carbon monoxide and smoke detectors (Conn. Admin. Code 20-327b-1).</p>
CT	<p><b>Connecticut General Statutes § 29-277</b></p> <p>Prohibits the sale or installation of foamed-in-place insulating material, except urethane foam insulation or styrene foam insulation, unless the manufacturer or supplier has submitted a certification to the State Building Inspector. Certification must include: a description of the type of insulating material; a statement that the insulating material is not a urea-formaldehyde foamed-in-place material; and verification that the material has undergone small-scale formaldehyde emissions testing and evaluation in accordance with a third-party testing method specified in the law or approved by the state. Certification must also include a description of the quality assurance program used by the manufacturer or supplier, including a training program for installers of the insulating material. Establishes fines for violations.</p>

CT	<p><b>Connecticut General Statutes § 4b-15b</b></p> <p>Requires state agencies to conduct IAQ inspections prior to buying or leasing a building and to develop an IAQ assessment and remediation protocol for the building that includes best practices for commercial space and all applicable provisions of EPA’s IAQ Tools for Schools Program. Mandates that state agency leases require lessors to carry out the state IAQ protocol and to make all necessary efforts to maintain indoor air quality.</p>
CT	<p><b>Connecticut General Statutes §§ 10-282--283</b></p> <p>Authorizes the Commissioner of Construction Services in consultation with the Commissioner of Education to approve applications for grants to support school building projects to remedy certified school IAQ emergencies. Defines a certified school IAQ emergency as the existence of a building condition determined by the Department of Public Health to present a substantial and imminent adverse health risk that requires remediation in an amount greater than one hundred thousand dollars.</p>
CT	<p><b>Connecticut General Statutes §§ 20-420--427</b></p> <p>Requires that home improvement contractors obtain a certificate of registration from the state and provides that contractors who perform radon mitigation may not obtain the certificate of registration unless they are certified as radon mitigators by the National Radon Safety Board or the National Environmental Health Association.</p>
DE	<p><b>Delaware Code, tit. 6, §§ 2570--2578</b></p> <p>Requires sellers of property containing up to four residential dwelling units to disclose to the buyer, agent and/or subagent all known material defects of the property, including information about radon tests or inspections. Sellers must also provide purchasers with written information developed by the Department of Health and Social Services describing radon exposure risks, radon testing, and radon remediation. The radon disclosure form, developed by the Delaware Real Estate Commission pursuant to the law, requires disclosure of any radon tests performed on the property. Real estate licensees are required by regulation (24 Del. Admin. Code 2900-9.0) to obtain the radon disclosure from sellers and to make the disclosure available to purchasers. A separate Property Condition Report requires disclosure of environmental hazards, such as asbestos, lead paint, toxic or hazardous substances, and mold, including any past mold testing results. [See <a href="http://www.dpr.delaware.gov/boards/realestate/forms.shtml">http://www.dpr.delaware.gov/boards/realestate/forms.shtml</a>.]</p>

DC	<p><b>District of Columbia Code § 38-825.01</b></p> <p>Requires D.C. Public Schools to use environmentally friendly cleaning supplies in its schools buildings and provides that the district may exhaust its existing supply of cleaners. Directs the Mayor to submit to the D.C. Council a report describing implementation of this requirement. Establishes an environmental programs office in the D.C. Department of General Services that is charged with, among other things, promoting EPA’s IAQ Tools for Schools program, establishing an integrated pest management program, and developing a proposal for recognizing schools that significantly improve their environmental portfolio.</p>
DC	<p><b>District of Columbia Code § 8--101.05</b></p> <p><b>Authorizes the Mayor, in carrying out a comprehensive program for the control and prevention of outdoor air pollution, to establish and maintain an indoor air hazard education program to educate District residents on the potential threats posed by and mitigation methods for indoor air hazards.</b></p>
DC	<p><b>District of Columbia Code §§ 42-1301--1311</b></p> <p>Requires sellers of property containing up to four dwelling units to provide to purchasers a real property disclosure statement on a form approved by the Mayor. Regulation adopting Seller's Disclosure Statement (17 D.C. Mun. Regs. 2708) requires information about sellers' knowledge of environmental problems on the property, including radon, asbestos, lead-based paint, and formaldehyde, and the presence of carbon monoxide detectors.</p>
DC	<p><b>District of Columbia Code §§ 42-3261 -- 3269</b></p> <p><b>Requires landlords to remediate mold contamination and disclose previous mold contamination to prospective tenants, and directs the District Department of the Environment to establish minimum work practices and guidelines for mold assessment and remediation and to set a threshold level of indoor mold contamination that requires professional remediation. Also requires the Department to establish a certification system for mold professionals, along with minimum mold work practice standards and guidelines, and prohibits anyone from engaging in the business of mold assessment or remediation without being certified or licensed.</b></p>

DC	<p><b>District of Columbia Statutes §§ 28-4201--4203</b></p> <p>Prohibits persons or companies from conducting radon screening, testing or mitigation unless they have been listed as proficient by the U.S. EPA or have received a certificate of proficiency from an organization approved by the Mayor. Requires the Mayor to maintain a public list of those who have been listed as proficient by EPA. Authorizes the Mayor to issue rules establishing radon screening, testing, or mitigation programs in the District that are in compliance with any recommendations or guidelines published by EPA.</p>
FL	<p><b>1994 Florida Session Law Serv. ch. 94-156 (C.S.H.B. 251)</b></p> <p>Requires the Department of Management to recommend policies for strengthening workplace regulation of indoor air quality and evaluating indoor air quality in state buildings. Also requires the department to review indoor air quality in public schools and universities and to develop and provide education and informational materials to state agencies. Requires the department to report to the legislature on measures to implement these recommendations.</p>
FL	<p><b>Florida Statutes § 193.1552</b></p> <p>Requires property appraisers to adjust assessed value of single-family residential property in specified cases, if appraiser determines that the property is affected by drywall that contains elevated levels of elemental sulfur that results in corrosion of certain metals. Provides that upon substantial completion of remediation and repairs, the property shall be assessed as if affected drywall had not been present.</p>
FL	<p><b>Florida Statutes § 381.006</b></p> <p>Requires the Department of Health to conduct environmental health surveillance, including an IAQ testing and monitoring program to assess health risks from exposure to chemical, physical, and biological agents in the indoor environment.</p>

FL	<p><b>Florida Statutes § 404.056</b></p> <p>Authorizes the Department of Health to establish environmental radiation standards for buildings and to conduct programs designed to reduce human exposure to harmful environmental radiation. Requires persons who perform radon measurements and mitigation to be certified by the department, and results of radon measurements to be reported to the department. Requires the department to administer a public information program. Requires radon testing of all public and private school buildings, 24-hour care facilities owned or regulated by the state, and state-licensed day care centers located in designated counties. Requires that a specified radon warning statement be provided prior to the sale or lease of a residential property. Regulations adopted under the law establish certification requirements (Fla. Admin. Code r. 64E-5.1201--1208). Regulations also establish that radiation exposure to the public from naturally occurring radioactive materials shall be maintained as low as reasonably achievable and that the annual average radon decay product concentration in a building shall not exceed 0.02 WL (4.0 pCi/L) (Fla. Admin. Code. R. 64E-5.1001).</p>
FL	<p><b>Florida Statutes § 409.175</b></p> <p>Requires the Department of Children and Family Services to adopt licensing rules for family foster homes that must include safety and health standards that provide for the physical well-being of the children served. Rules adopted by the agency (Fla. Admin. Code 65C-13.030) establishing standards for licensed out-of-home caregivers require family foster homes located in intermediate or elevated radon potential areas to be tested for radon. Establishes that radon must be at a level that does not affect the safety and well-being of children in the homes.</p>
FL	<p><b>Florida Statutes § 553.98</b></p> <p>Provides funds to the Department of Business and Professional Regulation for activities incidental to the development and implementation of building codes for radon-resistant buildings. Regulations implementing the law (Fla. Admin. Code r. 61-38.002--003) adopt a voluntary, model Standard for Passive Radon-Resistant New Residential Building Construction and Standard for Radon-Resistant New Commercial Building Construction. Requires that local jurisdictions that choose to adopt requirements for radon-resistant new construction use the model standard adopted by the state.</p>

FL	<p><b>Florida Statutes § 719.128</b></p> <p>Authorizes the Board of a Cooperative to take certain actions in response to damage caused by an event for which a state of emergency is declared. Authorized actions to mitigate further damage include contracting to remove debris and to prevent or mitigate the spread of fungus (including mold or mildew) by removing and disposing of wet drywall, insulation, carpet, cabinetry, or other fixtures on or within the cooperative property. (Separate law, Fla. Stat. 720.316, authorizes neighborhood associations to take similar actions on or within the association property.)</p>
FL	<p><b>Florida Statutes §§ 468.84--.8424</b></p> <p>Establishes a state mold-related services licensing program for mold assessors and remediators. Sets forth examination requirements, as well as requirements for education, training, and insurance. Authorizes the state to collect application and licensing fees. Establishes penalties for violations and addresses conflict of interest involving assessment and remediation activities. Department of Business and Professional Regulation has adopted rules to administer the program (Fl. Admin. Code r. 61-31.101 et seq.).</p>
GA	<p><b>Georgia Code § 12-3-5</b></p> <p>Authorizes the Department of Natural Resources to make grants, as funds are available, to public entities in order to further any of the services, purposes, duties, responsibilities, or functions vested in the department. Regulations promulgated under the law (Georgia Comp. R. &amp; Regs. 391-7-2-.01--.04) establish the Radon Awareness Grant Program to provide funds to local governments and community-based organizations to address radon issues in their communities. Provides that grants awarded under the program may not exceed \$7,500, must be met by matching funds, and may not be used for radon mitigation.</p>
HI	<p><b>Hawai'i Revised Statutes § 302A-1509</b></p> <p>Provides that the Department of Education must require all public schools to give first preference, where feasible, to the purchase and use of environmentally-sensitive cleaning and maintenance products approved under the Green Seal program, for a variety of cleaning applications as specified in the law.</p>

HI	<p><b>Hawai'i Revised Statutes §§ 321-411--413</b></p> <p>Establishes an IAQ program within the Department of Health. Authorizes the agency to assist in the correction of indoor air pollution problems in all buildings. Requires the agency to establish and coordinate an IAQ assessment network of state agencies and facility managers of publicly-owned buildings to identify, assess, and correct indoor air pollution problems. Authorizes the agency to establish a program for the approval of plans to construct, inspect, and monitor ventilation systems. Also addresses the provision of IAQ information to the managers, owners, and occupants of publicly- and privately-owned buildings.</p>
ID	<p><b>Idaho Code § 39-1210</b></p> <p>Requires the Board of Health and Welfare to promulgate appropriate rules to implement and enforce standards for licensing children's residential care facilities, including standards that assure the safety and physical care of children. Regulations promulgated under the law (Idaho Admin. Code 16.06.02.726) require buildings used as children's residential care facilities to be free from hazardous materials or toxins, including radon, lead paint, and asbestos, and to provide documentation of radon testing.</p>
IL	<p><b>Illinois Compiled Statutes Ch. 105, § 5/10-20.48</b></p> <p>Recommends that occupied school buildings be tested every five years for radon. Recommends that if radon levels are 4.0 pCi/L or above, the affected areas be mitigated by a licensed radon mitigation professional. Recommends that new schools be built using radon-resistant new construction techniques consistent with EPA guidance. Requires reporting of radon test results to the state Board of Education, which must submit a report every two years to the Governor and Legislature containing the results from all schools that have performed radon tests. [See also Ill. Comp. Stat. Ch. 105 § 5/34-18.39.]</p>
IL	<p><b>Illinois Compiled Statutes Ch. 105, § 5/34-205</b></p> <p>Requires the local board of education in cities with over 500,000 inhabitants to propose, by January 2012, school facility performance standards that address indoor air quality and other issues. Chicago Public Schools has proposed Facility Performance Standards pursuant to the law, which include requirements for use of low-VOC materials, green cleaning products, mechanical ventilation systems, minimum outdoor air supply, and minimum air filtration. [See <a href="http://www.cps.edu/About_CPS/Policies_and_guidelines/Pages/facilitystandards.aspx">http://www.cps.edu/About_CPS/Policies_and_guidelines/Pages/facilitystandards.aspx</a>.]</p>



IL	<p><b>Illinois Compiled Statutes Ch. 105, §§ 140/1 et seq.</b></p> <p>Requires the state to establish and amend annually guidelines for environmentally-sensitive cleaning and maintenance products for schools. Requires all elementary and secondary schools to establish a green cleaning policy and to purchase and use environmentally-sensitive cleaning products pursuant to the guidelines and specifications established under the law. The Illinois Green Governments Coordinating Council has adopted a rule to implement the law (23 Ill. Admin. Code 2800.10 et seq.). Statute amended in 2009 to require that guidelines developed by the state be used for state-owned buildings as well.</p>
IL	<p><b>Illinois Compiled Statutes Ch. 20, § 405/405-216</b></p> <p>Requires that every state-owned building adopt a green cleaning policy whereby the building purchases and uses only environmentally-sensitive cleaning products, in compliance with the guidelines and specifications established under separate state law (see Ill. Comp. Stat. Ch. 105 §§ 140/1 et seq.). Exempts buildings if adherence to the policy would result in an increase in the cleaning costs of the building.</p>
IL	<p><b>Illinois Compiled Statutes Ch. 225 § 10/5.8</b></p> <p>Requires licensed day care centers, day care homes, and group day care homes to test for radon at least once every three years, in accordance with state rules. Directs Department of Children and Family Services to require proof of radon testing in connection with initial or renewal license applications. Requires providers to post in the facility a copy of the most recent radon measurement report and to provide report to parents and guardians upon request. Also requires report to include a general warning statement about radon in homes. Regulations adopted by the Department (see 89 Ill. Admin. Code 406.4, 407.370, 408.10) incorporate the radon testing requirements.</p>
IL	<p><b>Illinois Compiled Statutes Ch. 410, §§ 87/1--15</b></p> <p>Requires the Board of Health to develop criteria for acceptable indoor air quality, create a program for the certification of IAQ inspectors, and undertake educational activity on indoor air quality for public and private agencies. Also requires the board to develop statewide IAQ guidelines, including ventilation standards, source control, and occupancy control guidelines. Guidelines adopted pursuant to the law establish non-binding Criteria for Acceptable Indoor Air Quality, including parameters for humidity, temperature, carbon dioxide, carbon monoxide, hydrogen sulfide, ozone, particulates, nitrogen dioxide and formaldehyde. [See <a href="http://www.idph.state.il.us/envhealth/factsheets/indoorairqualityguide_fs.htm">http://www.idph.state.il.us/envhealth/factsheets/indoorairqualityguide_fs.htm</a>.]</p>

IL	<p><b>Illinois Compiled Statutes Ch. 410, §§ 105/1 et seq.</b></p> <p>Authorizes the state health agency to adopt rules establishing a program for state registration of mold professionals.</p>
IL	<p><b>Illinois Compiled Statutes Ch. 420, §§ 44/1--90</b></p> <p>Authorizes the state to undertake a variety of radon-related activities, including radon measurement, surveys, monitoring, education, and technical assistance. Requires the licensure of persons selling radon detection devices, performing radon detection, or performing radon reduction services. Also requires state approval of radon sampling and measurement devices. Authorizes the state to establish minimum qualifications for licensure. Requires persons testing for radon to report results of testing within 45 days. Regulations adopted under the law (Ill. Admin. Code, tit. 32, Pt. 422) establish procedures and requirements for obtaining a license as a radon mitigator or tester, and set forth protocols for radon measurement and mitigation. Regulations include licensing provisions for measurement and mitigation of multi-family buildings of three stories or less.</p>
IL	<p><b>Illinois Compiled Statutes Ch. 420, §§ 46/1--25</b></p> <p>Establishes requirements for providing information about radon during residential real property sales. Requires sellers to provide buyers with: disclosure of known elevated radon levels in the home; a state-developed pamphlet on radon testing; and a general warning statement recommending radon testing prior to all home purchases. [State approved forms available at: <a href="http://www.state.il.us/iema/radon/holmen.asp">www.state.il.us/iema/radon/holmen.asp</a>.] Also requires landlords of residential units below the third story to notify current and prospective tenants of any radon hazard revealed by landlord's testing of the property, unless landlord mitigates the property and eliminates the hazard. Requires landlord to disclose to prospective tenants any radon hazard revealed by current tenants' testing, unless landlord's testing demonstrates that a hazard does not exist.</p>
IL	<p><b>Illinois Compiled Statutes Ch. 420, §§ 52/1 et seq.</b></p> <p>Requires that all new residential construction include passive radon-resistant construction techniques. Provides that installation of active radon mitigation systems, including installation of a radon vent fan or upgrade of a passive system, must be carried out by radon contractors. Rules adopted by the Illinois Emergency Management Agency (Ill. Admin. Code 422.160) establish construction methods "intended to resist radon entry and prepare the building for post-construction radon mitigation, if necessary."</p>

IL	<p><b>Illinois Compiled Statutes Ch. 765, §§ 77/1--65</b></p> <p>Requires a seller of real property containing up to four units to complete a disclosure report form, on which the seller must report if he/she is aware of various environmental conditions, including unsafe concentrations of radon and unsafe conditions relating to asbestos or lead paint on the premises.</p>
IL	<p><b>Illinois Compiled Statutes Ch. 815, §§ 505/2U--2W</b></p> <p>Provides that it is a misdemeanor to misrepresent the capabilities of a device for detecting and measuring radon or radon progeny.</p>
IL	<p><b>Illinois House Joint Resolution 12</b></p> <p>Creates a Joint Task Force on Mold in Indoor Environments, and requires the task force to make recommendations to the legislature regarding mold in indoor environments. In 2005, the Task Force issued its report, which discusses regulating mold remediation and testing providers.</p>
IN	<p><b>Indiana Code § 16-19-3-7</b></p> <p>Authorizes the Department of Health to conduct indoor air quality inspections of all public buildings and institutions occupied by a state or local government agency.</p>
IN	<p><b>Indiana Code §§ 16-41-37.5-1--4</b></p> <p>Requires the Department of Health to adopt rules establishing an IAQ inspection, evaluation, and parent/employee notification program. Provides that, upon written air quality complaint, the Department shall inspect a school or state agency and issue a report of its findings. Requires the inspection report to identify conditions that could contribute to poor IAQ, provide guidance on steps to address IAQ issues, and request a response from the school or agency within 60 days. Directs the Department to assist the school or agency in developing a reasonable plan to improve IAQ conditions found during the inspection. Requires the Department to develop and revise every 3 years a manual of best practices for IAQ in schools and to provide the manual to the state Department of Education and to the superintendent and facilities manager of each school district. Regulations (410 Ind. Admin. Code 33-1-1 et seq.) address inspection procedures; designation of a school IAQ coordinator; and minimum facility criteria, including requirements for addressing mold and water intrusion and for ensuring that pollutants from construction activities do not enter occupied spaces.</p>

IN	<p><b>Indiana Code §§ 16-41-38-1--10</b></p> <p>Requires the state to establish a certification program for persons engaged in radon testing and abatement, and provides for reciprocity. Regulations adopted under the law (410 Indiana Admin. Code 5.1-1-1 et seq.) establish certification requirements. Law also requires the state to use any relevant standards or requirements concerning radon gas established by the U.S. EPA.</p>
IN	<p><b>Indiana Code §§ 32-21-5-1--12</b></p> <p>Requires sellers of property containing up to four dwelling units to complete a Seller's Residential Real Estate Sales Disclosure form. Rules adopted under the law (876 Ind. Admin. Code 1-4-1,2) establish the disclosure form, which requires sellers to disclose knowledge of hazardous conditions on the property, including radon gas, mold, other biological contaminants, lead paint, asbestos insulation, methane gas, PCBs, and toxic materials, as well as moisture or water problems. [See <a href="http://www.in.gov/icpr/webfile/formsdiv">http://www.in.gov/icpr/webfile/formsdiv</a> (search for form 46234).]</p>
IA	<p><b>Iowa Code § 237A.12</b></p> <p>Requires the Department of Human Services to adopt rules setting minimum standards for the operation and maintenance of child care centers and registered child development homes. Regulations promulgated under the law (Iowa Admin. Code 441-109.11) require radon testing at centers operating at ground level, in basements, or with basements below program areas, and require that testing be performed in accordance with state law governing radon certification. Requires testing and retesting every two years if test kits are available from the local health department or state radon coalition. Requires that a mitigation plan be approved by the state prior to full licensing of the facility, if testing reveals radon levels over 4.0 pCi/L.</p>
IA	<p><b>Iowa Code § 257.31</b></p> <p>Provides for increased supplemental state aid to a school district for removal, management, or abatement of environmental hazards due to a state or federal requirement. States that environmental hazards shall include, but are not limited to, the presence of asbestos, radon, or any other hazardous material dangerous to health and safety.</p>

IA	<p><b>Iowa Code § 558A.1 et seq.</b></p> <p>Requires sellers of residential real property to deliver to buyers prior to transfer a written disclosure statement indicating the condition and characteristics of the property. Regulations adopted under the law (Iowa Admin. Code 193E-14.1(543B)) incorporate the required disclosure items in a sample form, including disclosure of the results of any radon tests and the presence of lead-based paint or asbestos. Regulation also requires the seller and buyer to acknowledge buyer's receipt of a state-issued radon fact sheet.</p>
IA	<p><b>Iowa Code § 8A.318</b></p> <p>Requires state agencies, school districts, community colleges, and institutions controlled by the state Board of Regents, to evaluate and assess the implementation of a green cleaning policy. Requires these entities to purchase only those cleaning and maintenance products identified by the Department of Administrative Services or that meet nationally recognized standards, but allows school districts and educational institutions to opt out of the requirement upon notice to the state. Directs the Department to provide information on environmentally preferable cleaning and maintenance products on its website. [See <a href="https://das.iowa.gov/procurement/agencies/green-buyer/green-clean-iowa-schools">https://das.iowa.gov/procurement/agencies/green-buyer/green-clean-iowa-schools</a>.]</p>
IA	<p><b>Iowa Code §§ 101C.1 et seq.</b></p> <p>Establishes the Iowa Propane Education and Research Council and authorizes the Council to develop energy efficiency programs, including weatherization programs. Defines weatherization services to include carbon monoxide and radon inspection and detection system installation.</p>
IA	<p><b>Iowa Code §§ 136B.1--.5</b></p> <p>Requires the Department of Public Health to establish programs for certifying persons who test for radon gas and credentialing persons who perform radon abatement, and to establish standards for radon abatement systems. Requires disclosure to the state of certain information on testing and mitigation services and provides for confidentiality of test results. Authorizes the department to perform periodic inspections of the validity of measurements and the adequacy of abatement measures performed by certified and credentialed persons. Regulations adopted under the law (Iowa Admin. Code 641-43, 44) set forth certification and credentialing requirements.</p>

IA	<b>Iowa Senate File 366</b>
	Requires the state Department of Education to notify each school district and accredited nonpublic school of the risks associated with radon, provide information about radon testing and mitigation, and encourage schools to adopt a radon testing and mitigation plan. School districts and nonpublic schools are required to notify the Department of any current or anticipated radon testing and mitigation plans. The legislation further required the Department to report to the legislature on information collected from schools ("Radon Notification and Testing" report available at <a href="https://www.legis.iowa.gov/publications/otherResources/reportsFiled?department=19248&amp;year=2014">https://www.legis.iowa.gov/publications/otherResources/reportsFiled?department=19248&amp;year=2014</a> ).

KS	<b>Kansas Statutes § 36-506</b>
	Requires the state to establish minimum standards for the safe and sanitary operation of lodging establishments (hotels, rooming houses or boarding houses). Regulations adopted under the law (Kansas Admin. Code 4-27-9) provide, among other things, that guest rooms with visible mold on the floors, walls, ceiling, or windows shall not be rented until mold cleanup is completed. Regulations also require that all sinks, bathtubs, and shower areas be kept free of mold and mildew.

KS	<b>Kansas Statutes § 58-3078a</b>
	Requires every contract for the sale of residential real property to contain a radon notice as specified in the law. Notice includes information about the health effects of radon and a recommendation for radon testing.

KS	<b>Kansas Statutes §§ 48-16a01 et seq.</b>
	Requires the Department of Health and Environment to establish a certification program for persons performing radon testing or mitigation and to develop rules to administer the program. Prohibits any person from performing radon measurement, laboratory analysis, or mitigation unless they have been certified by the Department, and establishes minimum training and examination requirements. Requires those performing radon testing, analysis or mitigation to report the results and other information to the Department within 90 days of the service, subject to certain limitations, and provides that such information is confidential. Authorizes the Department to establish fees and provides penalties for violations. Regulations (Kansas Admin. Regs. 28-35-600 et seq.) adopted by the Department set forth the certification requirements for radon service providers.

KY	<p><b>Kentucky Revised Statutes § 324.360</b></p> <p>Requires that a Seller's Disclosure of Conditions form be used in residential real estate transactions if licensed real estate agents are involved and receive compensation. Requires the real estate commission to promulgate an administrative regulation authorizing the form. The regulation (201 Ken. Admin. Regs. 11:350) requires disclosure of any radon testing of the property, of the existence of mold or other fungi, and of any other environmental hazards on the property.</p>
KY	<p><b>Kentucky Revised Statutes §§ 367.83801--.83807</b></p> <p>Directs the state Department of Law to establish minimum standards for mold remediation companies that are based on the general mold remediation principles set forth by the Institute of Inspection, Cleaning and Restoration Certification (IICRC). Establishes that the state may take civil action against mold remediation companies that violate the law's provisions. Regulations (40 Ken. Admin. Regs. 2:330) implementing the law establish minimum required practices for mold remediation companies.</p>
KY	<p><b>Kentucky Statutes § 211.9101 et seq.</b></p> <p>Requires persons or businesses to obtain state certification in order to conduct radon measurement, mitigation, or laboratory analysis. Regulations implementing the law (92 Ken. Admin. Regs. 95:040) require contractors and laboratories to, among other things: complete an AARST-NRPP or NRSB course and exam as well as continuing education; establish a quality control plan that includes several criteria specified in the regulation; provide evidence of financial responsibility in accordance with the law; conduct measurements and mitigation in accordance with standards set forth in the regulations; and report to the state on their testing and mitigation activities. The regulations also require that radon mitigation systems achieve a radon level below EPA's action level of 4.0 pCi/L for all post mitigation testing; additional mitigation and testing is required until that level is achieved.</p>
LA	<p><b>Louisiana Revised Statutes § 1300.411</b></p> <p><b>Creates the Louisiana Toxic Mold Task Force, whose functions include: advising the legislature on “policies and practices that protect all people of this state, particularly tenants, consumers, and vulnerable populations, from harm related to toxic mold;” serve as a coordinating forum between and among state agencies, local government, and nongovernmental groups; and make recommendations on state regulations, guidelines, policies, and procedures that pertain to mold. Directs the task force to prepare and submit to the governor and the legislature a report on the status of public health risks from mold in Louisiana.</b></p>

LA	<b>Louisiana Revised Statutes § 1478</b> <b>Requires licensed home inspectors to include in their written inspection report the presence of suspected mold growth if the licensed home inspector discovers visually observable evidence of suspected mold growth on the inside of the structure during the inspection.</b>
LA	<b>Louisiana Revised Statutes § 22:1319</b> <b>Requires that fire insurance policies that are delivered or issued for delivery within the state include a prominent disclosure of whether the policy covers mold damage to the property.</b>
LA	<b>Louisiana Revised Statutes § 22:1332</b> <b>Requires that homeowner insurance policies delivered or issued for delivery in the state include a prominent disclosure of whether the policy covers mold damage.</b>
LA	<b>Louisiana Revised Statutes § 37:1470</b> <b>Directs the State Real Estate Commission to approve a mold information pamphlet, which may be distributed to buyers by real estate licensees in connection with any real estate transaction. Provides that if the licensee elects to deliver the mold information pamphlet to the buyer, the licensee is not required to provide any additional information about mold. Real Estate Commission regulations (La. Admin. Code 46:LXVII.3801) establish U.S. EPA as official source of state mold information under the law.</b>
LA	<b>Louisiana Revised Statutes § 51:912.4</b> <b>Establishes that new manufactured and modular home builder warranties exclude mold and mold damage unless the parties otherwise agree in writing.</b>
LA	<b>Louisiana Revised Statutes § 9:2800.15</b> <b>Provides that licensed commercial or marine contractors, architects and engineers are not liable for mold damage unless caused by defects in workmanship or design. Also applies to manufactured homes and to real estate licensees representing commercial and marine contractors.</b>



LA	<p><b>Louisiana Revised Statutes §§ 37:2181 et seq.</b></p> <p>Requires the State Licensing Board for Contractors to: adopt rules and regulations to govern mold remediation; issue, suspend, modify, and revoke licenses to practice mold remediation; maintain an up-to-date list of all licensees; report violations to the Attorney General; and adopt minimum standards of practice for licensed mold remediators. Establishes various required practices for licensees.</p>
ME	<p><b>2008 Maine Public Law Chapter 699</b></p> <p>Establishes a state-wide building code, and requires the state to incorporate the Maine model radon standard for new residential construction. The Maine Uniform Building and Energy Code established pursuant to the law adopts ASTM E-1465-06 (Standard Practice for Radon Control Options for the Design and Construction of New Low-Rise Residential Buildings).</p>
ME	<p><b>Maine Legis. Doc. 88 (2007)</b></p> <p>Requires the state Department of Education to develop and update annually a list of cleaning products that are certified under third-party, health-based criteria for safety and efficacy (such as Green Seal) or listed by the state Department of Administrative and Financial Services as environmentally-preferred janitorial products. Also requires the Department to recommend green cleaning procedures that decrease use of toxic chemicals, improve indoor air quality, and achieve performance standards for cleanliness. Requires the Department to compile, maintain, and publicize a list of school administrative units that have committed to implementing a green cleaning program. [See <a href="http://www.maine.gov/education/const/chem/overview_green.htm">http://www.maine.gov/education/const/chem/overview_green.htm</a>.]</p>
ME	<p><b>Maine Legis. Doc. 945 (2001)</b></p> <p>Legislative resolution creates a task force to examine the establishment and implementation of IAQ standards for schools. Establishes a number of mandatory considerations for the task force, and requires the task force to submit a report of findings and recommendations to the legislature. [Report available at: <a href="http://www.mainelegislature.org/ros/LOM/LOM120th/Res1-50/Res1-50-49.htm">http://www.mainelegislature.org/ros/LOM/LOM120th/Res1-50/Res1-50-49.htm</a>.]</p>

ME	<p><b>Maine Resolves 2006 Chapter 174</b></p> <p>Requires the state environmental and health agencies to convene a working group and to submit a report to the state legislature concerning: the science of mold testing and removal; considerations for establishing mold clean-up standards; and considerations for developing building standards. [Report available at: <a href="http://www.maine.gov/dep/waste/publications/legislative-reports/documents/final-mold-report.pdf">http://www.maine.gov/dep/waste/publications/legislative-reports/documents/final-mold-report.pdf</a>.]</p>
ME	<p><b>Maine Revised Statutes, tit. 10, §1480</b></p> <p>Prohibits a person or company from providing both mold assessment and remediation services on a project unless the building owner has signed a disclosure statement regarding the potential conflict of interest.</p>
ME	<p><b>Maine Revised Statutes, tit. 14, § 6030-D</b></p> <p>Requires residential landlords to have the air in their buildings tested for radon. Requires re-testing every 10 years when requested by a tenant, unless a radon mitigation system has been installed. Except in situations specified in the law, requires testing to be conducted by a radon professional registered with the state. Requires the landlord to provide a written radon notice to tenants and prospective tenants, including information on the risks of radon; the date and results of the most recent radon test (including tests conducted by a tenant showing elevated radon levels); the tenant's right to conduct a test; and any completed mitigation. Directs the state health department to develop a standard disclosure statement for landlords to use, including an acknowledgment that the tenant has received the disclosure. Establishes a fine of \$250 per violation. Requires reporting of test results to state.</p>
ME	<p><b>Maine Revised Statutes, tit. 20-A, § 6302</b></p> <p>Requires school administrative units to ensure that HVAC systems are maintained and operated to provide at least the quantity of outdoor air required by the state building standards code at the time the systems were installed, and are operated continuously during school activity hours, with noted exceptions. Also requires school administrative units to be responsible for inspection of HVAC systems at least annually, to correct any problems within a reasonable time, and to maintain written records of HVAC system inspection and maintenance for at least five years.</p>
ME	<p><b>Maine Revised Statutes, tit. 20-A, §§ 258-A--B</b></p> <p>Provides for state inspections of schools. Requires the Commissioner of Education to inspect a school to test the air quality when requested by a school superintendent or school board, or when petitioned by 50% of the school's parents or 20% of the registered voters of the school unit.</p>

ME	<p><b>Maine Revised Statutes, tit. 22, §§ 771--784</b></p> <p>Authorizes the state Department of Health and Human Services to act as an information clearinghouse for radon concerns and to educate the public about radon, and establishes the Radon Relief Fund to support radon-related research, testing, educational, and mitigation activities. Requires persons who test for or mitigate radon to register with the Department, but exempts builders who use radon-resistant new construction techniques as specified in the state building code. Requires that registered radon testers notify the Department of test results. Regulations (10-144 Code Maine Regs. Ch. 224) set forth the requirements of the registration program.</p>
ME	<p><b>Maine Revised Statutes, tit. 26, § 565-A</b></p> <p>Requires the Occupational Safety Rules and Regulations Board to work with the Bureau of General Services to evaluate indoor air quality and ventilation in public school buildings and buildings occupied by state employees. Authorizes the board to propose more stringent air quality and ventilation standards.</p>
ME	<p><b>Maine Revised Statutes, tit. 30-A, § 6006-F</b></p> <p>Establishes the School Revolving Renovation Fund to make loans to school administrative units for school repair and renovation. Provides priority status to projects involving IAQ improvements.</p>
ME	<p><b>Maine Revised Statutes, tit. 33, § 173</b></p> <p>Requires seller of residential real property to provide purchaser with a statement that discloses any known defects, as well as the presence or prior removal of hazardous materials on the property, including radon, asbestos, and lead-based paint.</p>
ME	<p><b>Maine Revised Statutes, tit. 5, § 1742</b></p> <p>Requires the Department of Administrative and Financial Services to apply minimum air ventilation standards in new and renovated state buildings, and directs the Department to develop a plan for improving indoor air quality and ventilation standards in buildings occupied by state employees.</p>

ME	<b>Maine Revised Statutes, tit. 5, § 1742-E</b>
	Requires the Division of Safety and Environmental Services to provide asbestos, lead, and IAQ assessment and mitigation oversight services for public schools and state facilities, and establishes the Division as the lead agency in the state for these matters.

ME	<b>Maine Revised Statutes, tit. 5, § 1877-A</b>
	Requires the Commissioner of Administrative and Financial Services to develop priorities for improving indoor air quality and ventilation in preparing budget requests for the repair and capital improvement of state buildings.

MD	<b>2001 Maryland Senate Bill 283</b>
	Establishes a task force on indoor air quality and requires the task force to study the nature, location, and extent of health and environmental risks posed to workers as a result of molds, spores, and other toxic organisms located in the HVAC systems of office buildings. Requires recommendations regarding prevention of illnesses, remedies and controls, a plan to provide educational information, and legislative or regulatory measures necessary to address current gaps in federal, state and local protection of office workers. Requires the task force to submit a final report of its findings and recommendations to the Governor and the legislature. [Report available at: <a href="http://www.dllr.state.md.us/labor/indoorairfinal/iaqfinalreportjuly12002.doc#_Toc13131937">http://www.dllr.state.md.us/labor/indoorairfinal/iaqfinalreportjuly12002.doc#_Toc13131937</a> .]

MD	<b>Maryland Business Regulation Code §§ 8-701--718</b>
	Establishes a licensing program for companies and firms that provide mold remediation services. Directs the Maryland Home Improvement Commission to adopt regulations and implement the licensing program. Provides that companies must: be licensed in order to provide mold remediation services within the state; carry a specified minimum amount of insurance; and ensure that their employees are certified by a third-party accreditation body. Implementation of the law has been postponed indefinitely by the state licensing agency.

MD	<b>Maryland Education Code § 5-112(e)</b>
	Requires that each county board of education procure green product cleaning supplies to the extent practicable and economically feasible. Requires each county board of education to adopt written policies that: require the use of green product cleaning supplies; establish purchasing guidelines that meet third-party certification standards; establish green cleaning practices; and require staff training. The county boards must develop specifications that allow multiple avenues for certification of green product cleaning supplies, including Green Seal, Green Label, Environmental Choice, TerraChoice, Ecologo, or any other nationally recognized independent third-party entity that certifies environmentally preferable products.

MD	<b>Maryland Education Code § 5-301</b>
	Requires the state Board of Public Works to adopt regulations establishing criteria designed to enhance IAQ in relocatable (portable) school classrooms constructed after July 1, 2014 and that are purchased or leased using state or local funds. The regulations must include specifications that require units to be constructed in a manner that provides protection against water damage and with building materials that contain low amounts of volatile organic compounds consistent with industry standards. Also mandates that specifications require units to provide continuous forced ventilation while occupied.

MD	<b>Maryland Environment Code § 8-305</b>
	Requires radon testers to complete the U.S. EPA's National Radon Measurement Proficiency Program, use licensed facilities for analyzing test results, and provide consumers with test results.

MD	<b>Maryland Family Law Code §§ 5-506, 508</b>
	Authorizes the state to establish regulations for the licensing of residential child care programs. Regulations (Code of Md. Regs. 14.31.06.07) require licensees of residential child care programs to maintain evidence that the buildings have been tested for and found to be free of hazards from lead paint, asbestos, and radon.

MD	<p><b>Maryland Public Safety Code §§ 12-503--504</b></p> <p>Directs the state Department of Housing and Community Development to adopt Maryland Building Performance Standards, which apply throughout the state and are enforced at the local level, with local jurisdictions retaining authority to adopt local amendments to modify the Standards. Directs the Department to incorporate the International Building Code into the Standards, with modifications as determined by the Department. Local jurisdictions must implement the state Standards and any local amendments within six months of the effective date. Department regulations (Md. Admin. Code 05.02.07.04) incorporate the 2015 International Residential Code, including the radon-resistant new construction standard of IRC Appendix F, applicable to Zone 1 (high radon potential) counties.</p>
MD	<p><b>Maryland Real Property Code § 10-702</b></p> <p>Requires that sellers of residential properties with four or fewer single-family units provide buyers with a disclaimer or disclosure form. Disclaimer includes any known latent defects that would pose a direct threat to health or safety, and that would not be apparent by a careful visual inspection. Disclosure includes actual knowledge of hazardous or regulated materials including asbestos, lead-based paint, and radon, and whether a carbon monoxide alarm is installed on the property.</p>
MD	<p><b>Maryland Real Property Code §§ 10-603--604</b></p> <p>Requires home builders to complete a disclaimer or a disclosure regarding environmental hazards present on the home site, including radon, asbestos, lead-based paint, and methane.</p>
MA	<p><b>Massachusetts General Laws, ch. 111, § 127A</b></p> <p>Authorizes the Department of Health to adopt a state sanitary code to address matters affecting the health and well-being of the public. Regulations adopting the Sanitary Code (105 Code Mass. Regs. 675.001 et seq.) establish IAQ requirements for ice rinks, including air sampling and record-keeping requirements; action levels for carbon monoxide and nitrogen dioxide; and required corrective action, notification and evacuation measures. A separate chapter of the Sanitary Code (105 CMR 410.020) establishes Minimum Standards of Fitness for Human Habitation that apply to all dwelling units, including leased units. The Code requires dwelling owners to maintain structural elements (including foundation, floors, walls, doors, windows, ceilings, and roofs) in good repair and free from chronic dampness and defines chronic dampness as "the regular and/or periodic appearance of moisture, water, mold or fungi."</p>

MA	<p><b>Massachusetts General Laws, ch. 13, § 97</b></p> <p>Requires the state to publish an informational brochure for home buyers on home inspections, including information regarding radon inspections, and requires that the brochure be issued to home buyers at the signing of the first written contract to purchase. Rules promulgated under the law (266 Code Mass. Regs. 6.03) require home inspectors to notify their clients that answers to some questions, including whether or not a dwelling has been tested for radon gas, and whether there are any mold or air quality issues in the dwelling, should be ascertained from sellers and may not be readily observable through inspection.</p>
MA	<p><b>Massachusetts General Laws, ch. 43, § 93-100</b></p> <p><b>Requires the State Board of Building Regulations and Standards to adopt and administer a state building code. Regulations adopted by the Board (780 Code Mass. Regs. 5101) incorporate into the state residential building code an amended version of the International Residential Code Appendix F ("Radon Control Methods"), requiring passive radon control in new home construction in all Zone 1 (high radon potential) counties in the state.</b></p>
MA	<p><b>Massachusetts General Laws, ch. 70B, § 3</b></p> <p>Establishes a School Building Assistance program to provide funding to local governments for school construction and renovation, and authorizes the Board of Education to establish policies and standards regarding school construction. Amended in 2006 to create the Massachusetts School Building Authority and school building grant program. Regulations governing these state-funded projects (963 Code Mass. Regs. 2.04) require that all reasonable efforts be made to ensure suitable indoor air quality. The regulations also establish specific IAQ-related requirements for state-funded projects, including: ventilation and thermal comfort; containment procedures for pollutants created during renovation; filtration; walk-off mats; gas-fired equipment; siting of outside air intakes; and prevention of mold and water damage in building materials.</p>
MI	<p><b>Michigan Compiled Laws § 125.1504</b></p> <p>Directs the state to adopt a residential building code, specifically the International Residential Code, applicable statewide. The state Department of Licensing and Regulatory Affairs has incorporated the IRC, including Appendix F (radon control), into the Michigan Residential Code. The radon requirements are applicable to Zone 1, high radon potential counties within the state.</p>

MI	<p><b>Michigan Compiled Laws § 380.1285a</b></p> <p>Requires the state to develop standards for before- or after-school programs operated by school districts, and provides that the standards must address the indoor environment, among other issues.</p>
MI	<p><b>Michigan Compiled Laws § 722.112</b></p> <p>Directs the state Department of Human Services to develop rules for the care and protection of children. Regulations adopted under the law (Mich. Admin. Code r. 400.1934) establish a radon standard of 4.0 pCi/L for the lowest level of the family or group child care homes and require that documentation of radon test results be kept on file in the home.</p>
MI	<p><b>Michigan Compiled Laws §§ 565.951--.966</b></p> <p>Requires sellers of residential property consisting of up to four dwelling units to complete a seller's disclosure statement, which provides for disclosure of any environmental hazards on the property, including radon gas, asbestos, formaldehyde, and lead-based paint. The disclosure statement recommends that buyers obtain a professional inspection that specifically addresses indoor air and water quality, as well as any evidence of potential allergens such as mold, mildew and bacteria.</p>
MN	<p><b>1997 Minnesota Session Law Serv. 1st Sp. Sess. Ch. 4 (H.F. 1)</b></p> <p>Requires the state education agency, in collaboration with other state agencies, to develop a school IAQ maintenance manual and a manual for indoor air quality in school construction. Requires that the manuals contain specific information, including training needs and maintenance practices for ensuring good indoor air quality.</p>
MN	<p><b>Minnesota Statutes § 123B.57</b></p> <p>Provides that in order to receive state health and safety revenue, school districts must adopt a health and safety policy. Requires that the policy include provisions for implementing a health and safety program that complies with best practices for IAQ management. Establishes that health and safety revenues may be used for HVAC upgrades and mold abatement activities.</p>



MN	<p><b>Minnesota Statutes § 123B.571</b></p> <p>Authorizes the departments of health and education to develop a plan to encourage school districts to conduct radon testing, and authorizes districts to include radon testing as part of their health and safety plan. Also establishes that if school districts use health and safety revenues to conduct radon testing, they must comply with the state’s radon testing plan. School districts that have tested for the presence of radon must report results to Department of Health and local school board.</p>
MN	<p><b>Minnesota Statutes § 12A.08</b></p> <p>Authorizes the Commissioner of Health to provide assessment and evaluation of indoor environments of public and non-profit buildings and facilities in disaster-affected communities.</p>
MN	<p><b>Minnesota Statutes § 144.496</b></p> <p>Establishes requirements for providing information about radon during residential real property sales. Requires sellers to provide buyers with a copy of the Department of Health publication entitled "Radon in Real Estate Transactions," along with a written disclosure that includes: whether a radon test has occurred; the most recent records of radon concentrations in the dwelling; a description of any radon mitigation or remediation, including any installed mitigation system; and a radon warning specified in the law. Authorizes a buyer who is injured by a violation of the law to bring a civil action for damages and other equitable relief.</p>
MN	<p><b>Minnesota Statutes § 144.9513</b></p> <p><b>Requires the Commissioner of Health, within the limits of available appropriations, to make grants to support implementation of healthy housing programs to local boards of health, community action agencies, and non-profit organizations. Establishes that grants may be used, among other things, to: implement and maintain primary prevention programs; provide training and technical assistance; and promote evidence-based best practices for mitigating housing-based health threats.</b></p>

MN	<p><b>Minnesota Statutes § 16B.325</b></p> <p>Requires the state Department of Administration and Department of Commerce to develop sustainable building design guidelines for all new construction and major renovation of state buildings, and provides that the guidelines must include IAQ standards to create and maintain a healthy environment. Guidelines published in 2004 and later revised include extensive provisions relating to the indoor environment, including radon control requirements. [Guidelines available at: <a href="http://www.msbg.umn.edu">http://www.msbg.umn.edu</a>.]</p>
MN	<p><b>Minnesota Statutes § 240A.09</b></p> <p>Authorizes the Minnesota Amateur Sports Commission to make grants for rehabilitation and renovation of public ice facilities, and provides that priority must be given to grant applications for IAQ improvements such as zero-emission ice-resurfacing equipment and renovation/replacement of HVAC systems in arenas with ice edging equipment not powered by electricity, in order to reduce concentrations of CO and NO<sub>2</sub>.</p>
MN	<p><b>Minnesota Statutes § 273.11</b></p> <p>Provides that the owner of a homestead property may apply to the tax assessor for a reduction in the market value of a property that has been damaged by mold, where the costs to repair the mold are at least \$20,000. Requires the owner to file a form following completion of the remediation work, which may result in an increase in market value.</p>
MN	<p><b>Minnesota Statutes § 326B.106</b></p> <p>Requires the state to adopt a building code, and to incorporate into the state code standards for radon-resistant new construction based on the International Residential Code Appendix F. Regulations promulgated by the Department of Labor and Industries (Minn. Rules 1303.2400--2403) incorporate the IRC into the state building code, including an amended version of Appendix F that establishes requirements for radon-resistant construction in all new residential construction subject to the code. The code (Minn. Rules 1322.1104) also amends the IRC to require the installation of mechanical ventilation systems as specified in the code.</p>
MN	<p><b>Minnesota Statutes § 326B.118</b></p> <p>Requires the Commissioner of Labor and Industry to review the appropriateness of model energy codes for one- and two-family residential buildings and to take steps to adopt a code. Prohibits the Commissioner from adopting a model energy code without research and analysis that addresses air quality and moisture, among other issues.</p>

MN	<p><b>Minnesota Statutes §§ 144.12, 144.1222</b></p> <p>Provides that the Commissioner of Health is responsible for the adoption of rules and enforcement of applicable laws and rules relating to indoor air quality in the operation and maintenance of enclosed sports arenas. Agency rules (Minn. Rules 4620.3900--4900), revised in 2013, require operating certificates for indoor ice arenas and indoor motorsports arenas. The rules establish indoor air quality standards for carbon monoxide and nitrogen dioxide; require air quality measurements; specify corrective action, training, and recordkeeping requirements; and authorize enforcement for violations.</p>
MN	<p><b>Minnesota Statutes §§ 325F.177--178</b></p> <p>Prohibits manufacturers and wholesalers (as of August 2014) and retailers (as of August 2015) from selling children's products that intentionally contain formaldehyde or chemicals that may degrade under normal conditions to release formaldehyde. Prohibits use of replacement chemicals that have been identified by a federal, state or international agency as known or suspected to cause health effects specified by the law.</p>
MN	<p><b>Minnesota Statutes §§ 325F.18, 325F.181, 325F.23</b></p> <p>Requires manufacturers and users of building materials that contain urea-formaldehyde to disclose information on the health risks associated with formaldehyde through a written disclosure form or through product labeling. Requires compliance with federal formaldehyde product standards, certification, and labeling requirements for particleboard and plywood, as well as for medium-density fiberboard, used in newly-constructed housing. Requires labeling of insulation products.</p>
MS	<p><b>Mississippi Code § 37-11-71</b></p> <p>Directs the state Department of Education to require all public school districts to take certain actions to manage asthma in the school setting. These actions include implementing an IPM plan, minimizing school bus idling, and requiring local school health councils to develop long range maintenance plans addressing IAQ issues in each school building. School districts are also required to direct local school health councils to adopt and implement a local school wellness policy that addresses: (1) minimizing children's exposure to pollutants that trigger asthma; (2) assessing IAQ and ventilation in school buildings annually; (3) prohibiting the use of hazardous substances such as cleaning products and pesticides while children are present; and (4) ensuring that school construction projects implement containment procedures for pollutants that trigger asthma. Regulations under the law (Miss. Admin. Code 7-8) establish a K-8 Health Curriculum Resource that includes a teacher's classroom checklist with numerous IAQ-related items.</p>

MS	<b>Mississippi Code § 83-58-5</b>
	Excludes mold and mold damage from home builder warranty, unless the builder's negligence was a proximate or contributing cause, or unless the parties agree otherwise in writing.
MS	<b>Mississippi Code §§ 83-5-1, 83-5-29--51</b>
	Authorizes the state to regulate the practice of insurance companies, including the prohibition of unfair trade practices. Regulations adopted under the law (Miss. Admin. Code 19-1:34.05) establish the Mississippi Homeowner Insurance Policy Bill of Rights which, among other things, requires that the insured be provided with a statement indicating whether their residential property coverage includes insurance against mold.
MS	<b>Mississippi Code §§ 89-1-501--523</b>
	Requires written disclosure of the condition of real property consisting of up to four dwelling units, when property is transferred with the aid of real estate brokers or salespersons. Property Condition Disclosure Statement adopted under the law requires the disclosure of problems which may exist on the property, including hazardous or toxic waste, asbestos, lead-based paint, formaldehyde insulation, radon gas, and mold. [Disclosure Statement available at: <a href="http://www.mrec.ms.gov/docs/mrec_forms_property_condition_disclosure_statement.pdf">http://www.mrec.ms.gov/docs/mrec_forms_property_condition_disclosure_statement.pdf</a> .]
MO	<b>Missouri Revised Statutes § 161.365</b>
	Requires the state education agency to establish, update annually, and disseminate to all school districts guidelines and specifications for green cleaning programs, which include the use of environmentally sensitive cleaning and maintenance products, paper products, and equipment purchases. Requires guidelines to provide multiple avenues for determining if cleaning products are environmentally sensitive. [Guidelines available at: <a href="http://dese.mo.gov/financial-admin-services/school-governance/safety">http://dese.mo.gov/financial-admin-services/school-governance/safety</a> .] School districts are required to disseminate the guidelines to every school within the district.
MO	<b>Missouri Revised Statutes § 8.851</b>
	Establishes that the state may not sacrifice indoor air quality when developing minimum energy standards, establishing an energy efficiency rating system, and implementing efficient energy practices.

MT	<p><b>Montana Code § 70-16-703</b></p> <p>Requires sellers, landlords or their agents to inform buyers or renters of the known presence of mold in a building and to provide buyers or renters with the results of any mold tests that have been conducted. Authorizes sellers, landlords, agents, and property managers to provide buyers or tenants with a mold disclosure statement specified in the statute. Provides for relief from liability in certain cases for sellers and landlords who comply with these provisions.</p>
MT	<p><b>Montana Code §§ 75-3-601--607</b></p> <p>Requires radon professionals to pass a U.S. EPA proficiency examination in order to be publicly listed as proficient. Requires the Department of Environmental Quality to administer a program designed to educate and inform the public about radon, including: making presentations and providing materials; maintaining a toll-free telephone number; providing technical and training information on radon measurement and mitigation; establishing listings of qualified radon measurers and mitigators; and encouraging homeowners to test for radon. Requires provision of a general radon warning statement and disclosure of known radon test results to buyers of real property.</p>
NE	<p><b>Nebraska Revised Statutes § 71-3501</b></p> <p>Establishes a state policy to protect the public from radon by establishing requirements for persons providing radon measurement and mitigation services and radon mitigation system installation. Regulations adopted under the law (180 Neb. Rev. Admin. Code, ch. 11) provide for the licensure of radon measurement and mitigation specialists, technicians, and businesses. A separate law (Neb. Rev. Stat. 38-121) requires radon professionals to obtain a credential under the state's Uniform Credentialing Act.</p>
NE	<p><b>Nebraska Revised Statutes § 76-2,120</b></p> <p>Requires sellers of residential real property to submit a written disclosure statement to buyers during real estate transactions. Regulations establishing the disclosure form (302 Neb. Admin. Code, ch. 1, § 001) require the disclosure of sellers' knowledge of radon gas on the property and the provision of copies of any radon tests that have been conducted on the property. Disclosure form also requires sellers to report the presence of asbestos, lead-based paint, and toxic materials.</p>

NV	<p><b>Nevada Revised Statutes § 645D.300</b></p> <p>Establishes provisions for licensure of home energy auditors by the Department of Business and Industry. Provides that when conducting a full "energy audit" an energy auditor must include, among other things: (1) an assessment of building air flow, IAQ and ventilation; (2) any anticipated remediation issues, including moisture or combustion appliance problems; and (3) an assessment of moisture control in the home. Department requires licensure in order to perform an energy audit, a limited energy audit, or an energy assessment, and has established licensure application forms.</p>
NV	<p><b>Nevada Revised Statutes §§ 386.419, 386.4195</b></p> <p>Requires public schools to acquire and use environmentally-sensitive cleaning and maintenance products for cleaning of all floor surfaces. Directs state Department of Education to adopt regulations establishing standards for required environmentally-sensitive products, develop a sample list of approved products, and update this list at least every two years. Provides for school districts to request waivers if the associated costs are “unreasonable and would place an undue burden” on efficient school operation. Requires school districts to submit a written report to the Department describing their implementation of the law, including an assessment of the effectiveness of products used and waiver requests, by January 2011. Requires Department to summarize school district reports for the state legislature.</p>
NH	<p><b>1993 New Hampshire Laws Ch. 103 (H.B. 369)</b></p> <p>Establishes a committee to study indoor air quality and fire safety in public schools. Requires the committee to determine the scope of IAQ problems in public school buildings, report on issues of poor indoor air quality, and make recommendations on policy strategies to prevent and correct such problems.</p>
NH	<p><b>2008 New Hampshire Laws Ch. 242 (House Bill 1171)</b></p> <p>Establishes a commission to study air quality issues in public school buildings. Directs the commission to study the feasibility of implementing air quality standards and performing regular air quality inspections in public school buildings, and to study successful, cost-effective school air quality initiatives within and outside of the state. Requires the commission to report its findings and recommendations for proposed legislation to the state legislature. [Report available at:  <a href="http://www.gencourt.state.nh.us/statstudcomm/details.aspx?id=1931&amp;rbl=1&amp;txtyear=2008&amp;chksc=1&amp;chksc=1.">http://www.gencourt.state.nh.us/statstudcomm/details.aspx?id=1931&amp;rbl=1&amp;txtyear=2008&amp;chksc=1&amp;chksc=1.</a>]</p>

NH	<p><b>New Hampshire Revised Statutes § 125:9</b></p> <p>Requires the Department of Health and Human Services to investigate complaints of poor indoor air quality and to conduct inspections of buildings and dwellings, upon request, for the presence of radon or other health hazards in indoor air. Also requires the department to provide education, technical consultation, and recommendations for abatement of such health hazards in conjunction with the University of New Hampshire cooperative extension service.</p>
NH	<p><b>New Hampshire Revised Statutes § 170-E:34</b></p> <p>Directs state health agency to adopt rules establishing minimum standards for licensing child care facilities, including standards relating to the environmental health and safety of the premises. Regulations promulgated by the agency (NH Admin. Code He-C 4002.14) require licensed programs to maintain the child care environment free from conditions hazardous to children, including fumes from harmful chemicals or materials, and damp conditions that result in visible mold or mildew or a musty odor. Regulations also provide that when information indicates the building may contain radon hazards, the program must either submit evidence that the building has undergone a radon inspection and is free of radon hazards or submit a plan of action for reducing radon levels.</p>
NH	<p><b>New Hampshire Revised Statutes § 200:11-a</b></p> <p>Requires school principals to conduct an annual IAQ investigation of all school buildings, using a checklist provided by the state Department of Education. Requires completed checklists to be filed with the Department, the school board, and the local health officer and to remain on file for five years. Requires the state to review and consider the checklists when approving schools during the five-year school approval process. School IAQ Checklist adopted by the Department requires schools to indicate whether they follow a wide range of best practices for IAQ Management, including mold/moisture prevention and remediation. [See checklist at: <a href="http://www.education.nh.gov/program/school_approval/documents/a24iaq.doc">http://www.education.nh.gov/program/school_approval/documents/a24iaq.doc</a>.] Statute also requires the Department to encourage public schools to implement EPA's IAQ Tools for Schools program and to ensure that every school has a copy of the program materials.</p>
NH	<p><b>New Hampshire Revised Statutes § 200:48</b></p> <p>Requires the school board of each school district to develop and implement a policy governing air quality issues in schools. Provides that the policy must include methods to minimize or eliminate vehicle emissions.</p>

NH	<b>New Hampshire Revised Statutes § 310-A:189a</b>
	Requires that those who design or install radon mitigation systems be certified with the National Radon Proficiency Program or the National Radon Safety Board. Requires the state Board of Home Inspectors to provide notice of this requirement on its website.

NH	<b>New Hampshire Revised Statutes § 477:4-a</b>
	Requires that prior to executing a contract for the sale of real property, the seller must provide buyer with a statement about radon and radon testing and mitigation techniques.

NH	<b>New Hampshire Revised Statutes §§ 10-B:1--B:4</b>
	Requires the Department of Administrative Services to adopt clean air standards that must be met in buildings purchased, renovated or leased by the state. Provides that the department is responsible for certifying that buildings meet the clean air standards. Regulations promulgated under the law (NH Code Admin. R. ENV-A 2200 et seq.) expired in 2014.

NJ	<b>New Jersey Statutes § 13:1K-14</b>
	Requires the Department of Environmental Protection to provide the owner of certain residential property inspected for radon, where appropriate, with written certification that any radon gas contamination present was within acceptable limits as established by the U.S. EPA and the department. Also requires the department to provide written certification at the completion of projects undertaken to remove radium or to remedy excessive levels of radon gas from a residential property.

NJ	<b>New Jersey Statutes § 30:5B-5.2</b>
	Requires that child care centers be tested for radon at least once every five years. Also requires posting of the test results and of any measures taken or proposed to mitigate the presence of radon.



NJ	<p><b>New Jersey Statutes § 56:8-19.1</b></p> <p>Limits liability of licensed real estate brokers or salespersons for communicating false, misleading or deceptive information, where the licensee had no actual knowledge of the information, and made a diligent effort (e.g., obtained a property disclosure report from seller) to ascertain whether the information was false or misleading. State real estate commission property disclosure form adopted pursuant to the law (N.J. Admin. Code 13:45A-29.1) includes disclosure of number and location of carbon monoxide detectors, as well as disclosure of the presence of mold, lead-based paint, urea-formaldehyde foam insulation, asbestos, PCBs, other toxic substances, and any condition that adversely affects, or possibly adversely affects, the quality of air on the property. Disclosure form also includes a section providing information about radon testing results, though sellers can opt to provide this information at the time of the contract for sale.</p>
NJ	<p><b>New Jersey Statutes §§ 18A:7G-3, 9(b)(3), 13(d)</b></p> <p>Requires the Department of Education to promulgate rules requiring school districts to have comprehensive maintenance plans for school facilities. Regulations adopted under the law (N.J. Admin. Code 6A:26-20.3) require that maintenance activities include tests to monitor air quality.</p>
NJ	<p><b>New Jersey Statutes §§ 26:2D-59--62</b></p> <p>Requires the state to conduct a study of potential sources of radon contamination and to propose strategies for radon testing within the state. Requires the state's environmental and health agencies to establish a program of confirmatory radon monitoring in residences utilizing local health officers and Department of Environmental Protection personnel. Establishes a public information and education program.</p>
NJ	<p><b>New Jersey Statutes §§ 26:2D-70--80</b></p> <p>Prohibits persons from testing for or mitigating radon unless certified by the state, and requires the state to develop a certification program. Requires certified professionals to provide the state with information about services provided and tests performed, and provides for confidentiality of that information. Requires sellers to provide buyers with copies of any radon test results upon entering into contract for sale. Regulations adopted under the law (N.J. Admin. Code 7:28-27.1 et seq.) establish the requirements and procedures for certification of radon testers and mitigators. Additional regulations adopted under the law (N.J. Admin. Code 7:18-1.1 et seq.) establish rules governing certification of laboratories performing radon analysis.</p>

NJ	<p><b>New Jersey Statutes §§ 34:5A-10.1--10.5</b></p> <p>Prohibits the use of any hazardous substance in or on any building or grounds used as a school or child care center at any time when children are expected to be present in the building. Requires schools and child care centers to post notice of any construction or other activity that will involve the use of a hazardous substance. Also requires schools and child care centers to notify parents of these requirements and of the availability of facts sheets for any hazardous substances being used. Provides for local enforcement and directs the Department of Health to adopt regulations implementing the law that are consistent with federal and state IAQ standards and standards governing the exposure of children to hazardous substances.</p>
NJ	<p><b>New Jersey Statutes §§ 34:6A-1 et seq.</b></p> <p>Requires that every employer furnish a place of employment that is reasonably safe and healthful for employees and authorizes the state to adopt rules. Rules adopted under the law (N.J. Admin. Code 12:100-13.1 et seq.) establish safety and health standards for public workplaces, including certain requirements for addressing indoor air quality. The rules require that employers develop a plan for complying with the regulatory provisions and designate a person who is responsible for ensuring compliance. The rules also require employers to: establish and implement a preventive HVAC maintenance plan that includes a number of specified practices; undertake certain prevention and clean-up practices for microbial contamination; protect indoor air quality during renovation; respond to IAQ complaints; and keep and make available records of maintenance activities.</p>
NJ	<p><b>New Jersey Statutes §§ 52:27D-123A--123E</b></p> <p>Requires the state to adopt a radon hazard subcode to ensure that schools and residential buildings in areas of high radon potential are constructed in a manner that minimizes radon entry and facilitates any subsequent remediation activities. Authorizes state to include radon testing requirements. Regulations promulgated under the law (N.J. Admin. Code 5:23-10.1--10.4) establish the Radon Hazard Subcode, containing standards for radon-resistant materials and techniques to be used in certain residential and school buildings in designated areas of the state.</p>

NJ	<p><b>New Jersey Statutes §§ 52:27D-130.4--5</b></p> <p>Requires the Department of Health to adopt standards for maximum contaminant levels for the interiors of child care facilities and schools, as well as procedures for assessing the indoor environment in such buildings. Mandates that these regulations protect the health of children and infants, and take into account the rate at which children and infants absorb, metabolize, and excrete compounds. Directs the department to establish a certification program for certifying that child care centers and schools meet the agency’s standards. Prohibits the issuance of a construction permit to convert any building into a child care center or school if the building was formerly used for industrial, storage, or high hazard purposes, or is on a site where there is suspected contamination, unless the permit applicant obtains certification from the department demonstrating that the building was assessed and meets the agency’s indoor environmental standards. Also prohibits construction of a child care facility or school on a site used for industrial or high hazard purposes, unless the applicant demonstrates that the site has been (or is being) remediated pursuant to state law. Provides for civil administrative penalties for noncompliance. Health regulations implementing the law (N.J. Admin. Code 8:50) provide for licensure of indoor environmental consultants, standards for conducting indoor environmental assessments, and enforcement. State child care licensing regulations (N.J. Admin. Code 10:122-5.2) require certification that the facility has contacted the Department of Health to address risks posed by former uses.</p>
NM	<p><b>New Mexico Statutes § 22-20-1</b></p> <p>Appropriates \$300,000 to be expended during fiscal years 2007 and 2008 for the purpose of improving indoor air quality in schools by implementing EPA's IAQ Tools for Schools program in New Mexico. Separate legislation in 2007 appropriated \$27,000 to conduct environmental assessments of public schools pursuant to the program.</p>
NY	<p><b>New York Education Law § 409-i, New York State Finance Law §§ 163, 163-b</b></p> <p>Requires the state to maintain and distribute guidelines and specifications for environmentally sensitive cleaning and maintenance products for use in K-12 schools, as well as a sample list of products that meet the guidelines. Requires schools to follow these guidelines to identify and procure such products. Requires the state to maintain a list of contractors that produce, manufacture or offer for sale cleaning and maintenance products that meet the guidelines. [Office of General Services guidelines available at: <a href="https://greencleaning.ny.gov/Entry.asp">https://greencleaning.ny.gov/Entry.asp</a>.]</p>

NY	<p><b>New York Education Law §§ 409-d, 409-e</b></p> <p>Requires the Commissioner of Education to establish, develop, and monitor a comprehensive public school building safety program which must include a uniform inspection, safety rating, and monitoring system. Regulations promulgated under the law (8 N.Y. Code Rules &amp; Regs. 155.3--155.5) require a comprehensive maintenance plan for all major building systems, including provisions for establishing maintenance procedures and guidelines that will contribute to acceptable IAQ. Regulations also require: annual and five-year inspections that include IAQ components; an annual safety rating; and a process for monitoring the conditions of occupied schools to ensure they are maintained in good repair. Law also establishes requirements relating to IAQ during construction and renovation, and mandates establishment of health and safety committees at the school district level consisting of representation from district officials, staff bargaining units, and parents. (Legislation enacted in 2014 amended N.Y. Educ. Code 409-d to remove the statutory requirement for an annual visual inspection of schools until 2019.)</p>
NY	<p><b>New York Energy Law, App. §§ 7930.1 et seq.</b></p> <p>Establishes requirements for Radon Assessment Specialists to participate in the state's Radon Diagnosis Assistance Program. Requires the state's Energy Office to maintain a list of specialists who meet the requirements. Regulations adopted under the law (9 N.Y. Code Rules &amp; Regs. 7930) establish requirements for qualifying and provide a list of specialists.</p>
NY	<p><b>New York Environmental Conservation Law § 19-0301</b></p> <p>Authorizes the Department of Environmental Conservation to formulate and adopt codes and rules for preventing, controlling or prohibiting air pollution. Regulations adopted under the law (6 N.Y. Code Rules &amp; Regs. 232.18) require that owners of dry-cleaning facilities post a notice to inform building tenants and/or customers of the substances used in the dry cleaning system and their potential health effects. Regulations establish the notice to be posted, which states that individuals may request information from the facility about air testing that has been performed, and that individuals may contact the department to report chemical odors or leaks from the facility or to request information about indoor air testing or health effects of dry cleaning chemicals.</p>
NY	<p><b>New York General Business Law § 391-i</b></p> <p>Requires a person, firm, or corporation that sells or installs urea-formaldehyde insulation to provide a specific written notice of the potential health effects.</p>

NY	<b>New York Labor Law §§ 930--948</b>
	Requires those who engage in mold assessment and remediation to obtain a license from the state Department of Labor. Directs the agency to establish minimum qualifications for licensing, including completion of agency-approved course work. Also requires those seeking a mold remediation license to provide an audited financial statement to demonstrate financial responsibility. Provides certain exemptions from the licensing requirement, including for residential property owners who perform mold assessment or remediation on their own property. Establishes certain minimum work standards for licensed mold assessment and remediation work, including the requirement that licensees take into account, when deciding whether to use a disinfectant, biocide or antimicrobial coating on a mold remediation project, "the potential for occupant sensitivities and possible adverse reactions to chemicals that have the potential to be off-gassed from surfaces..." in 2014 and signed into law January 2015; effective July 28, 2015.]

NY	<b>New York Public Health Law § 1384</b>
	Established a state mold task force for the purpose of conducting a study and preparing a report covering the current state of knowledge about mold, the status of the problem in the state, and feasible legislative and executive actions to address the problem. [Law expired and deemed repealed in 2012. Report available at: <a href="http://www.health.ny.gov/environmental/indoors/air/mold/task_force/">http://www.health.ny.gov/environmental/indoors/air/mold/task_force/.</a> ]

NY	<b>New York Public Health Law § 225</b>
	Authorizes the Department of Health to issue regulations relating to ionizing radiation. Regulations issued under the law (10 N.Y. Codes Rules & Regs. 16.130) require radon testing and mitigation firms to report testing and mitigation results to the department.

NY	<b>New York Real Property Law § 462</b>
	Requires all sellers of residential real property to complete and provide to the buyer a property condition disclosure statement, which requires disclosure of the presence of hazardous substances, asbestos, and methane gas, and of any radon testing performed on the property. Also requires sellers to provide a copy of any radon testing reports and to report any known material defects in carbon monoxide detectors.

NC	<p><b>North Carolina General Statutes § 115C-521.1</b></p> <p>Provides that public school classrooms used as licensed child care facilities for pre-school students must have floors, walls, and ceilings that are free from mold, mildew, and lead hazards.</p>
NC	<p><b>North Carolina General Statutes § 42-42</b></p> <p>Requires that landlords repair or remedy, within a reasonable period of time, any imminently dangerous conditions on the premises, after acquiring actual knowledge or receiving notice of the conditions. Defines “imminently dangerous condition” to include excessive standing water, sewage, or flooding problems caused by plumbing leaks or inadequate drainage that contribute to mold.</p>
NC	<p><b>North Carolina General Statutes §§ 115C-12, 115C-47</b></p> <p>Directs the state to study methods for mold and mildew prevention and mitigation, and to incorporate recommendations into public school facilities guidelines as needed. Encourages local boards of education to remove and dispose of bulk mercury and mercury compounds in classrooms and prohibits the future use of mercury in classrooms, except in barometers. Also addresses other school environmental health issues such as arsenic-treated wood, pesticide use, and diesel emissions.</p>
NC	<p><b>North Carolina General Statutes §§ 47E-1 et seq.</b></p> <p>Requires owners of residential real property consisting of up to four units to provide buyers with a disclosure statement regarding known environmental conditions of the property, including the presence of radon gas, lead-based paint, asbestos, methane gas, and other hazardous or toxic materials. Regulations (21 N.C. Admin. Code 58A.0114) adopting the disclosure form require disclosure of these and other toxic substances, as well as disclosure of water leakage and dampness.</p>
OH	<p><b>Ohio Revised Code § 3748.20</b></p> <p>Requires the Governor to establish a radon advisory council for the purpose of advising and consulting on radon regulations and programs.</p>

OH	<p><b>Ohio Revised Code § 5302.30</b></p> <p>Requires sellers of residential real property containing up to four units to deliver a disclosure form to buyers disclosing material defects and the presence of hazardous materials or substances, including radon gas. Regulations adopted under the law (Ohio Admin. Code 1301:5-6-10) establish the form, requiring disclosure of the presence of radon, lead-based paint, asbestos, and urea-formaldehyde foam insulation. Form also requires disclosure of mold inspection or remediation of the property and contains a warning statement about mold to purchasers.</p>
OH	<p><b>Ohio Revised Code §§ 3723.01--.18</b></p> <p>Prohibits persons from providing professional radon testing and mitigation services unless licensed by the state. Requires the state to administer a licensing program for radon testers, mitigators, and laboratories. Regulations adopted under the law (Ohio Admin. Code 3701-69 et seq.) set forth the licensing program. Law also requires the state to collect and disseminate information on radon, and authorizes the state to conduct inspections and administer training programs.</p>
OK	<p><b>1991 Oklahoma Session Law Serv. Senate Joint Resolution 3</b></p> <p>Requires the Department of Labor to conduct a preliminary review of indoor air quality in buildings occupied by state employees, including air testing and a survey of the capacity of HVAC systems. Also requires a state agency to immediately implement all necessary steps to abate hazards if its building is found to be an imminent threat to the safety and health of workers.</p>
OK	<p><b>2003 Oklahoma Session Law Serv. Hs. Conc. Res. 1011</b></p> <p>Establishes a Joint Task Force on Mold and Mold Remediation, and requires the task force to report its findings and recommendations to the legislature.</p>
OK	<p><b>Oklahoma Statutes, tit. 15 § 765.4</b></p> <p>Provides that any person or entity that inspects houses for mold shall not also render services for removing the mold unless the total cost of the inspection and removal is \$200 or less.</p>

OK	<p><b>Oklahoma Statutes, tit. 60, §§ 831--839</b></p> <p>Requires sellers of residential property consisting of 1-2 dwelling units to provide to purchasers either a written property disclaimer statement or written Property Condition Disclosure Statement. Requires the Oklahoma Real Estate Commission to establish by rule a form for the disclosure statement. The regulation (605 Okla. Admin. Code Ch. 10, Subch 17, App. A) adopts a disclosure form that requires seller to disclose known presence of radon or any radon testing. Also requires seller to disclose any mold inspections or treatment, the known presence of asbestos, lead-based paint, and other hazardous or regulated materials. [See <a href="http://www.ok.gov/OREC/documents/Residential%20Prop%20Disclweb%207-2008.pdf">http://www.ok.gov/OREC/documents/Residential%20Prop%20Disclweb%207-2008.pdf</a>.]</p>
OR	<p><b>Oregon Revised Statutes § 105.848</b></p> <p>Requires the state Real Estate Agency to provide information on radon issues, such as radon hazard potential and methods of testing for and mitigating radon, to potential purchasers of one and two family dwellings. Information must be available on the agency's website and printed copies must be available to the public at a reasonable fee.</p>
OR	<p><b>Oregon Revised Statutes § 276.915</b></p> <p>Requires state agencies to consider IAQ issues when identifying energy conservation measures to be incorporated in state construction or renovation projects.</p>
OR	<p><b>Oregon Revised Statutes § 455.365</b></p> <p>Requires the state building code agencies to adopt design and construction standards for mitigating radon in new residential buildings and new public buildings, including schools, with standards to take effect between 2011-2013. Does not specify the radon control standard to be used, but requires the agencies to consider standards recommended by the U.S. EPA. New standard is to be applicable in seven counties listed in the law, as well as others the agency may consider appropriate in light of local radon levels. The state Building Code and Structures Board has incorporated the International Residential Code Appendix F (radon control) standard into the Oregon Residential Specialty Code and incorporated requirements for passive soil depressurization into the Structural Specialty Code for public buildings.</p>



OR	<p><b>Oregon Revised Statutes § 455.445</b></p> <p>Requires the Department of Consumer and Business Services to adopt ventilation standards for public areas and office workplaces that are at least equivalent to the most recent, nationally recognized and accepted standards. Requires the Department to adopt building codes and building product standards to protect the indoor air quality of private residences, but only as necessary to address serious or unique IAQ problems not addressed by federal standards or national codes.</p>
OR	<p><b>Oregon Revised Statutes §§ 105.462--.490</b></p> <p>Amends existing disclosure law to require sellers of real property consisting of up to four dwelling units to provide buyers with a seller's property disclosure statement, which includes disclosure of any testing of or treatment for formaldehyde, radon gas, mold, lead-based paint, or asbestos on the property.</p>
OR	<p><b>Oregon Revised Statutes §§ 433.502--.526</b></p> <p>Authorizes the Department of Human Services to conduct IAQ field investigations, establish IAQ standards, and implement a public information program. Requires that if established, the standards include particulate matter, aldehydes, radon, carbon monoxide, carbon dioxide, ozone, and water vapor. Authorizes the Department to establish a public recognition program for office workplaces, buildings, and public areas that consistently meet the IAQ requirements set forth in state law.</p>
OR	<p><b>Oregon Revised Statutes §§ 468A.775--785</b></p> <p>Requires the Environmental Quality Commission to establish a voluntary accreditation program for those who provide IAQ sampling or HVAC evaluation, and a voluntary contractor certification program for contractors providing remediation services for residential indoor air pollution problems. Authorizes the Commission to establish a pilot program for household or office products with the potential to contaminate indoor air, including a voluntary product-labeling program to identify products with a low potential for causing indoor air pollution.</p>
PA	<p><b>2002 Pennsylvania Senate Resolution No. 171</b></p> <p>Urges the Department of Health to establish a task force to investigate mold in homes, schools, and other buildings.</p>

PA	<p><b>Pennsylvania Statutes, tit. 35, §§ 7501--7504</b></p> <p>Directs the Department of Environmental Resources to implement a radon demonstration project in which the agency develops and implements methods for radon remediation and installs such systems in occupied residential buildings with the permission of the owners. Requires the Department to advise homeowners, in areas affected by high radon concentrations, of ways to avoid unscrupulous or unqualified contractors. Authorizes the Pennsylvania Housing Finance Agency to establish a low-interest loan program to finance home improvements designed to prevent radon infiltration and accumulation in residences.</p>
PA	<p><b>Pennsylvania Statutes, tit. 63, §§ 2001 et seq.</b></p> <p>Requires the Department of Environmental Resources to establish and carry out a certification program for persons who test for, mitigate, or safeguard a building from the presence of radon gas. Prohibits individuals from providing these radon services unless certified under the program. Requires certified radon testers to provide test results to the Department and provides for confidentiality of the information. Regulations adopted under the law (25 Pa. Admin. Code 240) establish the certification program.</p>
PA	<p><b>Pennsylvania Statutes, tit. 68, §§ 7301 et seq.</b></p> <p>Requires sellers of residential real property to complete and deliver to buyers a Seller's Property Disclosure Statement. Requires the State Real Estate Commission to create the disclosure statement. The disclosure statement adopted by state regulation (49 Pa. Code 35.335a) requires sellers to disclose knowledge of the presence of and/or testing for hazardous substances on the property, including radon, urea-formaldehyde foam insulation, PCBs, lead paint, and asbestos.</p>
RI	<p><b>Rhode Island General Laws § 16-60-4</b></p> <p>Authorizes the state Board of Regents to approve standards for the design and construction of school buildings. Regulations adopted under the law (R.I. Admin. Code 21-2-41:1.04--1.05) require all new school construction and school renovation projects that cost more than \$500,000 to incorporate a radon mitigation strategy if the site is located in an area with moderate or high radon potential. Regulations also require compliance with certain high performance construction standards, including protecting IAQ during renovation of occupied buildings.</p>

RI	<p><b>Rhode Island General Laws § 23-1-5.1</b></p> <p>Authorizes the Department of Health to provide, upon request, laboratory services for voluntary testing of indoor air pollutants, including radon. Authorizes the Department to establish fees to fund such activities.</p>
RI	<p><b>Rhode Island General Laws § 23-23.6-3</b></p> <p>Authorizes the Department of Health to establish air quality standards for carbon monoxide and other harmful gases in indoor ice arenas. Authorizes the Department to require owners/operators of ice arenas to conduct monitoring or perform air quality tests with respect to these pollutants. Also authorizes the Department to establish criteria for certification of acceptable air quality in ice arenas and to develop a public information program. Regulations (R.I. Admin. Code 31-1-4:1--9) establish maximum concentrations of carbon monoxide, require regular air quality measurement, and identify necessary corrective actions.</p>
RI	<p><b>Rhode Island General Laws §§ 23-61-1 et seq.</b></p> <p>Authorizes the Department of Health to undertake a variety of radon-related activities, including: conducting a voluntary radon testing program; undertaking radon testing; requiring that owners of "public or high priority buildings" test for radon; recommending radon-resistant construction standards; developing a public information program; and issuing radon standards for air and water. Requires licensure of radon professionals and establishes monetary fines and other penalties for violations. Requires the state to establish regulations requiring the evaluation of all public buildings, schools, and day care centers for elevated radon levels. Establishes a fee on new residential construction. Regulations promulgated under the law establish licensing and certification requirements for radon mitigation and measurement professionals and radon analytical services (R.I. Admin. Code 31-1-25:B.1--B.8). Regulations establish radon standards; measurement and mitigation protocols; and requirements for testing and mitigation of high radon levels in public buildings, schools, and child care facilities. [See also R.I. Admin Code 31-1-37:28.0 and 21-2-57:III.]</p>
RI	<p><b>Rhode Island General Laws §§ 5-20.8-1--8</b></p> <p>Requires sellers of residential real estate to provide buyers with a disclosure form explaining all known deficient conditions, including radon, urea-formaldehyde foam insulation, asbestos, and hazardous contaminants. Provides that disclosure form must include the statement: "Radon has been determined to exist in the State of Rhode Island. Testing for the presence of radon in residential real estate prior to purchase is advisable."</p>

RI	<b>Rhode Island General Laws §§ 6-38-1--4</b> Requires that before installing insulation in any residential, industrial or commercial building, an insulation contractor must provide the owner or lessee of the building with a written contract that includes warning statements concerning urea-formaldehyde insulation and urethane-based products.
RI	<b>Rhode Island Joint Resolution 04-R 369</b> Establishes a special joint commission to develop a comprehensive statewide plan to coordinate information and initiatives, and to identify resources, training and education needs, regarding school environmental health and safety issues. Designates members of the commission, including a variety of state agencies and non-governmental organizations.
SC	<b>South Carolina Code § 38-75-755</b> <b>Requires all insurers, at the issuance of a new policy and at each renewal, to notify the applicant or policyholder of a personal lines residential property insurance policy whether or not the insured has coverage for flood or mold.</b>
SC	<b>South Carolina Code § 40-57-137</b> Provides that no legal cause of action may be brought against real estate licensees who truthfully disclose any known material defects, including moisture or mold problems.
SC	<b>South Carolina Code §§ 27-50-10--110</b> Requires sellers of property containing up to four dwelling units to provide purchasers with a written disclosure statement disclosing environmental contamination on the property, including the presence of radon gas, lead-based paint, asbestos, methane gas, hazardous or toxic materials, and other environmental contamination. Disclosure statement adopted pursuant to the law also requires sellers to report the presence of formaldehyde or toxic mold. [See <a href="http://www.llr.state.sc.us/POL/REC/RECPDF/DOC360.pdf">http://www.llr.state.sc.us/POL/REC/RECPDF/DOC360.pdf</a> .]

SD	<p><b>South Dakota Codified Laws §§ 43-4-37--44</b></p> <p>Requires sellers of residential property to provide a form disclosing known hazardous conditions including radon, mold, methane gas, lead paint, asbestos insulation, urea formaldehyde foam insulation, and toxic materials, as well as any known testing for such conditions.</p>
TN	<p><b>2003 Tennessee Laws Pub. Ch. 381 (H.B. 891)</b></p> <p>Creates a special joint committee to study mold abatement in public schools, which must report findings and recommendations to the General Assembly no later than March 1, 2004.</p>
TN	<p><b>Tennessee Code § 49-2-121</b></p> <p>Encourages local education agencies to implement an IAQ inspection and evaluation program, such as EPA's IAQ Tools for Schools program, which may address ventilation, radon, relative humidity, separation of students and staff from construction, and reduced use of cleaning and maintenance products. Directs the state Department of Education to compile a statewide survey of IAQ in public schools by 2006.</p>
TN	<p><b>Tennessee Code § 62-6-112</b></p> <p>Establishes Environmental and Special Construction as one of nine major construction classifications in which a contractor may apply for a license, and requires the state contractor licensing board to adopt rules establishing specialty classifications that are automatically included in licenses issued for major classification. Licenses may also be issued for specialty classifications alone. Regulations implementing the law (Tenn. Admin. Code 0680-01-.16) establish mold remediation, asbestos material handling/removing, and lead paint abatement as specialty classifications under Environmental and Special Construction and require applicants to complete all training required by state or federal agencies and "keep abreast of all applicable state and federal requirements."</p>

TN	<b>Tennessee Code §§ 66-5-201 et seq.</b>
	Encourages local education agencies to implement an IAQ inspection and evaluation program, such as EPA's IAQ Tools for Schools guidance, which may address ventilation, radon, relative humidity, separation of students and staff from construction, and reduced use of cleaning and maintenance products. Requires that school districts and schools encourage the scheduling of maintenance, cleaning, repair and other projects at times when students and teachers will not be impacted by chemicals, fumes, vehicle exhaust, room fresheners, aerosol sprays, and other chemicals and particulate matter. Also directed the state Department of Education to compile a statewide survey of IAQ in public schools by 2006.

TX	<b>Texas Education Code § 42.352</b>
	Authorizes the state Board of Education to establish standards addressing the adequacy of Texas public school facilities. Regulations adopted under the law (19 Texas Admin. Code 61.1036) establish a variety of requirements for state-funded school construction and renovation projects, as well as the recommendation that schools consider the use of designs, methods, and materials that will reduce the potential for IAQ problems. The regulations further recommend that districts use the state's voluntary IAQ guidelines and the EPA's IAQ Tools for Schools program, and that they consult with a qualified IAQ specialist during the design process.

TX	<b>Texas Government Code § 2306.053</b>
	Authorizes the Department of Housing and Community Affairs to adopt regulations. Regulations implementing the state weatherization assistance program (10 Texas Admin. Code 5.612) require subrecipients of weatherization funding to conduct a whole house assessment on all eligible units, including the following health and safety items: smoke detectors, wiring, minimum air exchange, moisture problems, lead paint present, asbestos siding present, condition of chimney, plumbing problems, mold, unvented space heaters, carbon monoxide levels on combustion appliances, and carbon monoxide detectors. Regulations (10 Texas Admin. Code 5.522--5.523) also authorize the Department to provide mold work practices training to subrecipients and establish procedures that subrecipients must follow if they discover the presence of mold-like substances that the weatherization subcontractor cannot adequately address.

TX	<p><b>Texas Government Code §§ 2165.301--.305</b></p> <p>Requires the Building and Procurement Commission to refer matters related to the investigation and testing of indoor air quality in state buildings to the Department of Health. Requires the Department to conduct any necessary investigation and testing of IAQ in state buildings, when requested by the entity with responsibility for the building, and requires the Department to report all findings and test results to the State Office of Risk Management. Requires the Department to adopt rules and procedures relating to the investigation and testing of IAQ in state buildings. Requires the Department to contract with an outside entity to identify potential IAQ threats in state buildings and produce a report and recommendations for addressing IAQ issues in state buildings. Requires the Office of Risk Management to conduct an annual, one-day IAQ seminar and requires attendance at the seminar by a variety of individuals responsible for state buildings.</p>
TX	<p><b>Texas Health &amp; Safety Code, §§ 385.001--.003</b></p> <p>Requires the Board of Health to establish voluntary guidelines for indoor air quality in government buildings, including guidelines for ventilation and indoor pollution control systems. Provides that in establishing the guidelines, the Board must consider the potential effects of air contaminants and insufficient ventilation on human health; the potential health care costs resulting from exposure to indoor air contaminants; and the potential costs of compliance with the proposed guidelines. Regulations (25 Texas Admin. Code 297) incorporate the voluntary guidelines, which include a broad range of microbial management and other recommended practices for operations, maintenance, design and construction of schools and other public buildings.</p>
TX	<p><b>Texas Insurance Code §§ 542.251--.253</b></p> <p>Authorizes the state to adopt rules regulating the handling of water damage claims filed under residential property insurance policies, including required notice, processing procedures and time frames, claim investigation, and settlement of claims.</p>
TX	<p><b>Texas Insurance Code §§ 544.301--.305</b></p> <p>Prohibits an insurer from making an underwriting decision regarding a residential property insurance policy based on previous mold damage or mold damage claim if: mold remediation has been performed on the property and a certificate of mold remediation was issued to the property owner; or an independent assessor or adjustor inspected the property and determined that the property does not contain evidence of mold damage. State has incorporated this provision in its consumer bill of rights information to be distributed by insurers (see 28 Texas Admin. Code 5.9970) and has adopted rules to carry out the statute (see 28 Texas Admin. Code 21.1007).</p>

TX	<p><b>Texas Occupations Code §§ 1958.001 et seq.</b></p> <p>Prohibits a person from engaging in mold assessment or remediation, as defined in the law and regulations, unless that person holds a license from the state. Prohibits license holders (except those employed by school districts) from performing both mold assessment and mold remediation on the same project. Establishes certain minimum work practices and record-keeping requirements for licensed mold assessors and remediators. Requires the Board of Health to adopt rules governing the licensing program, including minimum performance standards and training requirements (25 Texas Admin. Code 295.301-295.338). Authorizes the board to adopt rules that facilitate reciprocity and communication with other states that have a similar licensing program. Directs the Department of Health to administer the program, and requires the department to investigate complaints regarding mold-related activities. Provides for administrative and civil penalties. Also requires the department to conduct a statewide education and outreach program on IAQ and mold.</p>
TX	<p><b>Texas Property Code § 5.008</b></p> <p>Requires that certain sellers of single-unit residential property give buyers a written notice that discloses a variety of conditions, including the presence of radon, asbestos, urea formaldehyde insulation, lead-based paint, or hazardous or toxic waste.</p>
UT	<p><b>Utah Code § 58-55-305</b></p> <p>Requires those installing or repairing radon mitigation systems to be licensed as a contractor under the state's construction trades licensing law. Pursuant to state regulations (Utah Admin. Code R156-55a-302b), in order to obtain a radon contractor license classification, the applicant must hold a current certificate from the National Radon Safety Board or National Radon Proficiency Program.</p>
UT	<p><b>Utah Code 26-7-7</b></p> <p>Requires the Department of Health, in consultation with the Division of Radiation Control, to develop a statewide electronic awareness campaign to educate the public regarding: the existence and prevalence of radon gas in buildings and structures; the health risks associated with radon gas; and options for radon testing and remediation.</p>



UT	<p><b>Utah Concurrent Resolution 11 (2013)</b></p> <p>Urges property owners, business owners, landlords, real estate professionals, home builders, government agencies, and others to take action to test for and remediate radon and educate the public about the dangers and risks of radon exposure.</p>
VT	<p><b>Vermont Public Act 125 (H.B. 192)</b></p> <p>Requires the Department of Health and the Department of Buildings and General Services to create and maintain a website to serve as a clearinghouse for information on environmental health in schools, including information on: common materials and practices that may compromise indoor air quality; preventative maintenance options; nontoxic or least-toxic supplies, equipment, and materials; and environmental health criteria that schools may use in determining which materials to purchase or use. Also requires the departments to: help schools identify and address potential sources of environmental pollution; organize annual training workshops for various school personnel; assist schools in establishing comprehensive environmental health programs; and report annually to the state legislature on the extent of indoor air and hazardous exposure problems in schools. Further requires the departments to develop and distribute a model school environmental health policy to all schools.</p>
VT	<p><b>Vermont Statutes tit. 18, §§ 1781 -- 1784</b></p> <p>Requires those who provide cleaning products or services to schools to provide and use only environmentally preferable cleaning products, defined as those used by the state department of buildings and general services (under state contracts) or those certified by a nationally recognized organization that has developed a certification program that meets several criteria listed in the law or that is otherwise approved by the state department of health. Requires a distributor or manufacturer of cleaning products to provide a green cleaning training to each school district it provides with environmentally preferable cleaning products, at no cost to the district.</p>
VT	<p><b>Vermont Statutes tit. 18, §102</b></p> <p>Authorizes the state to promulgate regulations to preserve the public health. Department of Health regulations adopting a Rental Housing Code (Code Vt. Rules 13-140-031) set forth minimum health and habitability standards for rental housing, including the requirement that dwellings be maintained “to be free from the regular or periodic appearance of standing water or excessive moisture which may result in visible mold growth.”</p>

VT	<p><b>Vermont Statutes, tit. 16, §§ 3447, 3448</b></p> <p>Establishes the framework for the state to provide financial assistance for school construction, and authorizes the state to adopt rules for the program. Rules adopted by the Department of Education (Vt. Admin. Code 7-1-14:6131) establish a variety of requirements for school construction and renovation projects receiving state aid, including: school board plans to address indoor air quality during all phases of construction; ventilation designs that comply with ASHRAE standards; project specifications that include a commissioning plan to incorporate a variety of specified elements; use of low-emitting finishes; and sufficient time for off-gassing of pollutants.</p>
VT	<p><b>Vermont Statutes, tit. 18, §102</b></p> <p>Authorizes the state Department of Health to promulgate rules and regulations for preserving public health. Rules (Vt. Admin. Code 12-5-25:8) establish habitability standards for rental dwellings, including the requirement that dwelling units "be maintained to be free from the regular or periodic appearance of standing water or excessive moisture which may result in visible mold growth."</p>
VT	<p><b>Vermont Statutes, tit. 33, § 3502</b></p> <p>Requires state licensing of child care facilities and registration of family child care homes. Regulations adopted by the Department of Social and Rehabilitative Services (Vt. Admin. Code 12-3-102:6, 12-3-103:6) establish health and safety requirements for such facilities and homes, including a prohibition on devices that diffuse harmful airborne chemicals, such as anti-pest strips, ozone generators, plug-in air fresheners, and aerosol sprays.</p>
VA	<p><b>Virginia Code §§ 36-156.1--.2</b></p> <p>Creates the Virginia Defective Drywall Correction and Restoration Assistance Fund, administered by the Virginia Resources Authority. Authorizes the Authority to make grants and loans for restoring or remediating properties contaminated as a result of defective drywall. Directs the Department of Housing and Community Development to develop guidelines governing use of the fund, including criteria for project eligibility.</p>
VA	<p><b>Virginia Code § 22.1-138</b></p> <p>Provides that every school building in Virginia shall be tested for radon, and that the test results shall be available for public review.</p>

VA	<p><b>Virginia Code § 36-98</b></p> <p>Authorizes the state to promulgate a Uniform Statewide Building Code. Building code adopted pursuant to the law (13 Va. Admin. Code 5-63-210--220) establishes Appendix F of the International Residential Code as the standard for local jurisdictions that elect to adopt a radon control standard for new construction in high radon potential areas.</p>
VA	<p><b>Virginia Code § 55-248.11:2</b></p> <p>Requires landlords to disclose whether there is any visible evidence of mold in a dwelling unit, as part of the move-in inspection report. Gives tenant the option of terminating lease if mold is noted in report. Requires that if tenant elects to take possession notwithstanding presence of mold, landlord must promptly remediate condition, reinspect, and issue new report. [See also Va. Code 55-225.7.]</p>
VA	<p><b>Virginia Code § 55-248.12:2</b></p> <p>Requires landlords to provide tenants with written disclosure prior to entering a lease agreement if landlord has actual notice of the existence of (unremediated) defective drywall in tenant's dwelling unit. Provides that tenants who do not receive notice may terminate lease following discovery of defective drywall in the dwelling unit. [See also Va. Code 55-225.11.]</p>
VA	<p><b>Virginia Code § 55-519.2</b></p> <p>Requires owners of residential real property to provide prospective purchasers with a written disclosure if the owner has actual knowledge of the presence of defective drywall. Requires notice be provided on form developed by Virginia Real Estate Board. Separate law (Va. Code 54.1-2131--2135) requires real estate licensees engaged by sellers, buyers, tenants, and landlords to disclose actual knowledge of defective drywall in a property.</p>
VA	<p><b>Virginia Code § 58.1-3284.2</b></p> <p>Provides that residential property owners may request the Commissioner of Revenue to re-assess property containing defective drywall, and directs Commissioner to conduct reassessment after confirming presence of defective drywall. Also authorizes local governing body to designate residential properties containing defective drywall as a rehabilitation district for purposes of granting the owner a partial real estate tax exemption under state law.</p>

VA	<p><b>Virginia Code §§ 32.1-229.01</b></p> <p>Prohibits individuals from providing radon screening, testing, or mitigation services unless they have completed a proficiency program acceptable to the state Board of Health. Requires radon professionals to comply with radon mitigation and testing standards accepted by the U.S. EPA and the Board of Health.</p>
VA	<p><b>Virginia Code §§ 54.1-201, -1102</b></p> <p>Requires the Board for Contractors to promulgate regulations necessary for the licensure of contractors, inspectors, and tradesmen. Rules adopted under the law (18 Va. Admin. Code 50-22-30--60) require radon mitigation contracting firms to hold a state building contractor license and set forth the licensing requirements. Separate regulations (18 Va. Admin. Code 15-40-120) require that if home inspections do not cover specified items (including mold, radon, and other environmental hazards), the inspection contract must note the exclusions.</p>
VA	<p><b>Virginia Code §§ 55-248.4, 248.13, 248.16, 248.18</b></p> <p>Requires landlords and tenants to maintain the premises to prevent the accumulation of moisture and the growth of mold. Requires landlords to respond promptly to notifications by tenants of mold or moisture accumulation. Provides that where mold condition materially affects the health or safety of a tenant, the landlord may require the tenant to temporarily vacate premises for up to 30 days, while the landlord undertakes mold remediation consistent with professional standards as defined in the law. Requires landlord to pay relocation cost. [See also Va. Code 55-225.3--.9.]</p>
WA	<p><b>1994 Washington Senate Bill 6244</b></p> <p>Provides a maximum of \$70,000 for the development of best management practices by local school districts to improve IAQ in newly constructed school buildings. The IAQ manual is referenced as a voluntary guideline in the Department of Health's checklist of school health and sanitary standards, which governs school inspections. [See manual at: <a href="http://www.doh.wa.gov/Portals/1/Documents/Pubs/333-044.pdf">http://www.doh.wa.gov/Portals/1/Documents/Pubs/333-044.pdf</a>.]</p>
WA	<p><b>Revised Code of Washington § 19.27.074</b></p> <p>Establishes duties for the state building code council. Regulations adopted under the law (Wash. Admin. Code 51-51-0327) adopt the Radon Resistant New Construction provisions of the International Residential Code for all buildings in High Radon Potential (Zone 1) counties and for all buildings constructed using unvented crawl space methods.</p>

WA	<b>Revised Code of Washington § 43.20.050</b> Requires the state Board of Health to adopt rules controlling public health related to environmental conditions in public facilities, including schools. Rule adopted under the law (Wash. Admin. Code 246-366-001 et seq.) establishes general minimum standards for schools relating to heating, lighting, ventilation, sanitation, and cleanliness and requires that local health officers inspect schools periodically. In August 2009 the Board of Health adopted a revised rule (Wash. Admin. Code 246-366A-001 et seq.) that requires annual inspections by local health boards and establishes a more detailed set of facility standards. The revised standards address numerous IAQ issues (moisture, ventilation, and others), along with drinking water, playground safety, site assessment, and construction requirements. The state enacted budget legislation in 2009 that prohibits implementation of the revised rule until the legislature appropriates funding for implementation (see Wash. Eng. Sub. House Bill 1244 (Sec. 222)), and the Board delayed the effective date of the revised rules until July 2015.
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WA	<b>Revised Code of Washington § 59.18.060</b> Requires landlords to provide tenants with written or posted information approved by the Department of Health about the health hazards of indoor mold and how to control mold growth to minimize health risks. The legislature appropriated \$43,000 in fiscal year 2006 for the implementation of these mold provisions.
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WA	<b>Revised Code of Washington §§ 64.06.005--.070</b> Requires sellers of improved and unimproved residential real property, as well as commercial real estate, to provide buyers with a disclosure statement providing information about carbon monoxide alarms and indicating knowledge of substances of environmental concern on the property, including radon gas, formaldehyde, asbestos, and lead-based paint.
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WA	<b>Revised Code of Washington §§ 70.162.005--.050</b> Requires the Department of Labor and Industries to develop policies for evaluating IAQ in state owned/leased buildings; for strengthening IAQ regulations in the workplace; and for improving IAQ in public buildings. Requires the Department to review IAQ programs in public schools and provide state agencies with educational and informational pamphlets on IAQ standards. Requires the Department to recommend to the legislature measures for improving IAQ in public buildings. Directs the State Building Code Council to bring ventilation and filtration standards into conformity with industry standards. Encourages state agencies to maintain and operate mechanical ventilation and filtration systems in a manner consistent with ASHRAE standards. Authorizes the Superintendent of Public Instruction to implement a model IAQ program.
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WA	<p><b>Revised Code of Washington §§ 70.164.010--.070</b></p> <p>Establishes a low-income weatherization program, and defines weatherization services to include indoor air quality improvements and other health and safety improvements. Specifically establishes as one purpose of the program, the identification and correction, to the extent practical, of health and safety problems for residents of low-income households, including asbestos, lead, and mold hazards.</p>
WV	<p><b>West Virginia Code § 18-5-10</b></p> <p>Authorizes the state Board of Education to require all school construction plans and specifications to comply with the provisions of the law. Regulations, in the form of a Handbook on Planning School Facilities (W. Va. Admin. Code 126-172-2--3), establish school design and construction requirements, including: incorporating ASHRAE 62; ensuring that ventilation systems be designed to maintain humidity levels at or below 60% and to use appropriate filters with a minimum of MERV 8 (and a recommended MERV 13); locating outside air vents at least 15 feet from pollutant sources; and installing carbon monoxide alarms in all areas that produce combustion gases.</p>
WV	<p><b>West Virginia Code § 18-9E-3</b></p> <p>Requires all new school buildings to be designed and constructed in compliance with current ASHRAE standards and requires the School Building Authority to promulgate rules consistent with ASHRAE standards for independent testing, adjusting, and balancing of HVAC systems in new and renovated school buildings. Requires that the Department of Education provide county maintenance personnel with additional training on school HVAC equipment. Requires the department to forward to the School Building Authority copies of any IAQ complaints that require system repair or replacement. Also requires the state Board of Education to develop rules allowing the use of appropriate floor covering in public schools; the rule adopted (W.V. Admin. Code 126-173-1--2) recommends restricting carpet to certain uses, requires that carpet meet industry standards, and further requires that custodial staff receive instruction on carpet maintenance. Requires the Division of Health to perform radon testing in new schools within one year of occupancy and at least once every five years thereafter. Requires the state to establish standards for safe levels of radon in public school buildings and requires mitigation if testing reveals high radon levels.</p>

WV	<b>West Virginia Code § 18-9E-5</b>
	Requires the state Board of Education to promulgate rules that require each county board to investigate all reports of school IAQ problems. Requires the rules to designate an official responsible for addressing IAQ complaints and to set forth a procedure for filing complaints. Requires county boards to develop a plan of correction when complaints are found to be valid, and to include those plans in the ten-year, county-wide major improvement plan. Requires legislative oversight commission to make a recommendation for funding plans of correction in certain cases. Rules adopted under the law (W.V. Admin. Code 126-174-1--2) establish procedures for school investigation and resolution of IAQ complaints.

WV	<b>West Virginia Code §§ 16-2-2, 16-2-11</b>
	Authorizes local boards of health to provide "enhanced" public health services, such as lead and radon abatement to improve indoor air quality.

WV	<b>West Virginia Code §§ 16-34-1 et seq.</b>
	Requires licensing of radon testers, mitigators, and laboratories. Authorizes the state to adopt rules (W. V. Admin. Code 64-78-1 et seq.) establishing the criteria, procedures, and fees for licenses as well as reporting requirements of radon testers, mitigators, and labs. Requires the Division of Health to maintain a list of all licensed radon testers, mitigation specialists, mitigation contractors, and radon laboratories in the state, and to investigate public complaints about licensees. Also requires agency to conduct research and disseminate information about radon.

WI	<b>Wisconsin Statutes § 254.02</b>
	Requires several state agencies to enter into memoranda of understanding with the Department of Health and Family Services in order to establish protocols for the department to review proposed rules of those agencies as they relate to indoor air quality, among other things.

WI	<b>Wisconsin Statutes § 254.22</b>
	Requires the Department of Health and Family Services to investigate illness or disease outbreaks suspected of being caused by poor indoor air quality. Requires the Department to assist local health departments in the adoption of regulations that establish standards for indoor air quality in public buildings and to provide training and technical support to local health departments for conducting IAQ testing and investigations.

# THE TASK FORCE ON MOLD IN LOUISIANA: FOLLOW UP SUMMARY REPORT – APRIL 2016

## ADDENDUM 4



# Indoor Environmental Exposures and Exacerbation of Asthma: An Update to the 2000 Review by the Institute of Medicine

Watcharoot Kanchongkittiphon,<sup>1,2,3\*</sup> Mark J. Mendell,<sup>4,5\*</sup> Jonathan M. Gaffin,<sup>1,2</sup> Grace Wang,<sup>6</sup> and Wanda Phipatanakul<sup>1,2</sup>

<sup>1</sup>Division of Allergy and Immunology, Boston Children's Hospital, Boston, Massachusetts, USA; <sup>2</sup>Harvard Medical School, Boston, Massachusetts, USA; <sup>3</sup>Department of Pediatrics, Ramathibodi Hospital, Mahidol University, Bangkok, Thailand; <sup>4</sup>Indoor Air Quality Program, California Department of Public Health, Richmond, California, USA; <sup>5</sup>Indoor Environment Group, Lawrence Berkeley National Laboratory, Berkeley, California, USA; <sup>6</sup>American Institutes for Research, San Mateo, California, USA.

\*These authors contributed equally to this work.

**BACKGROUND:** Previous research has found relationships between specific indoor environmental exposures and exacerbation of asthma.

**OBJECTIVES:** In this review we provide an updated summary of knowledge from the scientific literature on indoor exposures and exacerbation of asthma.

**METHODS:** Peer-reviewed articles published from 2000 to 2013 on indoor exposures and exacerbation of asthma were identified through PubMed, from reference lists, and from authors' files. Articles that focused on modifiable indoor exposures in relation to frequency or severity of exacerbation of asthma were selected for review. Research findings were reviewed and summarized with consideration of the strength of the evidence.

**RESULTS:** Sixty-nine eligible articles were included. Major changed conclusions include a causal relationship with exacerbation for indoor dampness or dampness-related agents (in children); associations with exacerbation for dampness or dampness-related agents (in adults), endotoxin, and environmental tobacco smoke (in preschool children); and limited or suggestive evidence for association with exacerbation for indoor culturable *Penicillium* or total fungi, nitrogen dioxide, rodents (nonoccupational), feather/down pillows (protective relative to synthetic bedding), and (regardless of specific sensitization) dust mite, cockroach, dog, and dampness-related agents.

**DISCUSSION:** This review, incorporating evidence reported since 2000, increases the strength of evidence linking many indoor factors to the exacerbation of asthma. Conclusions should be considered provisional until all available evidence is examined more thoroughly.

**CONCLUSION:** Multiple indoor exposures, especially dampness-related agents, merit increased attention to prevent exacerbation of asthma, possibly even in nonsensitized individuals. Additional research to establish causality and evaluate interventions is needed for these and other indoor exposures.

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## Introduction

Various allergens, airborne irritants, and infections trigger exacerbation of asthma. Because people spend > 75% of their time indoors (Klepeis et al. 2001), exposures found in the indoor environment are paramount. In 2000, the Committee on the Assessment of Asthma and Indoor Air of the Institute of Medicine (IOM) reviewed and summarized the scientific evidence for relationships between indoor air exposures and the exacerbation and development of asthma (IOM 2000). For exacerbation of asthma, sufficient evidence showed a causal relationship for four exposures and association for five exposures, and limited or suggestive evidence showed association with nine exposures. Since 2000, a substantial amount of research on indoor environmental exposures and exacerbation of asthma has been conducted. In this review we aim to provide a comprehensive update on this topic.

## Methods

We examined publications since 2000 relating indoor exposures and exacerbation of asthma

in conjunction with prior evidence (IOM 2000) and provide conclusions about the current strength of evidence. We used a set of previously defined categories for strength of evidence (IOM 2000): *a*) sufficient evidence of causal relationship, *b*) sufficient evidence of an association, *c*) limited or suggestive evidence of an association, *d*) inadequate or insufficient evidence to determine whether or not an association exists, and *e*) limited or suggestive evidence of no association (for category descriptions, see Supplemental Material, Table S1).

## Specific Priorities, Inclusions, and Exclusions

In this review we considered the evidence that specific indoor environmental exposures might cause exacerbation of asthma. Eligible outcome measures, all among asthmatics, included frequency or severity of respiratory symptoms, illness-related school absences, urgent care or emergency department visits, hospitalization, unscheduled health care visits, amount or frequency of medicine for asthma

control or prevention, airway inflammation assessed by fraction of exhaled nitric oxide (FeNO), and asthma-related quality of life.

Potentially modifiable biological and chemical exposures resulting from indoor sources were considered for inclusion as potential causes of asthma morbidity. Infectious agents and outdoor-generated pollutants that penetrate buildings were excluded. Studies on new onset of asthma, asthma prevalence, or experimental biologic markers of asthma were excluded.

Only studies of human health effects were included. Eligible study designs were controlled (experimental) exposure studies, environmental intervention studies, and a variety of observational designs: prospective or retrospective (longitudinal) cohort, case-control, and cross-sectional. Case studies and case series were ineligible. Detailed inclusion and exclusion criteria are described in the Supplemental Material, "Study inclusion criteria."

## Literature Search

PubMed searches were performed in May and August 2011 and updated in August 2013. Search terms focused primarily on the indoor environmental risk factors considered in the IOM 2000 review. We added the category tag "major" to identify articles that included the IOM risk factor as a main topic and the broader category tag "mesh" to identify

Address correspondence to M.J. Mendell, 819 Everett St., El Cerrito, CA 94530 USA. Telephone: (510) 295-9395. E-mail: [mmendell@pacbell.net](mailto:mmendell@pacbell.net)

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articles that included the IOM risk factors as a subject, but not necessarily as a main topic. This search strategy was designed to exclude editorials, letters, commentaries, clinical trials (phases 1–4) that would assess drug development and efficacy, and studies focusing on genetic predisposition or polymorphisms associated with asthma development. In addition, this search was restricted to findings published in English during the past 13 years. For further details regarding the search strategy, see Supplemental Material, “Literature search strategy.”

In total, the searches yielded 2,570 articles. After application of inclusion and exclusion criteria to the abstracts, we identified 162 articles of preliminary interest. We further excluded 99 studies after reviewing the full articles. Six additional peer-reviewed articles from reference lists or researchers’ files were included. Finally, 69 articles were selected for this review article. We considered recent findings in conjunction with evidence cited in the IOM (2000).

## Results

We organized evidence and conclusions by specific risk factors or exposures, ordered in categories by the previous strength of evidence for causation or association with exacerbation of asthma, as presented in the 2000 IOM review. Each section addresses a specific risk factor or exposure, presenting background material on the agent with conclusions from the IOM (2000) report, a summary of new evidence with consideration of prior evidence, and updated conclusions. Results are summarized in Table 1. A reevaluation of prior evidence cited in the IOM (2000) review is provided in Supplemental Material, “Prior evidence for selected exposures (IOM 2000).” Eligible studies included in the current review are listed in Supplemental Material, Tables S2–S13.

### Exposures for which Sufficient Evidence Had Existed for Causation of Exacerbation of Asthma

**House dust mite allergens.** **Background.** *Der p 1* and *Der p 2*, the major allergens identified from house dust mites (*Dermatophagoides pteronyssinus*), are concentrated in particles of mite feces. Because the allergens are found on large particles (mostly  $\geq 10 \mu\text{m}$ ), they become airborne relatively briefly when disturbed. Studies have found that exposure to dust mite allergens is associated with dust mite sensitization, which is associated with asthma. Reduction of exposure to these allergens decreases asthma symptoms in mite-sensitive asthmatics (IOM 2000). Mechanistic studies have implicated both allergic and nonallergic mechanisms in inducing airway inflammation, mirroring some clinical findings of dust

mite-induced asthma morbidity in nonsensitized subjects. Protease activity of dust mite allergen can act on airway epithelial cells to induce disruption of the tight junctions between epithelial cells and activation of protease-activated receptor-2 (PAR-2), facilitating allergen delivery across epithelium (Jeong et al. 2008). Activation of PAR-2 can trigger an innate immune response and the release of proinflammatory cytokines, such as interleukin-6 (IL-6) and IL-8 from airway epithelial cells (Kauffman 2006; Matsumura 2012). Citing the many studies that had found exposure to dust mite allergens to be associated with dust mite sensitization—which was in turn associated with asthma—and reduction of exposure to dust mite allergens to be associated with decreased asthma symptoms in mite-sensitive asthmatics, the IOM concluded:

- There is sufficient evidence of a causal relationship between dust mite allergen exposure and exacerbations of asthma in individuals specifically sensitized to dust mites. Continual exposure to dust mite allergens is also a contributing cause of chronic bronchial hyperactivity (IOM 2000).

**Summary of new evidence.** In the Supplemental Material, Table S2 summarizes recent reported findings from 11 studies on associations of dust mite allergens with exacerbation of asthma: in children, one randomized controlled trial, four prospective studies, and four cross-sectional studies (including one with case-control selection but cross-sectional analysis); in adults, one randomized control trial; and in children and adults, one cross-sectional study with findings reported only for adults.

In specifically sensitized children, the intervention trial (El-Ghitany and Abd El-Salam 2012) and all four prospective studies (Gent et al. 2009, 2012; Halken et al. 2003; Nitschke et al. 2006) found associations of dust mite exposure with exacerbation, with Gent et al. (2009) reporting a dose-related association of dust mite antigen with wheeze. Of three cross-sectional assessments, one (Spanier et al. 2006) found significant positive associations of dust mite exposure with exacerbation, one (Murray et al. 2006) found a nonsignificant increase, and one (Rabito et al. 2011) found no association. In children not specifically sensitized, the only prospective study (Gent et al. 2009) and one (Spanier et al. 2006) of two (Rabito et al. 2011) cross-sectional studies found associations. In children of unknown sensitization, the one study (Turk et al. 2006) found no association. In adults, the one study in specifically sensitized adults found no greater benefits associated with a dust mite reduction intervention than with control conditions (Dharmage et al. 2006).

In adults who were not specifically sensitized but were atopic asthmatics, a cross-sectional study found that exposure to dust mite allergen was significantly associated with more severe bronchial hyperresponsiveness (Langley et al. 2005). Spanier et al. (2006) reported a positive association between dust mite allergen level and FeNO in dust mite-sensitized children, suggesting a direct role in airway inflammation.

Evidence from the IOM (2000), while clearly documenting that dust mite allergen exposure caused asthma in dust mite-sensitive children, was less clear in documenting that such exposure caused exacerbation of existing asthma. The strongest evidence for this—the available intervention studies—also involved many changes other than dust mite reduction. In the evidence currently available, dust mite exposure consistently is positively associated with various measures of exacerbation or severity of asthma in children, including in studies of strong design, with proper temporality, and with biologic plausibility demonstrated. In children not specifically sensitized the evidence is more sparse, although more positive than negative. In adults the sparse evidence is not consistent, but only suggestive.

#### Conclusions.

- There is sufficient evidence of a causal relationship between exposure to dust mite allergen and exacerbation of asthma in children sensitized to dust mites.
- There is limited or suggestive evidence of an association between dust mite allergen exposure and exacerbations of asthma in children not sensitized to dust mites and in adults, whether sensitized or nonsensitized.

**Cat allergen.** **Background.** *Fel d 1* has been identified as the major cat allergen. High levels of *Fel d 1* are found in the air and dust of homes with cats, but are also found in many buildings without resident cats (IOM 2000). The mix of prior findings in studies of cat allergens, atopy, and asthma was complex, possibly suggesting different effects depending on age at exposure, level of exposure, and sensitization status. Early exposure to cats appeared possibly to prevent sensitization to cat allergens in some children, although findings were inconsistent. The IOM concluded:

- There is sufficient evidence of a causal relationship between cat allergen exposure and exacerbation of asthma in individuals specifically sensitized to cats (IOM 2000).

**Summary of new evidence.** In the Supplemental Material, Table S3 summarizes evidence from seven recent available studies: in children, three prospective and three cross-sectional, and in adults and children, one cross-sectional.

The prospective study by McConnell et al. (2006) found that associations of

various air pollutants with bronchitic symptoms were generally greater among children living in a home with a cat. Several studies have also demonstrated that among cat-sensitized children, cat allergen exposure had a positive association with increased asthma severity, rescue medication use, frequency of asthma symptoms, or FeNO: two prospective studies (Gent et al. 2009,

2012) and one cross-sectional (Murray et al. 2006). In other cross-sectional studies, Turyk et al. (2006) found no significant associations, and Spanier et al. (2006) found that high levels of cat allergen exposure and owning a cat were both associated with lower FeNO (i.e., less airway inflammation). This last finding may be biased by cat-allergic subjects tending not to own cats. In asthmatic adults

who were atopic but not sensitized to cat, no association was observed between *Fel d 1* and asthma, including measures of forced expiratory volume in 1 sec (FEV<sub>1</sub>), provocation dose causing fall in FEV<sub>1</sub> of at least 20% (PD20), and FeNO (Langley et al. 2005).

Thus, findings in children from prospective studies are fully consistent, and those from cross-sectional studies partly consistent,

**Table 1.** Prior and updated conclusions about strength of evidence linking specific indoor exposures to increased exacerbation of asthma in asthmatic individuals.

Exposures according to prior strength of evidence, per IOM (2000)	Prior conclusions (IOM 2000)	Updated conclusions
Sufficient evidence for causation		
House dust mite allergens	There is sufficient evidence of a causal relationship between dust mite allergen exposure and exacerbations of asthma in individuals specifically sensitized to dust mites. Continual exposure to dust mite allergens is also a contributing cause of chronic bronchial hyperreactivity.	There is sufficient evidence of a causal relationship between exposure to dust mite allergen and exacerbation of asthma in children sensitized to dust mites. There is limited or suggestive evidence of an association between dust mite allergen exposure and exacerbations of asthma in children not sensitized to dust mites and in adults, specifically sensitized or nonsensitized.
Cat allergens	There is sufficient evidence of a causal relationship between cat allergen exposure and exacerbation of asthma in individuals specifically sensitized to cats.	There is sufficient evidence of a causal relationship between cat allergen exposure and exacerbation of asthma in individuals specifically sensitized to cats.
Cockroach allergens	There is sufficient evidence of a causal relationship between cockroach allergen exposure and exacerbation of asthma in individuals specifically sensitized to cockroaches.	There is sufficient evidence of a causal relationship between cockroach allergen exposure and exacerbations of asthma in individuals specifically sensitized to cockroaches, especially adults. There is limited or suggestive evidence of association between cockroach allergen exposure and exacerbation of asthma in children not sensitized to cockroaches.
ETS	There is sufficient evidence to conclude that there is a causal relationship between chronic ETS exposure and exacerbations of asthma in preschool-age children. There is limited or suggestive evidence of a relationship between chronic ETS exposure and exacerbations of asthma in older children and adults. There is limited or suggestive evidence of an association between acute ETS exposure and exacerbation in asthmatics sensitive to this exposure.	There is sufficient evidence of an association between chronic ETS exposure and exacerbations of asthma in preschool-age children. There is limited or suggestive evidence of an association between chronic ETS exposure and exacerbations of asthma in older children and adults. There is limited or suggestive evidence of an association between acute ETS exposure and exacerbation of asthma in asthmatics sensitive to this exposure.
Sufficient evidence for association		
Dog allergens	There is sufficient evidence of an association between dog allergen exposure and exacerbation of asthma in individuals specifically sensitized to dogs.	There is sufficient evidence of an association between dog allergen exposure and exacerbations of asthma in children sensitized to dogs. There is limited or suggestive evidence of an association between dog allergen exposure and exacerbations of asthma in nonsensitized adults.
Fungi (quantified)	There is sufficient evidence of an association between fungal exposure and symptom exacerbation in sensitized asthmatics. Exposure may also be related to nonspecific chest symptoms.	There is sufficient evidence of a causal association between outdoor culturable fungal exposure and exacerbation in asthmatics sensitized to fungi. There is limited or suggestive evidence of an association between indoor culturable <i>Penicillium</i> exposure and exacerbation in asthmatic children with specific sensitization, any fungal sensitization, or unspecified sensitization. There is limited or suggestive evidence of an association between indoor total culturable fungal exposure and exacerbation of asthma in children with any fungal sensitization.
Dampness or dampness-related agents	Dampness may exacerbate existing asthma. The factors related to dampness that actually lead to the development of disease and to disease exacerbation are not yet confirmed, but probably relate to dust mite and fungal allergens.	There is sufficient evidence of a causal association between dampness or dampness-related agents and exacerbation of asthma in children, and of an association in adults. The evidence does not suggest that this relationship is restricted to those with specific sensitization to fungi or dust mites.
Nitrogen dioxide (NO <sub>2</sub> )	There is sufficient evidence of an association between brief high-level exposures to NO <sub>2</sub> and increased airway responses to both nonspecific chemical irritants and inhaled allergens among asthmatic subjects. These effects have been observed in human chamber studies at concentrations that may occur only in poorly ventilated kitchens with gas appliances in use.	There is sufficient evidence of an association between brief high-level exposures to NO <sub>2</sub> and increased airway responses to nonspecific chemical irritants and inhaled allergens among asthmatic subjects. There is limited or suggestive evidence of an association between NO <sub>2</sub> and exacerbation of asthma, although this association may be attributable to confounding by other consistently correlated emissions from gas stoves. There is inadequate or insufficient evidence to determine whether an association exists between gas stove use and exacerbation of asthma.

*Continued*

with prior findings that cat allergen exposure among cat-sensitized individuals (presumably with inflamed airways) increases asthma symptoms.

#### Conclusion.

- There is sufficient evidence of a causal relationship between cat allergen exposure and exacerbation of asthma in individuals sensitized to cats.

**Cockroach allergens. Background.** The major cockroach allergens include enzymes in fecal pellets that are incorporated into

household dust (Rabito et al. 2011). Cockroach allergen exposure is common in inner-city residences and was considered to be an important influence on the high rates of asthma among inner-city children (IOM 2000). The evidence cited by the IOM (2000) was limited but consistent, with two positive controlled exposure studies showing responses in specifically sensitized adults and one positive prospective observational study in children. There was documented association, biologic plausibility, and apparent causality

in specifically sensitized individuals. The IOM concluded:

- There is sufficient evidence of a causal relationship between cockroach allergen exposure and exacerbation of asthma in individuals specifically sensitized to cockroaches (IOM 2000).

**Summary of new evidence.** In the Supplemental Material, Table S4 summarizes findings from seven recent studies: one prospective and six cross-sectional, all in children; one study also included adults.

**Table 1.** Continued.

Exposures according to prior strength of evidence, per IOM (2000)	Prior conclusions (IOM 2000)	Updated conclusions
<b>Limited or suggestive evidence for association</b>		
Domestic birds	There is limited or suggestive evidence of an association between bird exposure and exacerbation of symptoms in bird-sensitized asthmatics. This association may be confounded by the allergic asthmatic response to mites harbored by birds.	There is limited or suggestive evidence of an association between exposure to birds and the exacerbation of symptoms in bird-sensitized asthmatics. This association may be confounded by the allergic asthmatic response to mites harbored by birds.
Formaldehyde (nonoccupational)	There is limited or suggestive evidence of an association between formaldehyde exposure and wheezing and other respiratory symptoms.	There is limited or suggestive evidence of an association between formaldehyde exposure and exacerbations of asthma, particularly through enhanced response to other allergens.
Fragrances, some	There is limited or suggestive evidence of an association between exposure to certain fragrances and the manifestation of respiratory symptoms in asthmatics sensitive to such exposures.	There is limited or suggestive evidence of an association between exposure to certain fragrances and the manifestation of respiratory symptoms in asthmatics sensitive to such exposures.
<b>Inadequate or insufficient evidence for association</b>		
Rodents (acute, nonoccupational)	There is sufficient evidence of an association between exposure to rodents in a laboratory setting and exacerbation of symptoms or lung function in rodent-sensitized asthmatics. There is inadequate or insufficient evidence to determine whether or not an association exists between exposure to rodents (wild or as pets) in the home and exacerbation of symptoms or lung function in rodent-sensitized asthmatics.	There is sufficient evidence of a causal association between exposure to rodents in a laboratory setting and exacerbation of symptoms or lung function in rodent-sensitized asthmatics. There is limited or suggestive evidence of an association between exposure to rats or mice in the home and increased exacerbation or severity of asthma in rodent-sensitized asthmatic children.
Cow and horse allergens (acute, nonoccupational)	There is inadequate or insufficient evidence to determine whether or not an association exists between cow or horse allergen in the home and the exacerbation of asthma in sensitive children.	There is inadequate or insufficient evidence to determine whether or not an association exists between cow or horse allergen in the home and the exacerbation of asthma in sensitive children.
Endotoxins (low level)	There is inadequate or insufficient information to determine whether or not an association exists between low-level indoor endotoxin exposure and exacerbation of asthma.	There is sufficient evidence of an association between indoor endotoxin exposure and the exacerbation of asthma.
Houseplants (+ cut flowers)	There is inadequate or insufficient evidence to determine whether or not an association exists between exposures from houseplants and the exacerbation of asthma.	There is inadequate or insufficient evidence to determine whether or not an association exists between exposures from houseplants and the exacerbation of asthma.
Pesticides (residential, nonoccupational)	There is inadequate or insufficient evidence to determine whether or not an association exists between pesticide exposures at the levels typically encountered in non-occupational or residential settings and the exacerbation of asthma.	There is inadequate or insufficient evidence to determine whether or not an association exists between pesticide exposures at the levels typically encountered in nonoccupational or residential settings and the exacerbation of asthma.
Plasticizers (nonoccupational)	There is inadequate or insufficient evidence to determine whether or not an association exists between nonoccupational exposure to plasticizers and the exacerbation of asthma.	There is inadequate or insufficient evidence to determine whether or not an association exists between nonoccupational exposure to plasticizers and the exacerbation of asthma.
Volatile organic compounds (VOCs) (residential, other than formaldehyde)	There is inadequate or insufficient evidence to determine whether or not an association exists between indoor residential VOC exposures and the exacerbation of asthma.	There is inadequate or insufficient evidence to determine whether or not an association exists between indoor residential VOC exposures (other than formaldehyde) and the exacerbation of asthma.
Pollen indoors	There is inadequate or insufficient evidence to determine whether or not an association exists between pollen exposure in the indoor environment and the exacerbation of asthma.	There is inadequate or insufficient evidence to determine whether or not an association exists between pollen exposure in the indoor environment and the exacerbation of asthma.
Down/feather bedding or synthetic bedding	There is inadequate or insufficient evidence to determine whether or not an association exists between down pillows and exacerbation of symptoms or lung function in asthmatics. Down pillows are believed to be a risk factor for asthma because of their documented mite content, rather than because of the presence of bird allergen.	There is limited or suggestive evidence that down/feather bedding may be protective for various respiratory effects relative to synthetic bedding, presumably due to lower content of dust mites, although evidence is not available regarding exacerbation of asthma.
Low outdoor air ventilation rate	There is inadequate or insufficient information to determine whether an association exists between lower ventilation rates and the exacerbation of asthma symptoms.	There is inadequate or insufficient evidence to determine whether an association exists between lower ventilation rates in buildings and the exacerbation of asthma.

ETS, environmental tobacco smoke. Exposures excluded from this review included all infectious agents (e.g., *Chlamydia pneumoniae*, *Chlamydia trachomatis*, *Mycoplasma pneumoniae*, respiratory syncytial virus) and all outdoor-generated pollutants (e.g., ozone, sulfur dioxide, nitrogen dioxide, nonbiologic particles).



No new controlled exposure studies were identified, but those cited by the IOM (2000) provided strong evidence confirming causality in sensitized adults (Bernton et al. 1972; Kang 1976). In children, controlled exposure studies have not been available. Prospective findings in children have been uniformly positive. For prospective studies, the one recent and one prior study, in specifically sensitized children, both found associations of bedroom cockroach allergen with increased asthma morbidity: allergen in bedroom floor and bed dust with significantly more asthma symptom days, school days missed, and caretaker-interrupted sleep in Gruchalla et al. (2005), and allergen in bedroom floor dust with more than three times the rate of hospitalization in Rosenstreich et al. (1997).

In contrast, cross-sectional findings in children on bedroom cockroach allergen, all recent, have been mixed. Gent et al. (2009) found no associations of cockroach allergen in beds with asthma severity in children with, or those without, specific sensitization. This study, however, had two limitations: Allergen levels were very low, with only 4% of children exposed at  $> 2 \mu\text{g/g}$  of dust, the level with increased risk in Gruchalla et al. (2005), compared with 35% in that study, and dust samples were taken only from beds, whereas all positive studies included bedroom floor dust. In children of unknown atopic status, Turyk et al. (2006) found strong, dose-related associations of cockroach allergen in bedroom floor and bed dust with number of symptoms, with odds ratios (ORs) up to 5.8, but Spanier et al. (2006) found no associations of allergen in bedroom floor dust with FeNO.

For cross-sectional findings on cockroach allergen measured in kitchens, Rabito et al. (2011) reported strong associations (ORs  $> 4$ ) with hospital admissions in both those with and those without specific sensitization. In cross-sectional findings based on other exposure assessments, neither of the two reports on measured cockroach antigens in living rooms found associations with exacerbation of asthma (Gent et al. 2009; Turyk et al. 2006); and neither of the two studies on visible cockroach presence in homes found associations with exacerbation of asthma: with asthma symptoms, unscheduled medical visits, or steroid use for asthma attacks (Bonner et al. 2006), and with asthma symptoms (Shedd et al. 2007).

The strong association of cockroach allergen with severe effects in both sensitized and nonsensitized children in one study (Rabito et al. 2011) might be attributable to irritant effects or non-IgE-mediated sensitization mechanisms. Cockroach allergen can induce mucosal allergic sensitization and inflammation via PAR-2 (Jeong et al. 2008),

induce expression of inflammatory cytokine (e.g., IL-8, IL-6), and trigger innate immune response in the human airway epithelium (Kauffman 2006; Matsumura 2012). These findings suggest a potential mechanism for cockroach allergen-induced asthma morbidity in sensitized and nonsensitized subjects.

The overall evidence demonstrates that exposure to cockroach antigen causes exacerbation of asthma in specifically sensitized adults, but such evidence is less consistent for children. For specifically sensitized children, the strongest studies, the two prospective, consistently show associations with measured allergen exposures in bedrooms, which may be a critical location for exposure. Although cross-sectional findings for bedroom dust are mixed, the only one with negative findings for sensitized children had very low exposure levels. Other cross-sectional study findings are limited but positive for kitchen exposures, and negative for exposures in living rooms or as assessed by visible cockroaches in homes. A few reported associations are strong (Rabito et al. 2011; Rosenstreich et al. 1997; Turyk et al. 2006), including a strong finding in nonsensitized children, and dose-response findings are available from one study (Turyk et al. 2006). The most reasonable conclusion is still of a causal relationship in both adults and children, although the evidence in children is weaker. Strong study designs and improved exposure assessment may be key to future demonstration of health risks associated with cockroach allergen.

#### Conclusions.

- There is sufficient evidence of a causal relationship between cockroach allergen exposure and exacerbation of asthma in individuals specifically sensitized to cockroaches, especially adults.
- There is limited or suggestive evidence of association between cockroach allergen exposure and exacerbation of asthma in children not sensitized to cockroaches.

#### Environmental tobacco smoke exposures.

**Background.** A substantial body of research has assessed the respiratory health effects of involuntary exposure to environmental tobacco smoke (ETS). Tobacco smoke contains solid particles and semivolatile and volatile organic compounds. These compounds include known or suspected eye and respiratory irritants, toxicants, mutagens, and carcinogens (Zeise and Dunn 1999). Distinguishing the effects of acute versus chronic ETS exposure is challenging, except by controlled chamber studies, which have been conducted only in adults (IOM 2000). Therefore, all observational studies are considered to assess chronic ETS exposure. The IOM concluded:

- There is sufficient evidence of a causal relationship between chronic ETS exposure

and exacerbations of asthma in preschool-age children.

- There is limited or suggestive evidence of a relationship between chronic ETS exposure and exacerbations of asthma in older children and adults.
- There is limited or suggestive evidence of an association between acute ETS exposure and exacerbation in asthmatics sensitive to this exposure (IOM 2000).

**Summary of new evidence.** In the Supplemental Material, Table S5 summarizes 19 recent studies on ETS exposure and exacerbation of asthma: in preschool-age children, two prospective studies; in older children, three prospective, one case-control, and eight cross-sectional studies; in adults and children, one prospective and one cross-sectional study, and in adults, three prospective studies. Some new findings have failed to show a relationship between ETS and exacerbation of asthma.

In preschool-age children, Kattan et al. (2007) found that high ETS exposures were not significantly related to increased wheeze or unscheduled medical visits, though they were associated with decreased peak flow in cold weather. Perzanowski et al. (2010) reported that, although previous ETS exposure was positively associated with FeNO, current exposure was inversely related to FeNO. ETS exposure at 4 years of age was associated with significantly lower FEV<sub>1</sub> and forced expiratory flow in mid 50% of exhaled volume (FEF<sub>25–75%</sub>) at 7 years, but not concurrent exposure at 7 years.

In older children with asthma, FeNO was not associated with reported tobacco smoke exposure, serum cotinine, or hair cotinine (Dinakar et al. 2005; Spanier et al. 2006, 2008). In fact, measured nicotine exposure was associated with decreased FeNO (Spanier et al. 2008), a response possibly mediated by a *NOS3* genetic polymorphism (Spanier et al. 2009). Glutathione *S*-transferase gene variants have also been implicated in lung function response to ETS (Palmer et al. 2006). This may indicate that ETS does not cause allergic airway inflammation. Other recent studies demonstrate no difference in acute asthma symptoms or responses to emergency therapy by ETS exposure (Karadag et al. 2003; Vargas et al. 2007).

In contrast, many studies in children have continued to demonstrate associations of ETS with reduced lung function, increased wheezing, nocturnal symptoms, and emergency department visits (Chapman et al. 2003; Lawson et al. 2011; Morkjaroenpong et al. 2002; Soussan et al. 2003; Sturm et al. 2004; Wang et al. 2007). Ecologic evidence presented by Herman and Walsh (2011) on adults and children demonstrated 22% lower hospital admission rates for asthma after a smoking ban in Arizona, compared with rates

in counties without bans. In adults, Eisner et al. (2002, 2005) demonstrated that ETS exposure was associated with greater asthma severity during follow-up, emergency department visits, and hospital admissions for asthma. Newman et al. (2010) reported that home ETS exposure had a nonsignificant association with reduced severity or frequency of symptoms during pregnancy.

Overall, regarding ETS and exacerbation of asthma in preschool-age children, the basis for the prior IOM conclusion of demonstrated causality is not clear. The two recent prospective studies in preschool-age children (Kattan et al. 2007; Perzanowski et al. 2010) have not found the clear relationships expected from a causal relationship. The overall evidence now, not fully consistent, seems to better support a finding of an association rather than of causality for preschool-age children. For older children and adults, available evidence is very inconsistent regarding association of ETS with increased asthma morbidity. This is in agreement with the prior assessment of limited or suggestive evidence of a relationship. No additional recent evidence was identified regarding acute ETS exposure and exacerbation of asthma.

#### Conclusions.

- There is sufficient evidence of an association between chronic ETS exposure and exacerbations of asthma in preschool-age children.
- There is limited or suggestive evidence of an association between chronic ETS exposure and exacerbations of asthma in older children and adults.
- There is limited or suggestive evidence of an association between acute ETS exposure and exacerbation of asthma in asthmatics sensitive to this exposure.

### Exposures for which Sufficient Evidence Had Existed for an Association with Exacerbation of Asthma

**Dog allergens. Background.** Two major dog allergens, *Can f 1* and *Can f 2*, have been identified. High levels of dog dander have been found in homes with dogs and in homes and buildings without resident dogs, and positive bronchial provocation tests with dog allergen have been correlated with sensitization to dog allergen (IOM 2000). The IOM concluded:

- There is sufficient evidence of an association between dog allergen exposure and exacerbation of asthma in individuals specifically sensitized to dog allergen (IOM 2000).

**Summary of new evidence.** In the Supplemental Material, Table S6 summarizes the findings of five recent available studies: in children, three prospective and one cross-sectional, and in adults, one cross-sectional.

McConnell et al. (2006) found that the presence of dogs in homes increased the

effect of ambient pollutants on bronchitic symptoms in asthmatic children not assessed for specific sensitization. Two other prospective studies and the cross-sectional study found that exposure to dog allergens significantly increased asthma severity in sensitized children (Gent et al. 2009, 2012; Murray et al. 2006). In adults, nonsensitized subjects exposed to high levels of dog allergens also demonstrated increased airway reactivity (Langley et al. 2005).

Prior evidence was sufficient only to suggest but not (as the IOM concluded) to establish associations between indoor dog allergen exposure and exacerbation of asthma. The addition of current findings establishes an association of dog allergen exposure to exacerbation of asthma in sensitized children, and also suggests associations in nonsensitized adults.

#### Conclusions.

- There is sufficient evidence of an association between dog allergen exposure and exacerbations of asthma in children sensitized to dogs.
- There is limited or suggestive evidence of an association between dog allergen exposure and exacerbations of asthma in nonsensitized adults.

**Fungi (quantified). Background.** In this section we review studies of quantified fungal exposures as triggers of asthma. Effects of qualitatively assessed environmental fungi or of fungal components, fungal by-products, or other dampness-related agents are reviewed in the next section, "Dampness or dampness-related agents."

Sensitization to many fungal species that occur outdoors and indoors has long been documented, but the mechanisms underlying the responses to most fungi have not been fully defined. Increased asthma severity with higher outdoor fungal spore concentrations, provocation of asthma symptoms among patients with fungal sensitivities, and reduction in asthma symptoms by desensitization with fungal antigens have been demonstrated repeatedly (IOM 2000). However, links between measured indoor fungal concentrations and exacerbation of asthma, including relevant exposure parameters and mechanisms, have been less clear. The IOM concluded:

- There is sufficient evidence of an association between fungal exposure and symptom exacerbation in sensitized asthmatics. Exposure may also be related to nonspecific chest symptoms (IOM 2000).

**Summary of new evidence.** The studies previously cited by the IOM (2000), in conjunction with Atkinson et al. (2006) and Pongracic et al. (2010), demonstrate that outdoor fungal exposures cause exacerbation of asthma in sensitized individuals. Atkinson

et al. (2006), for instance, reported that outdoor fungal concentrations were positively related to children's admissions to emergency rooms, after adjustment for pollen and air pollutants. The overall evidence documents strong association, temporality, consistency, and biologic plausibility, with dose-related response shown by Pongracic et al. (2010).

In the Supplemental Material, Table S7 summarizes six studies providing recent evidence on indoor fungal exposure and exacerbation of asthma, all in children: five prospective and one cross-sectional. All findings described below, unless otherwise specified, refer to indoor culturable airborne fungal concentrations, measured in prospective studies in asthmatic children, with analyses adjusted for key confounding variables.

Two prospective studies found that in specifically sensitized children, culturable airborne indoor *Penicillium* was associated with significantly increased outcomes of severe exacerbations (as indicated by unscheduled medical visits), severity, or symptoms (Gent et al. 2012; Pongracic et al. 2010), even after adjustment for outdoor fungal levels in one study (Gent et al. 2012). Among children with any fungal sensitization but not necessarily to the genus in question (26% were sensitized to *Penicillium*), Pongracic et al. (2010) found indoor culturable airborne *Penicillium*, and also the summed four most common fungal genera, to be associated with significantly increased severe exacerbations and symptoms, and total indoor fungal concentration to be associated with significantly increased severe exacerbations. Among those with any fungal sensitization, increases in symptom days associated with each specific genus were smaller among those not specifically sensitized than among those sensitized, although the decrease for *Penicillium* was only 5% (Pongracic et al. 2010).

Among asthmatic children of unknown sensitization status, a cross-sectional study by Turyk et al. (2006) found indoor *Penicillium* to be associated with significantly increased symptom frequency, and a prospective study by Bundy et al. (2009) found indoor *Penicillium*, but not total indoor fungi, to be associated with significantly increased peak expiratory flow variability (PEFV). In contrast, in unadjusted analyses from a small study of 19 children, Inal et al. (2007) found no significant associations between total indoor molds or four specific genera including *Penicillium*, and symptom or lung function outcomes; limitations of this study reduce its importance. An important weakness of these studies on airborne culturable fungi is that all those specifying their sampling methods used 1-min air samples, and thus had highly unreliable estimates of fungal concentrations, which have high

temporal variability. In unadjusted analyses in children of unspecified atopic status, Wu et al. (2010) found that total culturable fungi in dust were associated with an increased number of urgent care visits only in those with genetic polymorphisms that caused reduced enzymatic breakdown of chitin, an important fungal protein. (This study provides biologic plausibility for nonallergic mechanisms for exacerbation of asthma in relation to fungal exposures.)

The overall available evidence is sufficient to document that asthma exacerbation is caused by outdoor fungal exposures in those sensitized. Although these outdoor fungi also occur indoors, the evidence is not sufficient to demonstrate causality or association directly from indoor fungal exposures. The associations reported for *Penicillium* may be attributable to confounding by other indoor dampness-related exposures.

#### Conclusions.

- There is sufficient evidence of a causal association between outdoor culturable fungal exposure and exacerbation in asthmatics sensitized to fungi.
- There is limited or suggestive evidence of an association between indoor culturable *Penicillium* exposure and exacerbation in asthmatic children with specific sensitization, any fungal sensitization, or unspecified sensitization.
- There is limited or suggestive evidence of an association between indoor total culturable fungal exposure and exacerbation of asthma in children with any fungal sensitization.

#### Dampness or dampness-related agents.

**Background.** Sufficient evidence has long been available to document associations between indicators of dampness and exacerbation of asthma and other respiratory effects. The specific dampness-related causal agents, although not identified, were assumed to be dust mite or fungal allergens (IOM 2000). The few available studies showed fairly consistent, strong associations between dampness indicators in buildings and exacerbation of asthma. The prior IOM conclusion did not clearly specify if evidence demonstrated causality or only association:

- Dampness may exacerbate existing asthma. The factors related to dampness that actually lead to the development of disease and to disease exacerbation are not yet confirmed, but probably relate to dust mite and fungal allergens (IOM 2000).

**Summary of new evidence.** Eight studies on qualitative assessments of dampness indicators (e.g., visible dampness, water damage, or mold, or mold odor) or quantified dampness and exacerbation of asthma have become available or were not previously considered. In the Supplemental Material, Table S8 summarizes evidence from these eight studies: in children,

two controlled intervention, two prospective, and two cross-sectional studies; and in adults, one prospective and one cross-sectional study.

Kercsmar et al. (2006), in a controlled intervention study in damp houses of asthmatic children, reported that comprehensive remediation of dampness sources and visible mold caused dramatic reductions in severe exacerbation of asthma. Acute care visits after remediation were significantly reduced (by 90%) in the children in homes actually receiving remediation (i.e., as treated) compared with those in the control homes. Another intervention study (Bernstein et al. 2006) and two prospective studies (Hagmolen of Ten Have et al. 2007; Venn et al. 2003) in children found significant positive associations between dampness or mold and exacerbation or severity of asthma outcomes. Bernstein et al. (2006) performed a controlled intervention in which ultraviolet radiation was applied in home ventilation ducts to reduce microbial exposures to fungally sensitized asthmatic children. Ultraviolet radiation was associated with a significant reduction in PEFV and a nonsignificant reduction in FEV<sub>1</sub>; with significant reductions in severity scores for shortness of breath and chest tightness, in number of days of shortness of breath and chest tightness, and in amount of medication used; and with nonsignificant reductions in all other disease severity measures (Bernstein et al. 2006). The presumed mechanism is reduction of unspecified microbial exposures. The intervention study by Burr et al. (2007) was considered ineligible because its intervention for mold removal also increased outdoor air ventilation, which reduces concentration of other indoor airborne contaminants, thus making the study benefits not specific to mold removal.

Venn et al. (2003) reported a dose-related positive association of measured wall moisture with wheezing in children with persistent wheezing over 3 years, significantly more in atopic cases. ORs for measured bedroom moisture and nighttime symptoms, and measured living room moisture and daytime symptoms, both showed dose-related responses, with ORs ranging up to 7.0 for the highest moisture level. Visible mold was not significantly associated with either symptom type, but was significantly associated with presence of wheezing illness. Hagmolen of Ten Have et al. (2007) reported that damp stains or mold growth were significantly positively associated with three asthma severity metrics. Only one-third of the subjects were fungally sensitized.

Of two cross-sectional studies in children, Bonner et al. (2006) found strong positive associations between home moisture or mold and three asthma severity metrics, but Teach et al. (2006) found no such relationships.

Bonner et al. (2006) reported the presence of moisture or mildew at home to be associated with more than three times the hospital visits for breathing-related problems, more than three times the frequency of wheezing episodes, and more than twice the expected frequency of night symptoms. Teach et al. (2006) reported that visible dampness or mold in the home during the previous month was not associated with unscheduled medical care visits above the median, persistent asthma symptoms, or quality-of-life scores below the median.

In adults, a prospective study found a doubling in asthma attacks with home mold exposure (Wen et al. 2009), regardless of subject obesity. A cross-sectional study in diagnosed asthmatics, previously cited by IOM (2000), found that both moisture meter-measured total home dampness and visible mold score had significant positive dose-related associations with asthma severity, and higher measured dampness was associated with significantly greater measured airflow obstruction (Williamson et al. 1997).

The specific causal agents for exacerbations of asthma that are associated with dampness have not been identified. Although it is often assumed that these agents are fungal, they may include other biologic exposures such as bacteria, amoebas, or dust mites that thrive in dampness, or nonbiologic exposures such as chemicals emitted from damp materials (Mendell et al. 2011).

In these studies, evident dampness or mold or measured dampness was positively associated—with almost complete consistency—with exacerbation or severity of asthma. The intervention studies, which had the strongest designs, both showed these relationships clearly. The intervention and prospective studies, both demonstrating temporality of effects, were consistent, as were all but one of the cross-sectional studies. Both Venn et al. (2003) and Williamson et al. (1997) showed strong, dose-related positive associations between measured moisture and asthma severity outcomes. Because of the implausibility of noncausal explanations for all these findings, especially those of Kercsmar et al. (2006), this evidence indicates a causal association between indoor dampness or dampness-related agents and exacerbation of asthma in children with asthma. Few of the populations in these studies were restricted to atopic subjects, much less to those sensitized to any fungi, specific fungal genera, or dust mites.

#### Conclusion.

- There is sufficient evidence of a causal association between dampness or dampness-related agents and exacerbation of asthma in children, and of an association in adults. The evidence does not suggest that this



relationship is restricted to those with specific sensitization to fungi or dust mites.

**Nitrogen dioxide. Background.** Nitrogen dioxide (NO<sub>2</sub>) is a common pollutant gas found indoors and outdoors. It is produced, along with other oxides of nitrogen, whenever high-temperature combustion occurs. Indoor combustion sources, including gas stoves and space heaters, kerosene space heaters, and poorly vented furnaces and fireplaces, produce high indoor NO<sub>2</sub> concentrations. Individual NO<sub>2</sub> exposures in homes equipped with combustion appliances are usually driven by concentrations generated indoors even when elevated outdoor levels infiltrate into the home. Indoor NO<sub>2</sub> levels in homes equipped with gas stoves are higher in kitchens than in other rooms and greatly higher during cooking. Thus, individual exposure in a home depends heavily on the amount of time spent in the kitchen during cooking (IOM 2000).

In addition to nitrogen oxides, indoor combustion appliances generally emit a variety of other pollutants such as carbon monoxide, sulfur dioxide (SO<sub>2</sub>), formaldehyde, volatile organic compounds (VOCs), and submicron particulate matter (PM), some of which are known respiratory irritants. Epidemiologic studies generally have used only the presence of gas appliances as an indicator of elevated indoor NO<sub>2</sub>, or have measured NO<sub>2</sub> but not other gas combustion emissions. Such studies thus have not been able to attribute health effects associated with gas appliances, or even with measured NO<sub>2</sub>, to NO<sub>2</sub> exposure itself (IOM 2000). Brief, controlled high-level NO<sub>2</sub> exposures, such as might be found in poorly ventilated kitchens during gas appliance use, caused enhanced airway responsiveness in asthmatic adults (IOM 2000). The IOM concluded:

- There is sufficient evidence of an association between brief high-level exposures to NO<sub>2</sub> and increased airway responses to both nonspecific chemical irritants and inhaled allergens among asthmatic subjects. These effects have been observed in human chamber studies at concentrations that may occur only in poorly ventilated kitchens with gas appliances in use (IOM 2000).

**Summary of new evidence.** In the Supplemental Material, Table S9 summarizes recent evidence from eight studies of NO<sub>2</sub> and exacerbation of asthma: in children, two controlled intervention, four prospective cohort, and one cross-sectional study; and in adults, one prospective study. In the Supplemental Material, Table S10 summarizes the evidence from six studies of gas stove use and exacerbation of asthma: in children, three cross-sectional, and in adults, two prospective and one cross-sectional study.

For NO<sub>2</sub> studies in children, the two intervention studies (Gillespie-Bennett

et al. 2011; Pilotto et al. 2004) replaced unflued gas heaters that emitted NO<sub>2</sub> and other combustion products indoors. Either unreplaced gas heaters or higher NO<sub>2</sub> were associated with increased asthma symptoms (Gillespie-Bennett et al. 2011; Pilotto et al. 2004) and/or reduced FEV<sub>1</sub> (Gillespie-Bennett et al. 2011). In prospective studies, higher indoor NO<sub>2</sub> indoors was associated with increases in many but not all measures of asthma-related morbidity (Belanger et al. 2013; Fu et al. 2012; Hansel et al. 2008; Kattan et al. 2007). In the study by Belanger et al. (2013), four outcomes had significant dose-related increases. However, in one study, this association was found for wheeze only in nonatopic children (Kattan et al. 2007). Fu et al. (2012) found high NO<sub>2</sub> exposures associated with more severe asthma in children with high beta-2-adrenergic receptor (*ADRB2*) gene methylation. In a cross-sectional study, Belanger et al. (2006) found that measured NO<sub>2</sub> concentrations had a significant positive association with increased likelihood of wheeze and chest tightness among asthmatic children in multi-family housing, but not in single-family housing. In adults, a prospective study (Ng et al. 2001) found adverse respiratory effects in asthmatic women associated with cooking-related measured NO<sub>2</sub> exposures.

Regarding gas stove use, two cross-sectional studies in children found associations with some but not all studied respiratory effects. Belanger et al. (2006) found that the presence of a gas stove in the home had a significant positive association with wheeze, shortness of breath, and chest tightness among children living in multi-family housing, but not single-family housing. Chapman et al. (2003) found that use of a gas stove in the home for cooking had a significant inverse relationship on FEF<sub>25–75%</sub>, FEF<sub>25–75%</sub>/forced vital capacity (FVC), FEV<sub>1</sub>, and FEV<sub>1</sub>/FVC among girls who did not take prescription respiratory medication. There was no association among girls when respiratory medication was taken, and no association at all among boys. Use of an exhaust fan had no influence on the effects of using a gas stove (Chapman et al. 2003). Bonner et al. (2006) found that the presence of a gas stove not equipped with an outside vented exhaust was not associated with any measure of asthma severity related to symptoms, missed school, unscheduled health care visits, or steroid-treated asthma attacks.

Studies of gas cooking in adults included two prospective cohort studies and one cross-sectional study. Ng et al. (2001), in a prospective study, found adverse respiratory effects in asthmatic women from both short-term and repeated cooking exposures. Eisner et al. (2002) reported from a prospective study that

personal use of a gas stove for cooking was not associated with asthma severity score, use of systemic corticosteroids or other asthma medications, or a history of hospitalizations and intubations. In a cross-sectional study, Eisner and Blanc (2003) reported that gas stove use had no significant association with FEV<sub>1</sub>, FVC, FEV<sub>1</sub>/FVC ratio, or FEF<sub>25–75%</sub> and no association with chronic cough or phlegm production. Gas stove use was related to a greater risk of dyspnea, wheeze, and any respiratory symptom, although those relationships were not statistically significant (Eisner and Blanc 2003).

The overall available evidence leaves unchanged, due to lack of new evidence, the IOM (2000) conclusion about brief high-level NO<sub>2</sub> exposures in asthmatics. Substantial new evidence, although not fully consistent, shows associations between indoor NO<sub>2</sub> exposure and exacerbation of asthma. Conclusions on this relationship are further limited by the fact that many other unmeasured combustion-related chemical and particulate compounds are emitted by gas stoves and heaters that may be related to asthma morbidity. Evidence for this relationship is thus considered to be only suggestive. Findings on gas stove use and exacerbation of asthma are too inconsistent to demonstrate associations.

#### Conclusions.

- There is sufficient evidence of an association between brief high-level exposures to NO<sub>2</sub> and increased airway responses to nonspecific chemical irritants and inhaled allergens among asthmatic subjects.
- There is limited or suggestive evidence of an association between NO<sub>2</sub> and exacerbation of asthma, although this association may be attributable to confounding by other consistently correlated emissions from gas stoves.
- There is inadequate or insufficient evidence to determine whether an association exists between gas stove use and exacerbation of asthma.

#### Exposures for which Limited or Suggestive Evidence had Existed for an Association with Exacerbation of Asthma

**Domestic birds. Background.** Respiratory allergies to birds have been known to occur among zoo keepers and pet shop workers, but specific links between exposures and exacerbations of asthma have not been made. The IOM review found that, although asthmatic symptoms had been documented in association with bird-keeping, specific bird antigens associated with allergies and asthma had not been identified and available evidence was lacking.

There was an assumption that feather bedding was associated with exacerbation of asthma because of mites associated with birds, but no supportive evidence was found. The



IOM report cited only one epidemiologic study, which found increased risk of wheeze in children using foam rather than feather pillows, and theorized that this unexpected association might result from bias due to parental replacement of feather bedding by synthetic bedding for symptomatic children (Strachan and Carey 1995). The IOM review also cited findings of higher dust mite antigen levels in synthetic pillows than in feather pillows and theorized the difference might result from more impermeable covers on feather bedding preventing infestation (IOM 2000). The IOM review concluded

- There is limited or suggestive evidence of an association between bird exposure and exacerbation of symptoms in bird-sensitized asthmatics. This association may be confounded by the allergic asthmatic response to mites harbored by birds.
- There is inadequate or insufficient evidence to determine whether or not an association exists between down pillows and exacerbation of symptoms or lung function in asthmatics. Down pillows are believed to be a risk factor for asthma because of their documented mite content, rather than because of the presence of bird allergen (IOM 2000).

**Summary of new evidence.** No additional evidence was available on exposure to domestic birds and exacerbation of asthma over the past decade. Evidence continues to suggest that occupational exposure is associated with the development of antibodies to feathers from specific birds (Renström et al. 2011; Swiderska-Kielbik et al. 2011), but that allergic responses may also occur to mites harbored by birds (Rimac et al. 2010). Down/feather bedding is discussed as a separate exposure, below.

#### Conclusion.

- There is limited or suggestive evidence of an association between exposure to birds and the exacerbation of symptoms in bird-sensitized asthmatics. This association may be confounded by the allergic asthmatic response to mites harbored by birds.

#### Formaldehyde (nonoccupational).

**Background.** Formaldehyde, an aldehyde and VOC, is emitted from many building materials, items of furniture, and consumer products, and by combustion processes including those in gas stoves and tobacco smoking. Cigarette smoke is considered to be one of the largest indoor sources of formaldehyde. The strongest sources have been urea-formaldehyde foam insulation (no longer used) and various composite wood products made with urea-formaldehyde resins. Formaldehyde is also present in outdoor air, where motor vehicle exhaust is a major source. Indoor concentrations are determined by the presence, number, and age of sources, modified by the rate of outdoor air ventilation. Formaldehyde

concentrations are generally highest in newly constructed or renovated building spaces and in areas that contain new furnishings made with formaldehyde resins (IOM 2000).

High-level exposure to formaldehyde has been documented to cause occupational asthma, although whether this occurs through immunologic or irritant mechanisms has been unclear. Little evidence was available related to effects of residential exposures on exacerbation of asthma (IOM 2000). The IOM concluded:

- There is limited or suggestive evidence of an association between formaldehyde exposure and wheezing and other respiratory symptoms (IOM 2000).

**Summary of new evidence.** In the Supplemental Material, Table S11 summarizes the findings of two recent studies, both controlled exposure studies. In a blinded crossover study (Casset et al. 2006), exposure to 32 or 92  $\mu\text{g}/\text{m}^3$  formaldehyde for 30 min had no effect on lung function or symptoms in asthmatic adults, but enhanced both immediate and late responses to dust mite antigen. Formaldehyde thus increased effects of a common asthma trigger without having apparent direct effects (Casset et al. 2006). A similar lack of lung function effect of 500  $\mu\text{g}/\text{m}^3$  formaldehyde exposure for 60 min was demonstrated in patients with intermittent asthma (Ezraty et al. 2007). Although epidemiologic studies have shown associations of indoor formaldehyde exposures with asthma development and prevalent asthma in children (reviewed by McGwin et al. 2010), evidence on exacerbation of asthma was not available.

#### Conclusion.

- There is limited or suggestive evidence of an association between formaldehyde exposure and exacerbation of asthma, particularly through enhanced response to other allergens.

**Exposure to certain fragrances (among sensitized individuals).** **Background.** Fragrances contain a variety of chemical compounds. Some asthmatics have been reported to have symptomatic responses to some scents. The few available controlled clinical challenge studies had inconsistent findings on respiratory effects of fragrance exposure in sensitive populations, and many studies failed to control for the possible influence of odor perception. Based on the studies that did account for odor, the IOM concluded:

- There is limited or suggestive evidence of an association between exposure to certain fragrances and the manifestation of respiratory symptoms in asthmatics sensitive to such exposures (IOM 2000).

**Summary of new evidence.** No recent studies were identified.

#### Conclusion.

- There is limited or suggestive evidence of an association between exposure to certain fragrances and the manifestation of respiratory symptoms in asthmatics sensitive to such exposures.

### Exposures for which Inadequate or Insufficient Evidence Had Existed to Determine an Association with Exacerbation of Asthma

**Rodent allergens.** **Background.** Although several mouse and rat allergens have been identified, these may not be the key allergens for all species potentially present in the home (IOM 2000). Work-related allergies to rats or mice are well documented, but clear associations between rodent exposures in homes and exacerbation of asthma had not been established. The IOM concluded:

- There is sufficient evidence of an association between exposure to rodents in a laboratory setting and exacerbation of symptoms or lung function in rodent-sensitized asthmatics.
- There is inadequate or insufficient evidence to determine whether or not an association exists between exposure to rodents (wild or as pets) in the home and exacerbation of symptoms or lung function in rodent-sensitized asthmatics (IOM 2000).

**Summary of new evidence.** In the Supplemental Material, Table S12 summarizes three available recent studies, all in children: one environmental intervention, one prospective, and one cross-sectional.

Pongracic et al. (2008), in a controlled environmental intervention study that removed mouse allergens from the homes of inner-city children with asthma and sensitization to mouse or rat allergen, did not find a decrease in asthma symptoms or health care utilization to be associated during the intervention year with mouse allergen reduction. They did, however, report significantly reduced school absenteeism, nights of child and caretaker waking, and number of days on which caretakers had to change plans (Pongracic et al. 2008). The study by Pongracic et al. (2008) suggests a potential relationship between mouse allergen exposure in sensitized children and asthma severity or exacerbations. A prospective study on inner-city asthmatic children found that mouse allergen exposure contributed significantly to sensitization, but, among mouse-sensitized children, only to several nonsignificant trends for measures of asthma morbidity (Phipatanakul et al. 2000). Bonner et al. (2006), in a cross-sectional study in children of unknown sensitization status, found no association between presence of rats or mice in the home and symptoms or unscheduled medical visits; however, because sensitization status was unknown, this study does

not provide information about responses of rodent-allergic children.

The IOM (2000) had suggested that sufficient home exposures to rodent allergen among sensitized individuals might be expected to be associated with exacerbation of asthma, but insufficient information was available on home exposures and on nonoccupational sensitization. A reconsideration of evidence previously considered by the IOM (2000) on occupational rodent exposure, which demonstrates strong, consistent, temporally appropriate, and biologically plausible relationships, leads to a conclusion of a causal relationship between occupational rodent exposure and exacerbation of asthma in sensitized adult workers. Also, recent evidence shows a substantial minority of inner-city homes to have rodent allergen levels comparable with occupational settings, and also to have rodent-sensitized children (e.g., Matsui et al. 2005).

The two available studies on asthmatic response to rodent allergen among sensitized children, a controlled intervention (Pongracic et al. 2008) and a prospective study (Phipatanakul et al. 2000), found either significant effects for several but not other outcomes, or small and not statistically significant effects in only a few outcomes. These findings do not suggest a clear association. However, together with a determination that occupational rodent exposure causes exacerbation of asthma in sensitized adult workers, and the recent findings about home exposure levels, these findings suggest possible associations in populations of highly exposed, sensitized children.

#### Conclusions.

- There is sufficient evidence of a causal association between exposure to rodents in a laboratory setting and exacerbation of symptoms or lung function in rodent-sensitized asthmatics.
- There is limited or suggestive evidence of an association between exposure to rats or mice in the home and increased exacerbation or severity of asthma in rodent-sensitized asthmatic children.

**Cow and horse allergens (acute, nonoccupational exposures).** **Background.** Although occupational allergy to cows or horses has been well recognized, data for nonoccupational exposures have not been readily available. In contrast, evidence has increasingly shown that living on farms with animals may protect children against development of atopy and atopic asthma (IOM 2000). The IOM concluded:

- There is inadequate or insufficient evidence to determine whether or not an association exists between cow or horse allergen in the home and the exacerbation of asthma in sensitive children (IOM 2000).

**Summary of new evidence.** No recent studies were identified.

#### Conclusion.

- There is inadequate or insufficient evidence to determine whether or not an association exists between cow or horse allergen in the home and the exacerbation of asthma in sensitive children.

**Endotoxins.** **Background.** Endotoxins are compounds found in the outer membranes of gram-negative bacteria. These bacteria are associated with the presence of pets, rodents, and dampness or mold in homes. Toxic effects associated with endotoxins are considered to come from a specific endotoxin, lipopolysaccharide (LPS). Toxicologic and epidemiologic studies have demonstrated that endotoxins cause inflammatory and atopic responses in nonasthmatic and asthmatic subjects, but are also associated with decreased atopy. Variations in the structure of the polysaccharide chain or its lipid portion in different bacteria, the route of exposure, dose rate, age at exposure, and atopic status all potentially influence the biological effects. Adverse effects from endotoxins were apparently increased by other dampness-associated agents, and vice versa (IOM 2000). Because the available evidence supported predictions of either increased or decreased inflammatory responses in asthmatic individuals exposed to endotoxins, the IOM concluded:

- There is inadequate or insufficient information to determine whether or not an association exists between low-level indoor endotoxin exposure and asthma exacerbation (IOM 2000).

**Summary of new evidence.** In the Supplemental Material, Table S13 describes three recent studies available on endotoxins and exacerbation of asthma: in children, one cross-sectional study; in adults, one controlled challenge study; and in adults and children, one cross-sectional study. Two studies provide evidence associating elevated endotoxin levels with increased asthma severity and bronchial hyperresponsiveness (Rabinovitch et al. 2005; Thorne et al. 2005). Rabinovitch et al. (2005) measured personal daily endotoxin exposures of children in particulate fractions of PM  $\leq 2.5$   $\mu$ m diameter (PM<sub>2.5</sub>) and  $\leq 10$   $\mu$ m diameter (PM<sub>10</sub>). Endotoxin levels were related to clinically significant increases in asthma severity indices. Personal endotoxin exposures had a significant positive association with asthma symptom scores and with evening FEV<sub>1</sub>, but not with morning FEV<sub>1</sub>. Thorne et al. (2005) reported that endotoxin in bedroom floor dust was associated with significantly elevated ORs for asthma symptoms, asthma medication use, and wheezing; similar but lower associations were found for bedding endotoxin concentrations. No association of increased hay fever

risk or protection was found. These effects of endotoxins were found in adults, but not children. The authors concluded that U.S. household endotoxin exposures are associated with asthma symptoms, current asthma medication use, and wheezing, but not with allergy (Thorne et al. 2005). Kitz et al. (2006) found that controlled inhalation challenge to LPS in asthmatic adults caused a significant fall in FEV<sub>1</sub> 90 min later, reaching a maximum after 120 min.

Among studies cited by the IOM (2000), two provided prior evidence linking indoor endotoxin exposures to exacerbation of asthma: Experimental endotoxin exposure increased bronchial responsiveness to histamine among asthmatic adults, lasting 5 hr, but not among nonasthmatic adults (Michel et al. 1989); a cross-sectional study showed that endotoxin content of house dust was associated with increased asthma severity in dust mite-sensitized adults, but concentration of dust mite allergen was not (Michel et al. 1996). Overall, the evidence suggests that endotoxin exposure is associated with increased inflammation and asthma severity, but not increased allergy. In fact, a growing number of studies suggest that early-life microbiologic exposures to endotoxin may protect against later atopy (e.g., Illi et al. 2014; Lawson et al. 2012), although these exposures are also associated with increased wheeze (Celedon et al. 2007). This potentially protective effect is consistent with the “hygiene hypothesis,” which postulates that growing up in a microbially more hygienic and less diverse environment may increase risk of developing respiratory allergies (Heederik and von Mutius 2012). In contrast, damp or moldy buildings, even though they are associated with increased endotoxin, seem only to increase, not decrease, the development of respiratory disease, even in infants (Mendell et al. 2011).

The available evidence shows a clear association of indoor endotoxin exposure with exacerbation among asthmatic individuals, regardless of whether early exposures prevent later development of allergies. With strong and consistent effects shown in epidemiologic studies and controlled exposures, biologic plausibility for inflammatory effects, and appropriate temporal relationships, the evidence is close to documenting a causal relationship between endotoxin and exacerbation in asthmatics. However, the dual protective and adverse effects suggest caution in labeling indoor endotoxin simply as an adverse causal exposure. The roles of timing, dose, and circumstance of this protective response to exposure need to be better delineated.

#### Conclusion.

- There is sufficient evidence of an association between indoor endotoxin exposure and exacerbation of asthma.

**Houseplants. Background.** In theory, houseplants have the potential to release pollen, sap, and other plant parts, or to host pests or fungi that could release allergens, thus provoking allergic responses in people with the necessary sensitization (IOM 2000). Because no studies had been conducted to document these relationships, the IOM concluded:

- There is inadequate or insufficient evidence to determine whether or not an association exists between exposures from houseplants and the exacerbation of asthma (IOM 2000).

**Summary of new evidence.** No recent studies have addressed houseplant exposure.

**Conclusion.**

- There is inadequate or insufficient evidence to determine whether or not an association exists between exposures from houseplants and the exacerbation of asthma.

**Pesticides. Background.** Pesticides include many kinds of fungicides, herbicides, insecticides, and rodenticides. Pesticides are reportedly used in > 80% of U.S. homes. Inhalation and dermal absorption are two potential routes of exposure to pesticides used in the home. The diversity of pesticides used in homes suggests that their relationships to exacerbation of asthma will not be uniform (IOM 2000). The IOM concluded:

- There is inadequate or insufficient evidence to determine whether or not an association exists between pesticide exposures at the levels typically encountered in nonoccupational or residential settings and the exacerbation of asthma (IOM 2000).

**Summary of new evidence.** No recent data have directly addressed pesticides in relation to exacerbation of asthma. In a longitudinal study in the Center for the Health Assessment of Mothers and Children of Salinas (CHAMACOS), increased T helper 2, asthma, and wheeze outcomes in children were associated with reported maternal work in agriculture, which may be an indirect indicator of pesticide exposure to children, either prenatally or at home (Duramad et al. 2006).

**Conclusion.**

- There is inadequate or insufficient evidence to determine whether or not an association exists between pesticide exposures at the levels typically encountered in nonoccupational or residential settings and the exacerbation of asthma.

**Plasticizers. Background.** Plasticizers are chemicals that increase the flexibility of plastic resins. A major use of plasticizers is in polyvinyl chloride, widely used indoors in sheet vinyl flooring, wall coverings, vinyl upholstery, and shower curtains. These products are major sources of plasticizer residues, such as di(2-ethylhexyl) phthalate (DEHP) in homes (IOM 2000). DEHP was associated with airway inflammation and possibly with

asthma causation. Occupational exposure to plasticizers at high levels was also associated with exacerbation of asthma and asthma causation. The available evidence was very limited. The IOM review concluded

- There is inadequate or insufficient evidence to determine whether or not an association exists between nonoccupational exposure to plasticizers and the exacerbation of asthma (IOM 2000).

**Summary of new evidence.** Recent studies have demonstrated associations between the presence of plastic materials in homes and increased allergies, respiratory symptoms, and diagnosed asthma (Jaakkola and Knight 2008; Jaakkola et al. 2000, 2006; Mendell 2007), but have not evaluated effects on exacerbation of asthma.

**Conclusion.**

- There is inadequate or insufficient evidence to determine whether or not an association exists between nonoccupational exposure to plasticizers and the exacerbation of asthma.

**VOCs other than formaldehyde. Background.** Personal exposures to VOCs are dominated by indoor exposures, even in areas near major outside VOC sources. Hundreds of VOCs have been measured in indoor air, and their diversity suggests lack of uniformity in their potential associations with health. Buildings contain numerous sources of VOCs, including tobacco smoke, combustion appliances, building and renovation materials, house cleaning and maintenance products, solvents, photocopying machines, dry-cleaned clothes, personal care products, printed materials, room deodorizers, moth crystals, and chlorinated water. The main factors influencing exposures are the presence of materials, emission rates, ventilation, and personal behavior (IOM 2000). Very limited evidence suggested any associations between exposures to VOCs indoors and exacerbation of asthma. The multiple correlations between the few studied compounds and many others, often unmeasured, made it difficult to implicate specific VOCs. The IOM review concluded

- There is inadequate or insufficient evidence to determine whether or not an association exists between indoor residential VOC exposures and the exacerbation of asthma (IOM 2000).

**Summary of new evidence.** Although some studies have suggested associations between indoor VOCs or semi-VOCs and respiratory or allergic effects (Arif and Shah 2007; Choi et al. 2010; Mendell 2007; Rumchev et al. 2004), and between outdoor VOCs and exacerbation of asthma (Delfino et al. 2003), no new evidence related to exacerbation of asthma by indoor VOCs other than formaldehyde was identified.

**Conclusion.**

- There is inadequate or insufficient evidence to determine whether or not an association

exists between indoor residential VOC exposures (other than formaldehyde) and exacerbation of asthma.

**Pollen exposures indoors. Background.** The primary source of indoor pollen is infiltration from outdoors. Evidence of outdoor pollen in indoor dust samples suggests that it may be an important exposure for exacerbation of asthma (IOM 2000). Because of lack of any direct evidence, the IOM concluded:

- There is inadequate or insufficient evidence to determine whether or not an association exists between pollen exposure in the indoor environment and the exacerbation of asthma (IOM 2000).

**Summary of new evidence.** No recent evidence regarding indoor pollen exposure and exacerbation of asthma was identified.

**Conclusion.**

- There is inadequate or insufficient evidence to determine whether or not an association exists between pollen exposure in the indoor environment and the exacerbation of asthma.

**Down/feather bedding/synthetic bedding. Background.** This question was considered by the IOM (2000) in the context of bird-related allergy. Down bedding, compared with synthetic, was believed to exacerbate asthma because it harbored bird mites. The possibility was also considered that the increased wheeze reported among children using synthetic pillows resulted from increased mite exposure from synthetic pillows (IOM 2000). The IOM concluded:

- There is inadequate or insufficient evidence to determine whether or not an association exists between down pillows and the exacerbation of symptoms or lung function in asthmatics. Down pillows are believed to be a risk factor for asthma because of their documented mite content, rather than because of the presence of bird allergen (IOM 2000).

**Summary of new evidence.** Glasgow et al. (2011) reported that dust mite–sensitized asthmatic children who used new feather pillows and quilts had nonsignificant reductions in dust mite antigen exposures and wheeze outcomes. Many other studies, reviewed by Siebers and Crane (2011), have shown that feather pillows or quilts, compared with synthetic bedding, accumulate substantially lower concentrations of dust mite antigen and are consistently protective against many respiratory and allergic outcomes, including asthma in unselected populations of infants or children; however, evidence was not available on exacerbation of existing asthma.

**Conclusion.**

- There is limited or suggestive evidence that down/feather bedding may be protective for various respiratory effects relative to synthetic bedding, presumably due to lower content of dust mites, although evidence is not available regarding exacerbation of asthma.



### Low outdoor air ventilation rates.

**Background.** Low outdoor air ventilation rates in buildings lead to increased indoor concentrations of pollutants emitted indoors by occupants, furnishings, equipment, coatings and glues, cleaning products, and building materials. The IOM (2000) considered evidence on whether ventilation rates influenced indoor exposures, and concluded that low ventilation rates strongly influence the level of many indoor exposures, including potential asthma triggers (IOM 2000). Regarding health effects, the IOM concluded:

- Existing data are inadequate for conclusions regarding the association between ventilation rates or ventilation system microbiologic contamination and the exacerbation of asthma symptoms. However, both theoretical evidence and limited empirical data indicate that feasible modifications in ventilation rates can decrease or increase indoor concentrations of some indoor generated pollutants associated with asthma by  $\leq 75\%$  (IOM 2000).

**Summary of new evidence.** A substantial body of research, reviewed by Seppänen et al. (1999) suggests that lower ventilation rates in buildings are associated with a variety of symptoms, including upper and lower respiratory tract symptoms. The effect may be mediated by transmission of respiratory infections or by increased indoor humidity, leading to increased dust mites, fungi, and other microorganisms indoors (Seppänen et al. 1999). No studies were identified that explicitly examine this relationship to exacerbation of asthma. The intervention study by Burr et al. (2007) was considered ineligible because its intervention included increased outdoor air ventilation and mold removal, so study benefits were not specific to increased ventilation.

### Conclusion.

- There is insufficient evidence to determine whether an association exists between lower ventilation rates in buildings and exacerbations of asthma.

## Discussion

This review updates previous conclusions (IOM 2000) with recent evidence, elevating the strength of evidence for some exposures (Table 1). Major changed conclusions include a documented causal relationship with exacerbation for indoor dampness or dampness-related agents (in children); documented associations with exacerbation for dampness or dampness-related agents (in adults), ETS (in preschool-age children), and endotoxin; and limited or suggestive evidence of association with exacerbation for indoor culturable airborne *Penicillium* or total fungi, NO<sub>2</sub>, rodents (nonoccupational exposure), and feather/down pillows (protective relative to synthetic bedding). There is also limited or

suggestive evidence that dust mite, cockroach, dog, and dampness-related agents may exacerbate asthma even in nonsensitized individuals, suggesting proinflammatory effects.

In this review we identified limited recent evidence suggesting associations between quantified indoor culturable *Penicillium* or total fungi and exacerbation of asthma. If these associations are confirmed in future studies, this will call into question conclusions based on previous evidence—that available indoor microbial measurement strategies, especially culture-based assays of air samples, are not informative regarding indoor mold-related health effects (Mendell et al. 2011; World Health Organization 2009). Earlier reviews had found no consistent associations between respiratory or allergic health outcomes and quantitative microbial measurements. For instance, few studies had reported significant positive associations between indoor airborne culturable *Penicillium* and specific health outcomes (and these did not include exacerbation of asthma): current asthma in adults (Dharmage et al. 2001); both wheeze and persistent cough in infants, with dose–response relationships (Gent et al. 2002); and respiratory infections in infants (Müller et al. 2002; Stark et al. 2003). No associations were seen between indoor *Penicillium* and allergy (Dharmage et al. 2001) or allergic rhinitis (Stark et al. 2005).

Specific dampness-related causal agents for exacerbation of asthma may include biologic exposures in addition to fungi, such as bacteria, amoebas, and dust mites, or nonbiologic exposures such as chemicals emitted from damp materials (Mendell et al. 2011) [e.g., formaldehyde (McGwin et al. 2010) and 2-ethyl-1-hexanol (Norbäck et al. 2000)]. Furthermore, dampness is associated with respiratory infections (Fisk et al. 2010), the most common cause of exacerbation of asthma (Jackson and Johnston 2010).

Findings from interventional trials of single or multiple strategies, although the strongest study design for demonstrating causality, have often been inconsistent regarding successful reduction of exposures or exacerbation of asthma. A prior review has found that sufficient evidence is available to recommend three types of intervention to reduce asthma symptoms and possibly exacerbations: *a*) tailored in-home education and remediation of asthma triggers, *b*) integrated pest management, and *c*) combined elimination of moisture intrusion or leaks and removal of moldy items (Krieger et al. 2010). Additional rigorous research is needed to better document causality and determine the effectiveness of specific remediation strategies (Sauni et al. 2011).

This review did not include the indoor intrusion of outdoor pollutants, including ozone, SO<sub>2</sub>, NO<sub>2</sub>, fungal spores, pollen,

and nonbiologic PM such as diesel exhaust particles. Outdoor exposures to PM are associated with asthmatic symptoms (Delfino et al. 2002; Rabinovitch et al. 2006; Sheppard et al. 1999) and exacerbations (Chang et al. 2009; Salam et al. 2008; Spira-Cohen et al. 2011). Experimental exposures to SO<sub>2</sub> and ozone result in exacerbation of asthma, airway inflammation, and increased response to inhaled allergens (Linn and Gong 1999; Peden et al. 1995). Some strategies for reducing pollutant exposures indoors may also reduce indoor exposures to outdoor-generated pollutants. Such strategies might include using air conditioning and high-efficiency particulate filters in home mechanical systems, and thorough daily washing to remove allergens settled on people (Diette et al. 2008). However, reducing entry of outdoor pollutants by keeping doors and windows closed or sealing a building against air infiltration would result in increased indoor concentrations of indoor-generated pollutants, unless effectively enhanced particle filtration or gas air cleaning strategies were used. In contrast, increasing ventilation rate to dilute indoor-generated pollutants may increase indoor concentrations of outdoor pollutants. The advantages and disadvantages of ventilation-related strategies for controlling indoor exposures must be weighed, considering the type and amounts of specific indoor and outdoor pollutants. For a more detailed discussion of the impact of ventilation on indoor exposures relevant to asthma, see Chapter 10 of the IOM review (IOM 2000).

This review builds on the conclusions of the IOM (2000) document without thoroughly reexamining prior evidence and without inclusion of unpublished studies, and therefore is limited in its scope and potentially subject to publication bias. A further limitation is the lack of uniformity in reviewed studies of the definitions for exacerbation of asthma and the tools for assessing exacerbation. In addition, the literature used in this review was restricted to findings published in English. Therefore, conclusions drawn from this review should be considered provisional.

In future research, the inconsistencies in current research may be reduced by improved exposure assessment, such as for dampness-related microbial agents (e.g., non-culture-based, species-specific assays) and determination of subjects' sensitization. More rigorous study designs should be emphasized: performing cross-sectional studies only for hypothesis generation; using intervention, prospective, or true nested case–control designs to confirm associations; and conducting rigorously designed intervention studies with careful measurements of exposures and health to document the causality and effectiveness of real-world environmental interventions.

## Conclusions

In this review we have revised prior evidence-based conclusions about relationships between specific indoor exposures and exacerbation of asthma. Exposures to indoor dampness and dampness-related agents have a causal relationship with exacerbation of asthma (in children). Exposures to dampness-related agents (in adults), ETS (in preschool-age children), and endotoxin are associated with exacerbation of asthma. Exposures to indoor culturable *Penicillium* and total fungi, rodents (nonoccupational exposure), and NO<sub>2</sub> have limited or suggestive evidence for an association with exacerbation of asthma, and limited data suggest that exposures to feather/down pillows may have a protective association relative to synthetic bedding. Exposures to dust mite, cockroach, dog, fungi, and dampness-related agents also have limited or suggestive evidence for an association with exacerbation of asthma even in nonsensitized individuals, suggesting proinflammatory effects. Prospective or intervention studies are needed to confirm hypothesized associations, and rigorous real-world environmental intervention trials are needed to demonstrate effective remediation and resulting reductions in exacerbation of asthma.

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# THE TASK FORCE ON MOLD IN LOUISIANA: FOLLOW UP SUMMARY REPORT – APRIL 2016

## ADDENDUM 5



# A Review of Adult Asthma Hospitalizations in Louisiana, 2006-2011

Jocelyn Lewis, PhD, MSPH; Michelle Lackovic, MPH; Shannon Soileau, MPH

This paper examines asthma inpatient hospitalizations for Louisiana residents ages 15 years and older from 2006 to 2011. There were 21,398 asthma hospitalizations, with 14,401 unique cases. Approximately 22 percent of cases had more than one asthma hospitalization. The case rate of adults hospitalized for asthma decreased significantly during the six-year period. However, the rate of all adult hospitalizations for asthma did not significantly change. Black women had the highest age-adjusted case rate, followed by white women. Days hospitalized averaged from 2.8 to 4.9 among the youngest to the oldest age groups, respectively. Differences between black and white patients were observed in type of payment and admit source. Parish rates varied significantly: Caldwell, Jefferson Davis, and LaSalle had rates that were at least twice the mean state rate. Rural parishes had a significantly higher rate than non-rural parishes. The information in this review can be used to target outreach and prevention activities.

## BACKGROUND

Asthma is a chronic lung disorder characterized by inflammation of the small, medium, and large airways and recurrent symptoms of wheezing, chest tightness, shortness of breath and persistent cough. It can be controlled through appropriate medical care that emphasizes compliance with pharmacological treatment and avoidance of environmental triggers. There are a number of asthma triggers including aeroallergens, respiratory infections, stress, cold air, and exercise. Co-morbidities, such as obesity and cigarette smoking also impact the control of asthma symptoms. Poorly controlled asthma can result in emergency department visits, hospitalizations, and, on rare occasion, death.

Adult asthma is a major health burden in Louisiana impacting both patients and their families. About one in 10 Louisianans suffers from asthma during his or her lifetime. Hospitalizations for asthma are generally considered preventable and typically represent a failure in asthma management.<sup>1</sup> The evaluation of asthma-related hospitalizations is an important step to understanding the global

impact of asthma in Louisiana. It is anticipated that these data would be useful in the design and prioritization of adult asthma prevention and intervention efforts.

## METHODS

Asthma hospitalization data from 2006 to 2011 for adult Louisiana residents were extracted retrospectively from the Louisiana Hospital Inpatient Discharge Data (LAHIDD). LAHIDD contains detailed information related to inpatient hospital discharges from all licensed, non-federal acute care hospitals in Louisiana. Records were selected for review for all residents 15 years and older with a primary discharge diagnosis for asthma (ICD- 9th revision: 493.00-493.92).

For individuals with more than one hospitalization during this six-year period, only the record from the first inpatient hospitalization was included in the primary analysis; however subsequent admissions were used to calculate total hospitalization rates and seasonal variation. Data were stratified according to race: African American/Black,

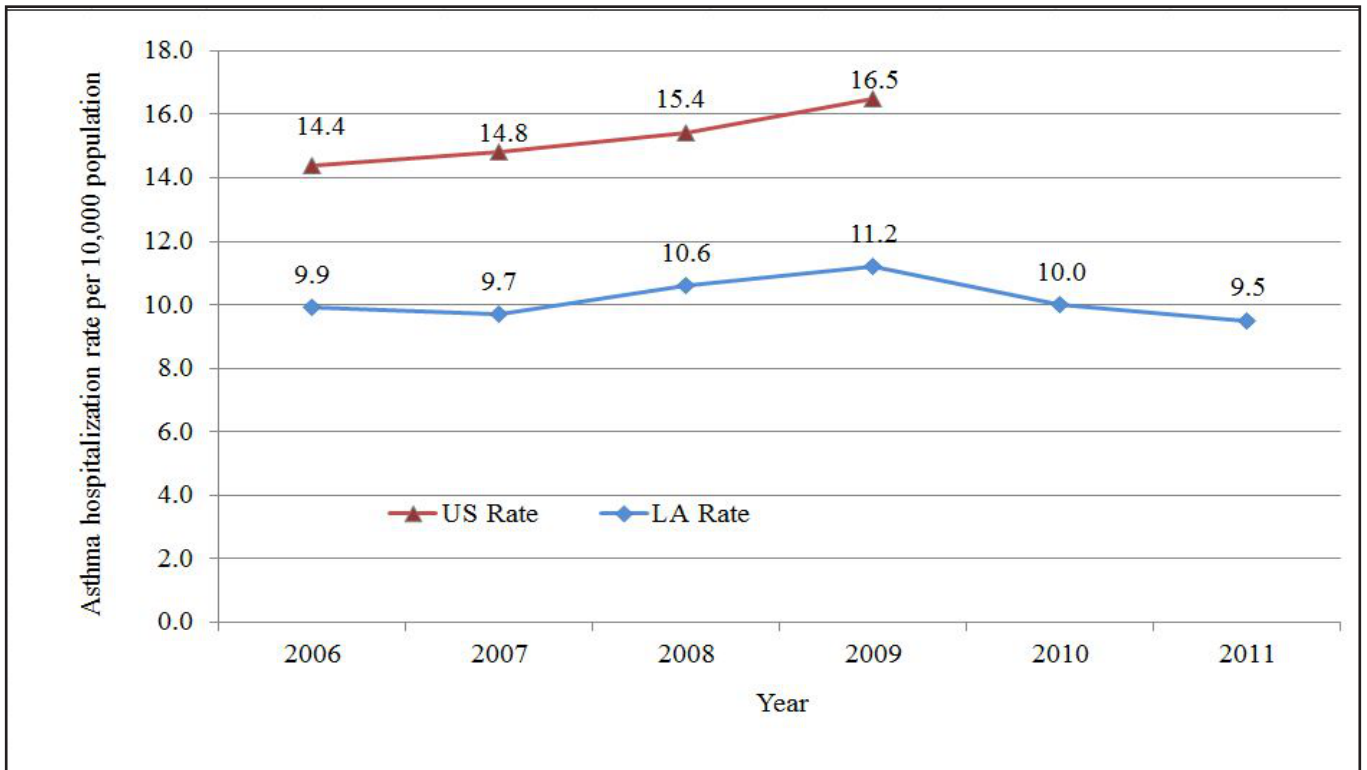


Figure 1: Age-Adjusted Adult Asthma Hospitalization Rates, United States & Louisiana. 2006-2011

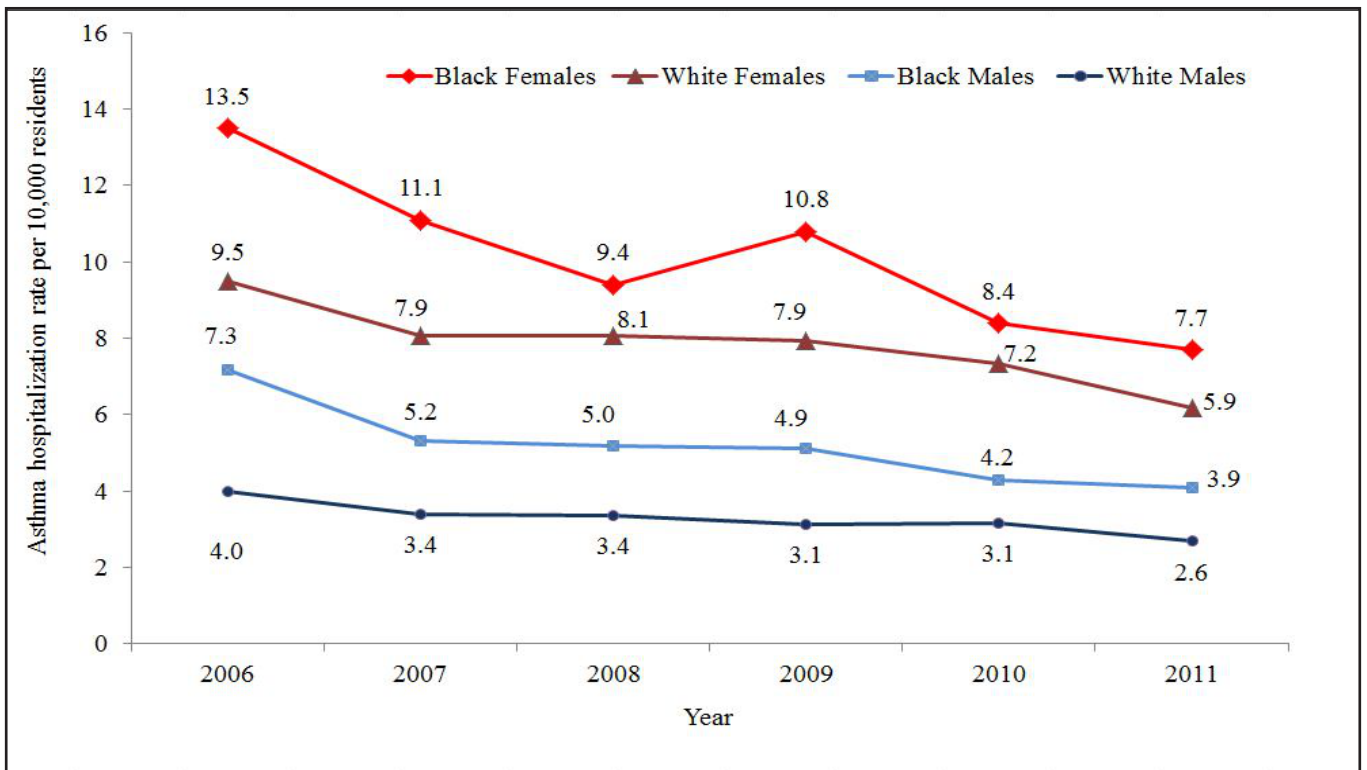


Figure 2: Annual Age-adjusted Asthma Hospitalization Case Rates by Race & Sex, Louisiana. 2006-2011

Caucasian/White, Asian/Pacific Islander, Native American/Alaskan native, other and unknown. Analyses by race for annual case rate, admittance source, repeat hospitalizations, and payment source included only black and white cases.

Denominator data used annual Louisiana population estimates for years 2006 through 2009 from the National Cancer Institute's Surveillance Epidemiology and End Results (SEER), and 2010 to 2011 from the US Census.<sup>4,5</sup> SEER data were adjusted for fluctuations in population due to Hurricane Katrina. National asthma hospitalization rates for individuals ages 15 and older were obtained from the National Hospital Discharge Survey (NHDS); the 2010 national rate was not included due to a change in NHDS' rate calculation by age groups. National hospitalization data for 2011 were not available.

To evaluate the effect of rural and urban environments on asthma morbidity, the National Center for Health Statistics' (NCHS) urban-rural classification system was used to assign each parish to one of six urbanization levels. The most urban category consisted of large metropolitan areas, and the most rural included non-metro, non-core counties. For the purpose of this analysis, the six NCHS categories were combined into three: rural, small-medium metro, and large metro.

Rates and 95% confidence intervals were calculated for total cases, total hospitalizations, age group and cases by race, sex, and parish. All rates were age-adjusted to the 2000 US Census population. Patient addresses were geocoded to a parish. The numbers of admissions per month were aggregated. Statistical analyses were conducted using Statistical Analysis Software (SAS 9.3) and Windows Program for Epidemiologists software (WINPEPI). For changes in annual rates per race-sex group, linear regression and Tukey post hoc tests were calculated. Kruskal Wallis tests with Bonferroni adjustments for multiple comparisons were calculated for differences between US and LA rates, age groups and stratified race-sex groups. Chi-square or t-tests were calculated to evaluate the difference among age, admittance source, repeat visits, payment source, and rural-urban classification. Relative standard errors were calculated for rates to determine instability; rates above 30 percent were deemed unstable and potentially unreliable. All rates were stable. Hewitt's

rank-sum test was calculated to determine statistical significance of the 4-month seasonal peak. Statistical significance for all tests was set at  $p < 0.05$ .

## RESULTS

During the six-year period (2006-2011), there were a total of 21,398 adult inpatient hospitalizations with a primary discharge diagnosis of asthma in Louisiana or approximately 3,600 per year. Many individuals were hospitalized more than once during the study period. After eliminating repeat admissions, there were 14,401 individuals hospitalized for asthma or approximately 2,400 adult asthma cases per year (Table 1).

Annual age-adjusted adult asthma hospitalization rates for the US and Louisiana are compared in Figure 1. Many individuals were hospitalized more than once for asthma, thus, Figure 1 is not a measure of persons with asthma. The mean US rate was significantly higher than Louisiana's mean rate (15.3 vs 10.2;  $p = 0.002$ ). During the four-year period (2006-2009), the US rates significantly increased from 14.4 in 2006 to 16.5 in 2009 ( $p = 0.03$ ). During this same time period, Louisiana's overall adult hospitalization rate for asthma did not significantly change ( $p = 0.94$ ).

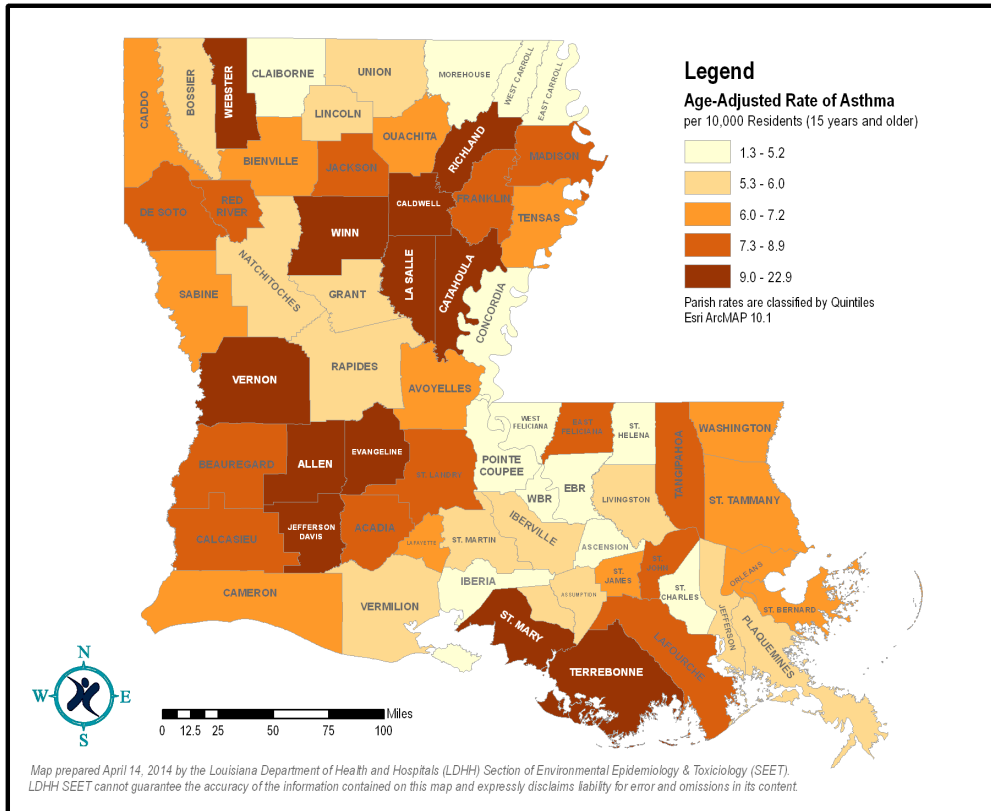
As depicted in Table 1, there were a total of 14,401 adults hospitalized for asthma at least once during the six-year period. Black and White adults accounted for 91% of all asthma cases ( $n=13,106$ ), therefore the remaining analyses only include black and white cases.

There were 8,349 white cases (58%) and 4,757 black cases (33%). The age-adjusted rate was highest for black females (10.2 per 10,000) followed by white females (7.8 per 10,000), black males (5.1 per 10,000) and white males (3.3 per 10,000). Overall, females had significantly greater rates than males ( $p = 0.0002$ ); and the rate for Black females was significantly greater than the rates for either black or white males ( $p < 0.0001$ ).

Figure 2 graphically represents rates by race and sex over the six-year period. Case rates for all stratified race-sex groups decreased significantly during the 6-year review period. The overall percent decrease in rates from 2006 to 2011 ranged from 35% (white males) to 51% (black males).

**Figure 3:** Age-Adjusted Rate of Adult Asthma in Louisiana.

**About this map:** Adult asthma hospitalization case rates from 2006-2011 were age-adjusted to the 2000 U.S. Census population and are classified by Quintiles.

**Figure 4:** Urban-Rural Parishes in Louisiana.

**About this map:** Louisiana parishes were designated as large urban, semi-medium urban or rural using National Center for Health Statistics data, 2006. Categories are based on population density and proximity to metropolitan areas, with urban areas more population-dense.

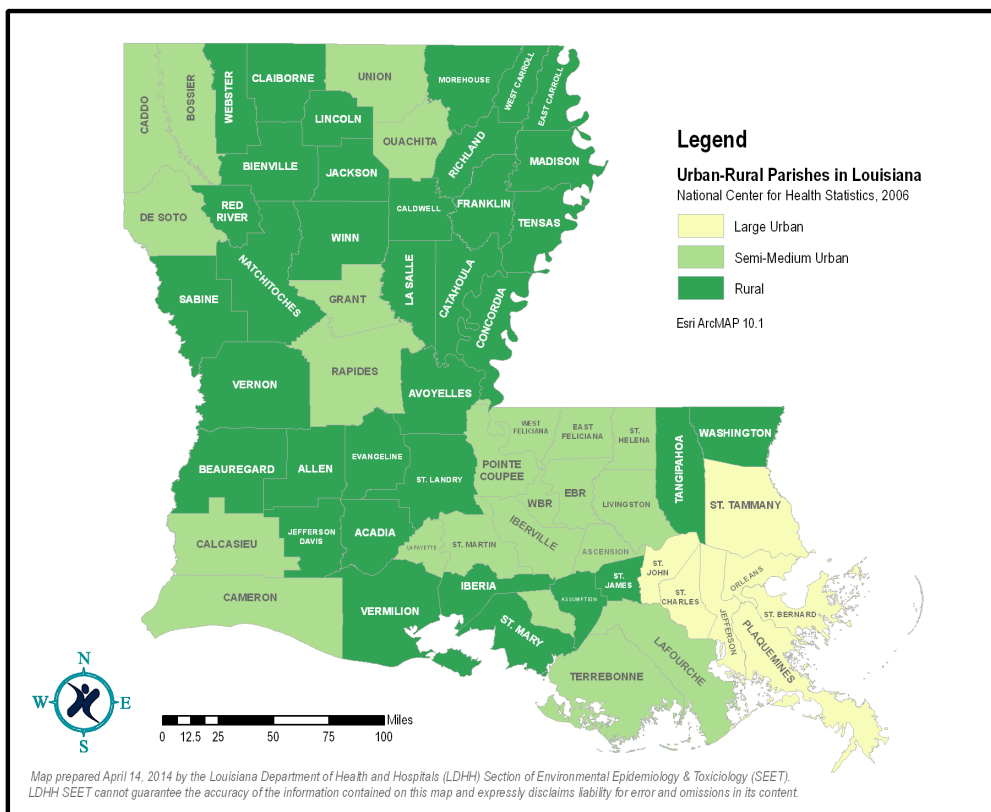


Table 1: Demographics of Adult Asthma Hospitalization, Louisiana 2006-2011

	Total Count	% of all Asthma Cases	Average Annual Count	Average Annual Age-adjusted Rate <sup>a</sup>	95% CI	P-value (annual rate changes) <sup>b</sup>
All LA Asthma hospitalizations	21,398	**	3,566	10.2	9.5 -10.8	0.940
All LA Asthma cases	14,401	100%	2,400	6.8	6.0 - 7.6	0.012
Black and White asthma cases only	13,106	91%	2,184	6.6	5.4 - 7.8	0.006
Age Group (years)						
15-34	1,796	12%	299	2.7	2.2 - 3.1	0.054
35-64	6,600	46%	1,100	7.2	5.7 - 8.7	0.010
>=65	4,710	33%	785	15.0	11.9 - 18.0	0.009
Race and Sex						
Black	4,757	33%	793	7.6	5.9 - 9.3	0.010
Females	3,378	23%	563	10.2	7.9 - 12.4	0.013
Males	1,379	10%	230	5.1	3.8 - 6.3	0.015
White	8,349	58%	1,392	5.5	4.7 - 6.4	0.006
Females	6,114	42%	1,019	7.8	6.5 - 9.0	0.009
Males	2,235	16%	373	3.3	2.8 - 3.8	0.004

Notes: (a) All rates are stable, with relative standard errors (RSE) below 30%. b) 2-tailed p-values show the significance for linear regression; bold p-values are statistically significant at alpha 0.05.

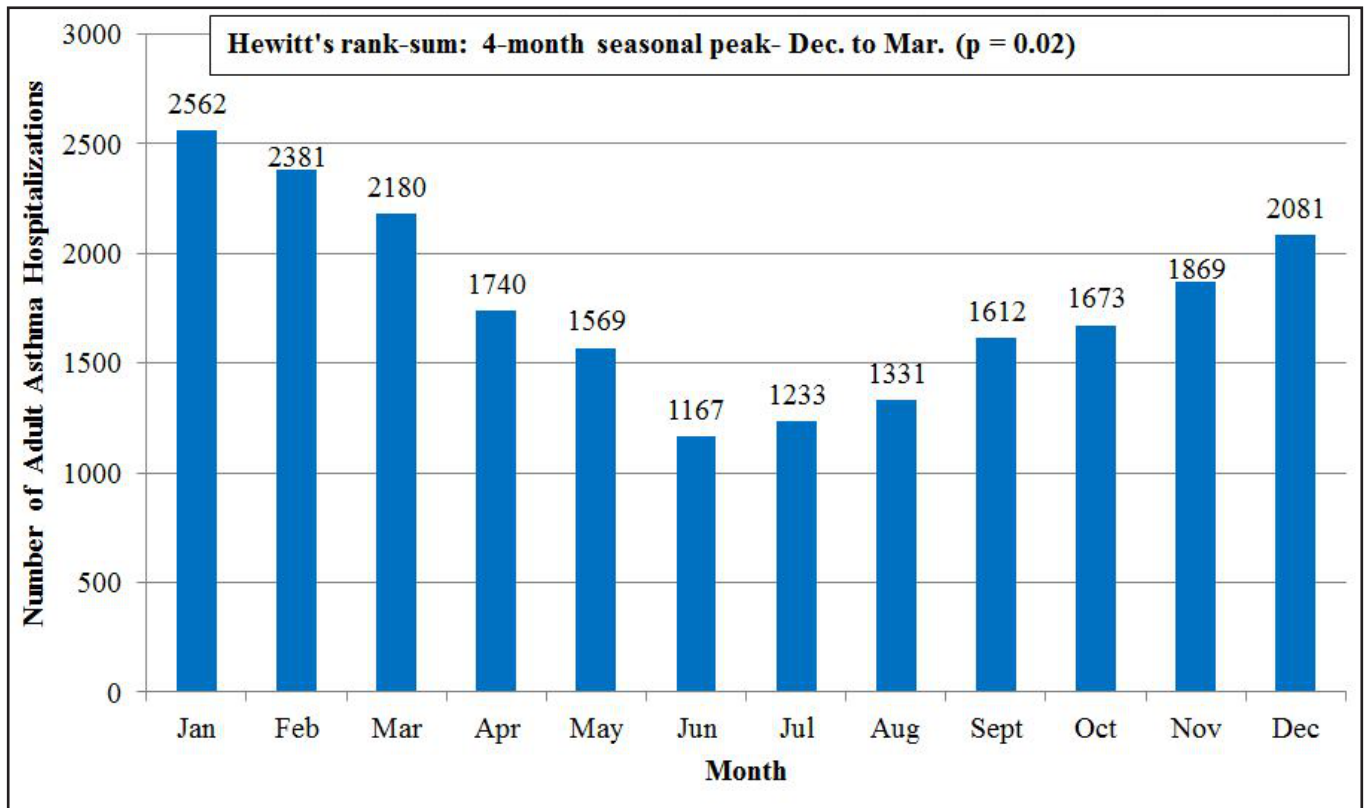
The mean age of hospitalized cases was 56.3 years, and individuals age 35 to 64 made up 46% of the cases. White cases were on average older (mean years, 59.2) than black cases (mean years, 51.5) ( $p < .0001$ ). The asthma hospital admission rate significantly increased with age: 2.7 (ages 15-34), 7.2 (ages 35-64), and 15.0 ( $\geq 65$  years). At the same time, the average length of stay also significantly increased from 2.8 to 4.9 days among the youngest to the oldest age groups, respectively ( $p = 0.001$ ). For all age groups, there was a rate decrease over the six-year study period. The rate among cases 65 years and older decreased 43% from 20 in 2006 to 11.5 in 2011 ( $p = .009$ ), and the rate for cases 35-64 years decreased 42% from 9.6 to 5.6 ( $p = .010$ ) during the six-year period. The case rate for 15-34 years

decreased 38% from 3.4 to 2.1 ( $p = 0.054$ ).

Admission to the hospital was most commonly through the emergency department (ED) (50%) and physician/clinic referral (50%). Source of admission varied significantly by race. Black patients were significantly more likely to be admitted through the ED than white patients (57% vs 45%,  $p < .0001$ ) (Table 2).

Single and repeat hospitalizations are depicted in Table 2. Overall, 22% of black and white cases had more than one hospital visit during the six-year time period. Black females had the highest percent of readmission during the study period (28%), followed by black males (23%), white females (22%), and white males (16%). The mean number of repeat admissions ranged from a low of 2.8 for white men,





**Figure 5:** Adult Asthma Hospitalizations by Month, Louisiana 2006-2011. Note: Seasonal counts are based on admission dates (exception: 1 count in Nov. based on discharge date, since admit date unknown).

to a high of 3.8 for black men. The frequency of multiple (>6) hospitalizations was twice as high for Black females and males as for White females and males ( $p < 0.001$ ). The 301 Black and White cases with six or more hospitalizations during the six-year period accounted for 2854 hospital admissions, or 13% of all adult asthma hospitalizations. A single individual case accounted for 56 admissions totaling 195 hospitalized days.

Medicare was the largest payor source for asthma hospitalizations (40%) followed by Medicaid (22%). About 20% of patients under the age of 65 were covered by Medicare. Black patients were more likely than White patients either to be covered by Medicaid (28% vs 13%,  $p < 0.0001$ ) or to be uninsured (12% vs 5%;  $p < 0.0001$ ). Asthma hospitalizations during this 6-year period were estimated to cost approximately \$7 million or \$19,500 per hospitalization. Workers' Compensation, often

used by proxy to ascertain potential work-related hospitalizations, accounted for less than 1% of all asthma hospitalizations.

Average annual age-adjusted case rates and urban-rural designations by parish are shown in Figures 3 and 4, respectively. The average annual rate for Louisiana was 7.3 cases per 10,000 residents; while parish rates ranged from 1.31 (Claiborne) to 22.93 (LaSalle). Three parishes had rates that were greater than twice the mean rate: Caldwell (15.29), Jefferson Davis (17.08), and LaSalle (22.93). The mean age-adjusted hospitalization rate of the 35 parishes classified as rural was 8.38 which was statistically greater than the mean age-adjusted rates for 22 small-medium parishes (6.02,  $p = 0.004$ ), and the 7 large urban parishes (6.16,  $p = 0.006$ ).

Monthly trends were observed for all adult asthma hospitalizations. The greatest number of admissions was in January (2,562), with the lowest

number admitted in June (1,167). Hewitt's rank-sum test statistically confirmed the four-month seasonal peak was from December to March ( $p = 0.02$ ) (Figure 5).

## DISCUSSION

This study demonstrates the overall rate of asthma hospitalizations has remained largely unchanged between 2006 and 2011. Furthermore, when repeat hospitalizations for the same individual are censored, the resulting numbers suggest that the rate of adult asthma hospitalization has been decreasing for all race-sex categories. This corresponds with general trends at the national level showing that while the number of persons with asthma has increased over the past decades, there have not been comparable increases in the number of health care encounters for asthma.<sup>2</sup>

While better asthma management has reduced overall hospitalization rates, sharp racial and sex disparities exist within Louisiana and at a national level. Studies have shown that asthma hospitalizations for blacks are 1.4 to 4.0 times more likely than for whites, and that women with asthma report significantly lower quality of life.<sup>8</sup> These same patterns were observed in our data which showed that women were significantly more likely than men to be hospitalized for asthma. This was especially relevant for black women who had a hospitalization rate that was two times greater than the other race-sex categories.

Our findings are consistent with other data on the prevalence of asthma among Louisiana residents. Louisiana's Behavioral Risk Factor Surveillance System (BRFSS), a CDC-supported annual telephone survey that collects information on health risk behaviors, preventive practices, and health care access, estimated adult asthma prevalence in Louisiana at 11.6 % in 2008-2010 and 10.8 in 2006-2008. BRFSS data indicate that prevalence rates were higher among Black men and women.<sup>3</sup>

In our study, asthma hospitalizations increased with age. Older adults were hospitalized two days longer than younger adults. However, BRFSS prevalence data suggest that asthma rates decrease with age (16.9% for ages 16-24 and 9.7% for adults > 65).<sup>3</sup> The difference between prevalence and hospitalization rates likely represent hospitalizations

of older adults with co-morbid conditions causing more complicated and more severe asthma. The prevalence of chronic conditions among asthma patients is also seen in the large percentage of cases younger than 65 years who were on Medicare (approximately 20% of all cases less than 65 years). In addition to covering people age 65 years and older, Medicare also provides medical coverage to younger disabled people and those who have permanent kidney failure. Similar to older patients, these cases may also have other chronic, health conditions in addition to asthma.

The race-sex differences in admit source and insurance status suggest that differences in asthma management may be operational. More than half of all black cases were admitted to the hospital through the ED (58%) compared with white cases who were more likely to be admitted from an outpatient clinic (53%). While national data show a heavy reliance on the ED for asthma management, the racial difference in our study is noteworthy.<sup>8</sup> Other studies have documented that EDs are more likely to misdiagnose asthma as bronchitis or viral infections, and less likely to refer patients to an asthma specialist.<sup>9</sup>

About one-quarter of all our cases were on Medicaid or uninsured, and this percentage was higher among black patients. Uninsured and underinsured patients are less likely than private insurance patients to have ongoing care with an asthma specialist, to have adequate follow-up care and to have supportive physician-patient communication. These factors impact asthma self-management and increase the risk of disease exacerbation, and ultimately, hospitalization. The National Asthma Education and Prevention Program (NAEPP) recommends that all patients with moderate or severe asthma be seen by asthma specialists and treated with long-term controller medications, e.g., inhaled corticosteroids (ICS), in addition to quick relief medications, e.g., albuterol.<sup>1</sup> Despite these national recommendations, studies have shown that Black patients are less likely to be seen by an asthma specialist and are less likely to receive a prescription for inhaled corticosteroids. Once prescribed, patient adherence to asthma medication ranges from 50-60%, and may be lower among black patients.

Twenty-two percent of all cases had multiple hospitalizations. These data might suggest that a significant percentage of Louisianans receive poor

asthma management and are at risk for future asthma attacks and mortality.<sup>1</sup> Our study indicates that 13% of all hospitalizations were due to the 301 patients who had more than six visits during the six-year period. Targeting this high-risk population is an essential component of improving asthma outcomes and reducing medical care costs.

Although the cause of asthma is not entirely understood, a variety of factors are known to trigger asthma including irritants, aeroallergens, respiratory infections, exercise, and cold air. Hospitalization rates by season were similar to national trends, with peak asthma admissions in the winter months (December through February) and a decline in admissions in the summer months (June through August). A previous New Orleans-based study attributed the increased late fall-to-early winter asthma hospital

admissions to sudden climatological changes (e.g. decreasing relative humidity, wind velocity and temperatures with rising barometric pressure), along with increasing burden of aerosolized fungal and ragweed pollen spores. Aside from seasonality, our data do not provide information about possible environmental factors leading to hospitalization for asthma. Possible asthma triggers impacting Louisiana residents, however, can be estimated through other data sources.

Tobacco smoke continues to be a common and significant risk factor for poor asthma control, and is a potential exposure for many asthmatics. Despite advances in tobacco cessation programs nationwide, there has not been a large decrease in smoking rates in Louisiana. While the percent of current smokers decreased 6% nationwide, the

Table 2: Characteristics of Adult Asthma Hospitalizations in Louisiana, 2006-2011

	TOTAL		BLACK FEMALES		BLACK MALES		WHITE FEMALES		WHITE MALES	
	#	%	#	%	#	%	#	%	#	%
Black and White asthma cases	13,106	100	3,378	26%	1,379	11%	6,114	47%	2,235	17%
ADMIT SOURCE <sup>a</sup>										
Emergency Room	6,462	49%	1,862	55%	828	60%	2,715	44%	1,057	47%
Physician/Clinic	6,393	49%	1,444	43%	521	38%	3,290	54%	1,138	51%
Other	251	2%	72	2%	30	2%	109	2%	40	2%
REPEAT HOSPITALIZATIONS										
1	10,183	78%	2,447	72%	1,062	77%	4,799	78%	1,875	84%
2 to 5	2,622	20%	806	24%	268	19%	1,211	20%	337	15%
>5	301	2%	125	4%	49	4%	104	2%	23	1%
PAYMENT SOURCE <sup>a</sup>										
Medicaid	2,403	18%	1,024	30%	318	23%	854	14%	207	9%
Medicare	5,398	41%	1,105	33%	447	32%	2,742	45%	1,104	49%
Private Health Insurance	3,629	28%	790	23%	269	20%	1,887	31%	683	31%
Self-Pay	1,031	8%	325	10%	257	19%	320	5%	129	6%
Other	645	5%	134	4%	88	6%	311	5%	112	5%

Notes: (a) Other includes TRICARE (insurance for armed forces members and family) and unknown.



percentage of Louisiana adults identifying as current smokers decreased only 4% between 2000 and 2010. Furthermore, tobacco use was reported more often by males than females and by white than black individuals.<sup>3</sup> Even though cigarette smoke is known to trigger asthma attacks, about 25% of asthmatics in Louisiana smoke cigarettes while nationally about 21% of people with asthma smoke. Secondhand smoke can also negatively impact asthmatics. Exposure to secondhand smoke outside the home was reduced in 2007 with implementation of Louisiana's Smoke-Free Air Act which prohibits smoking in most public places and workplaces, including all restaurants. However, 34% of Louisiana survey respondents with asthma reported that "smoking is done inside the home."<sup>3</sup>

Despite the reduction of smoking in the workplace, there are many other occupational exposures that can exacerbate asthma. Work-exacerbated asthma is defined as asthma due to conditions at work and is generally associated with inhaling chemicals, gases, fumes, dusts, and solvents, or workplace factors such as high humidity and extreme temperature. Studies estimate that about one in five asthma patients report that his/her symptoms worsen at work.<sup>14,15</sup>

There was notable variation of asthma hospitalizations by parish with rates ranging from 1.3 to 22.9 cases per 10,000 residents. Unlike other research that has found elevated prevalence of asthma hospitalizations in urban areas, our results show a higher rate of asthma hospitalizations in rural areas, particularly in the northeast and northcentral regions of the state. Variation by parish may reflect a number of issues including access to care, environmental exposures, and socioeconomic status.

### LIMITATIONS

This review has several limitations. First, hospitalization data may underestimate the actual number of asthma hospitalizations in Louisiana because of 1) incomplete reporting of all hospitals to LAHIDD; 2) Louisiana residents hospitalized in another state are not reported to LAHIDD; and 3) LAHIDD only includes reports from non-federal, acute care hospitals. Therefore, cases hospitalized through the Veterans Affairs (VA) Hospital are not

included in the current analysis.

Second, the case rate for 2006 may be artificially inflated as 2006 was the first year for inclusion in this data review, and cases with multiple visits were not included in subsequent years. Rates may also be impacted by Hurricanes Katrina and Rita which resulted in fluctuations in population, particularly in the southern parishes.

Third, we may have over- or under-estimated true asthma-related hospitalization since we used ICD-9 discharge coding to identify asthma hospitalizations. It is likely that some admissions that were discharge coded as "asthma" actually represented exacerbations of co-morbid conditions, such as heart failure in a patient with a history of asthma. The opposite is also equally plausible, i.e. that some asthma-related admissions might have been coded incorrectly as an alternative diagnosis.

### CONCLUSIONS

This is the first in-depth analysis of adult asthma hospitalizations in Louisiana. Our results show a disproportionate burden of asthma hospitalizations among black, female, and rural residents. While potential healthcare, behavioral, and socioeconomic factors contributing to disparities among asthma patients cannot be fully addressed, this analysis provides an important foundation for prioritizing and targeting prevention and outreach efforts. Public health efforts to mitigate the impact of asthma focus on increasing the proportion of persons with current asthma who receive appropriate asthma care according to NAEPP guidelines.<sup>1</sup> Some of the factors addressed in the guidelines include increasing the proportion of asthma patients who receive appropriate medical evaluation and drug treatment, educating patients about proper responses to an asthma episode, and reducing exposure to asthma triggers. Adherence to these improvements in care among Louisiana's asthmatics would likely contribute to a decrease in severe asthma outcomes. Periodic reviews of asthma morbidity data, such as hospitalization visits, are an important tool in focusing and evaluating outreach and prevention efforts.

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**Dr. Lewis, Ms. Lackovic and Ms. Soileau** are all affiliated with the Louisiana Department of Health and Hospitals, Office of Public Health, Section of Environmental Epidemiology & Toxicology, New Orleans, LA.

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# THE TASK FORCE ON MOLD IN LOUISIANA: FOLLOW UP SUMMARY REPORT – APRIL 2016

## ADDENDUM 6

Louisiana Toxic Mold Task Force  
September 29, 2014, 9am-12pm  
Meeting Summary

Task Force Members in Attendance:

Buddy Amoroso, Apartment Association of Louisiana  
Todd Folse, Louisiana Housing Corporation  
Angela Gaines, Southern University Law Center  
Blake Hudson, Louisiana State University (LSU) Law Center  
Frank Morse, Louisiana Home Builders Association  
Felicia Rabito, Tulane University School of Public Health & Tropical Medicine (TUSPH&TM)  
Raoult Ratard, Louisiana Department of Health and Hospitals (LDHH)  
Matt Ritchie, Louisiana Realtors Association  
Chris Styron, Louisiana Department of Justice  
Liz Sumrall, LSU Office of Health Affairs and Medical Education  
Louis Trachtman, LDHH  
Doug Traylor, Louisiana State Licensing Board for Contractors  
LuAnn White, LDHH, TUSPH&TM  
Jeff Williams, Louisiana State Medical Society

Task Force Members in Absence:

Jonathan Chapman, Louisiana Primary Care Association

Attendees:

Dianne Dugas, LDHH  
Jocelyn Lewis, LDHH  
Darcie Olexia, LDHH  
Melanie Ramson, LDHH  
Jose Serrano, LDHH  
Collette Stewart-Briley, LDHH

Following introductions, Darcie Olexia, LDHH, presented attendees with an information packet containing a meeting agenda, contact information for all task force members, a copy of Act No. 258, LDHH's Indoor Air Quality Education Service Case Report Summary, the Environmental Law Institute's Database of State Indoor Air Quality Mold Laws, and the following publications:

- Grimsley, F. et al. "Indoor Environmental Exposures for Children with Asthma Enrolled in the HEAL Study, Post-Katrina New Orleans." *Environmental Health Perspectives* 120 (2012) 11
- Barbeau, D. et al. "Mold Exposure and Health Effects Following Hurricanes Katrina and Rita." *Annual Review of Public Health* 31 (2009) 2.1-2.14
- Rando, R. et al. "Respiratory Health Effects Associated with Restoration Work in Post-Hurricane Katrina New Orleans." *Journal of Environmental and Public Health* (2012)  
*doi:10.1155/2012/462478*

The functions of the task force, as outlined in the instrument, were read for the record:

1. Serve as an advisory body to the legislature on policies and practices that protect all people of this state, particularly tenants, consumers, and vulnerable populations from harm related to toxic mold.
2. Serve as a coordinating forum between and among state agencies, local government, and nongovernment groups on matters related to toxic mold.
3. On a regular basis, research and review state regulations, guidelines, policies and procedures that pertain in any way to toxic mold and make recommendations to the governor, the legislature and the secretary of the Department of Health and Hospitals as deemed necessary and appropriate by the chairman.

On or before January 1, 2015, and annually thereafter, the task force shall prepare and submit to the governor and the legislature a report on the status of public health risks from toxic mold in Louisiana. The report shall include without limitation the following:

1. An assessment, based on scientific evidence, of the nature, scope and magnitude of the adverse environmental and health impacts caused by toxic mold in the state.
2. Measurement based on scientific evidence, of the adverse health effects of exposure to molds on the general population, including specific effects on any subgroups identifiable as being at greater risk of adverse health effects when exposed to molds.
3. Identification of actions taken by the state, local governments, and any other public or private organizations that have made a positive impact on mitigating the harm to public health of toxic mold.
4. Identification of best practices for the control of mold in a cost-effective and environmentally sound manner.

Task force members and attendees provided perspectives on matters related to how mold affects health, best practices of mold mitigation, and positive actions that have been taken and can be taken in the future to mitigate potential adverse mold effects on property and health.

#### *Health Effects:*

Task force members agreed that referencing mold as “toxic mold” incites anxiety and that defining the characteristics of mold is an important first step in responding to the legislative directive. There are no health or regulatory standards available in which to accurately measure and compare levels of mold in indoor air environments; measurement and speciation are not effective mitigation tools in the prevention of adverse health effects. Controlling humidity and eliminating the water intrusion source followed by remediation is the most effective approach in eliminating adverse health effects.

Task force members with medical expertise noted that immunocompromised individuals are generally at increased risk of exposure response. Institutes of Medicine research was cited that mold variably affects individuals with some being allergic and reactive; if the reaction is allergy specific, then the exposure is not a typical dose-response.

Post-hurricane Katrina research was shared that studied indoor environmental exposures for children with asthma who were already enrolled in an asthma prevention study. Research results noted that asthmatic children with well-controlled symptoms and medical management did not react negatively to exposures.

Another study conducted locally by Ochsner health systems researchers in collaboration with the US Centers for Disease Control and Prevention, found no increased risk of invasive mold infections in immunocompromised transplant patients exposed to molds in indoor air environments after entering hurricane-damaged homes. Although the data suggested that molds associated with water-damaged buildings infrequently cause infections in susceptible patients, it was recommended that at-risk individuals avoid or limit exposures and/or use protective wear.

Suggestions for health education materials were presented, placing an emphasis on quality of life concerns related to indoor air mold exposures.

#### *Mitigation Best Practices:*

Task force members noted the importance of creating a plan of action to identify mold in a building in order to move forward into the remediation stage. Suggested best practices included comprehensive education plans specifically tailored for licensed general contractors, licensed mold remediators, HVAC professionals, home inspectors, home owners, landlords and tenants. Several task force members serve on additional parish and state workgroups and task forces where education materials could be shared for cross-training purposes. It was further suggested that parish county agents may be an available resource to assist in advising homeowners/tenants on how to identify and clean up mold in their homes and when it might be time to call in a professional.

There are a number of publications that have been prepared by various federal and state entities that can be utilized. An online file sharing site will be created to allow task force members to post and access educational and support materials.

One major risk driver for mold growth is the decreased air exchange rates in new construction and the improper use of foam insulation in both old and new structures. Generally speaking, the less ventilation in a home, the greater risk of mold growth. Excess A/C unit tonnage and inadequate dehumidification for the square footage of a building is also a significant issue, as humidity and water have the potential to create an environment conducive to mold growth.

Simple, cost-effective suggestions were shared to prevent mold growth such as replacing air vent plates where moisture may pool, and using auto ventilation systems in business restrooms to prevent humidity.

There is also a need to refine current building codes to account for outdated practices that may contribute to the propagation of mold.

#### *Mitigation Actions:*

The Louisiana State Licensing Board for Contractors currently provides licensure for mold contractors. The training component consists of 24 education hours and 4 hours of ethics training. There are approximately 100 licensed mold remediators in the State of Louisiana; a provider database is available to share with the public. Future education modules can be tailored to reflect task force education messaging.

The Louisiana Department of Justice/Attorney General's Office has a tenant rights pamphlet available for agencies to provide mold education materials to renters. LDHH staff regularly use and reproduce the pamphlet for public health purposes.

The Louisiana Department of Health and Hospitals maintains a database of calls and reported health effects related to mold and other indoor air quality concerns. A case report summary from the last 10 years of data was provided to the task force members and is available for reference.

The task force unanimously selected Frank Morse of the Louisiana Home Builder's Association as the annual chairman.

Preparation and submission of the annual report to the legislature will be further discussed at the upcoming December 2014 meeting. Task force members agreed that the first annual report would include currently available best mold control practices, a summary of potentially adverse health effects related to indoor air mold exposures (including immunocompromised and susceptible subgroups) and proposed education training and outreach. Task force members will prepare a summary of discipline-specific information and agency position for inclusion in the draft report.

Task force members agreed that a bi-annual meeting schedule was inadequate and suggested meeting on a quarterly basis. The next meeting will be held in the Baton Rouge area in early December 2014.

Task Force on Mold in Louisiana  
April 15, 2015, 10:00 am- 11:05 am  
Conference Call Summary

Task Force Members in Attendance:

Todd Folse, Louisiana Housing Corporation  
Frank Morse, Louisiana Home Builders Association  
Felicia Rabito, Tulane University School of Public Health & Tropical Medicine (TUSPH&TM)  
Raoult Ratard, Louisiana Department of Health and Hospitals (LDHH)  
Chris Styron, Louisiana Department of Justice  
Liz Sumrall, Louisiana State University (LSU) Office of Health Affairs and Medical Education  
Louis Trachtman, LDHH  
Doug Traylor, Louisiana State Licensing Board for Contractors  
LuAnn White, LDHH, TUSPH&TM

Task Force Members in Absence:

Buddy Amoroso, Apartment Association of Louisiana  
Jonathan Chapman, Louisiana Primary Care Association  
Angela Gaines, Southern University Law Center  
Blake Hudson, LSU Law Center  
Jeff Williams, Louisiana State Medical Society  
Matt Ritchie, Louisiana Realtors Association

Attendees:

Dianne Dugas, LDHH  
Jocelyn Lewis, LDHH  
Darcie Olexia, LDHH  
Melanie Ramson, LDHH  
Jose Serrano, LDHH

Following introductions, Chairman Morse initiated discussion related to his meeting last month with representatives from the Greater New Orleans Housing Alliance (GNOHA). Alex Whatley, Monica Gonzales (GNOHA representatives) and guest, Johnell Colbert (realtor), shared a list of requests (with Chairman Morse) pertaining to real estate mold inspection certifications, building code materials and inspections, and laboratory biological fungal panels (refer to email sent to task force members 4/8/15).

Chairman Morse polled task force members to determine if each felt it appropriate to invite GNOHA representatives to attend the next scheduled meeting as a guest to listen to their concerns and educate based on discussed task force positions. The chairman may schedule a follow-up meeting with one representative of GNOHA in advance of the next task force meeting for briefing purposes; an update will be provided to task force members.



Noted task force positions:

1. There is little value in offering fungal panel blood tests at LDHH health units due to the scarcity of blastomycosis and coccidioidomycosis cases in Louisiana; further, candidiasis is a common condition related to varied sources; and aspergillosis is usually diagnosed in a hospital setting due to intensity of illness and not commonly diagnosed in a primary care setting.

2. Water damaged homes that have been renovated are inspected prior to closing interior walls.

*Citation: International Residential Code R 109.4 Approval required. Work shall not be done beyond the point indicated in each successive inspection without first obtaining the approval of the Building Official. The Building Official upon notification shall make the requested inspections and shall either indicate the portion of the construction that is satisfactory as completed, or shall notify the permit holder or an agent of the permit holder wherein the same fails to comply with this code. Any portions that do not comply shall be corrected and such portion shall not be covered or concealed until authorized by the Building Official.*

3. Plaster is not preferable over sheet rock for flood prone areas. While it may be a less porous material with less potential for mold growth, it is cost prohibitive and regardless would need to be replaced following a flood event.

4. Due to the ubiquitous nature of mold in the environment, it is impossible to certify a home as a mold-free residence. Often during inspections, mold cannot be seen. Visual and olfactory observations can be noted; however, the best course of action is to conduct an inspection that identifies sources of moisture and lack of proper ventilation in order to prevent mold growth and potential irritant/allergenic indoor air conditions.

Chairman Morse informed task force members that Logan Burke with the Alliance for Affordable Energy (AAE) has requested a meeting to discuss their concerns presumably relative to the updated 2015 HVAC building codes. An informal meeting will be scheduled in the upcoming week; Chairman Morse will provide an update to task force members on the nature of AAE's concerns following the meeting.

Chairman Morse will alert task force members of any need for assistance or attendance at meetings with GNOHA and/or AAE. The next task force meeting will be held in person; potential dates forthcoming.

Task Force on Mold in Louisiana  
June 16, 2015, 11:00 am- 12:15 pm

Task Force Members in Attendance:

Todd Folse, Louisiana Housing Corporation  
Angela Gaines, Southern University Law Center  
Frank Morse, Louisiana Home Builders Association  
Felicia Rabito, Tulane University School of Public Health & Tropical Medicine (TUSPH&TM)  
Chris Styron, Louisiana Department of Justice  
Louis Trachtman, Louisiana Department of Health and Hospitals (LDHH)  
Doug Traylor, Louisiana State Licensing Board for Contractors (LSLBC)  
LuAnn White, LDHH, TUSPH&TM

Task Force Members in Absence:

Buddy Amoroso, Apartment Association of Louisiana  
Jonathan Chapman, Louisiana Primary Care Association  
Blake Hudson, Louisiana State University (LSU) Law Center  
Raoult Ratard, LDHH  
Matt Ritchie, Louisiana Realtors Association  
Liz Sumrall, LSU Office of Health Affairs and Medical Education  
Jeff Williams, Louisiana State Medical Society

Attendees:

Rita Bautista, Home Builders Association of Greater New Orleans (HBAGNO)  
Dianne Dugas, LDHH  
Lindsey Lewis, Greater New Orleans Housing Alliance (GNOHA)  
Darcie Olexia, LDHH  
Melanie Ramson, LDHH  
Jose Serrano, LDHH

Following introductions, Chairman Morse led the meeting to discuss future task force steps detailed in the January 2015 legislative report. Discussions focused on the importance of promoting sound building maintenance and remediation practices and the development and marketing of targeted education materials. As the task force operates without a budget, task force members agreed it would be necessary to leverage existing resources to successfully execute a multi-faceted education program. A task force sub-committee will be established to collect education materials and to refine a distribution/marketing plan. Preliminary suggestions noted as follows:

Target Audiences:

- DIY homeowners
- General public including renters
- Healthcare providers
- HVAC contractors

- Mold remediators
- Commercial/residential building maintenance professionals

#### Material Suggestions:

- EPA, LSU AG, CDC, NIOSH, LDHH, etc. publications (see attached list provided by LSLBC)
- Public Service Announcements (PSAs)

#### Distribution Suggestions:

- Public libraries, repositories
- LA Association of Broadcasters
- LA Press Association and Advertising Club
- News stations
- County agents
- State and local agency websites with task force affiliations
- Big box improvement stores (Lowe's, Home Depot, Sears)
- LA Attorney General's Office hotline
- LDHH Indoor Air Quality hotline
- LA Morbidity Report (LDHH infectious epidemiology)
- GOSEP (post flood emergencies)
- Fire Marshall's Office
- List serves (highlight taglines)
- Public Health Training Center: free online, on-demand 1-hour course for healthcare providers
- Greater New Orleans Housing Alliance

The task force discussed the importance of a public education plan to address mold remediation using certified mold remediators following flood events. Post-Katrina experiences were shared; any instances of opened walls required an inspection to rule out structural, substrate and/or electrical damages related to mold.

International building code changes (2015) were also discussed. Code changes promote energy efficiency, inspections for new construction and renovations, etc. Contractor education and workshops are underway to educate builders/contractors about what must be done to pass inspections. Chairman Morse noted that renovations and new construction projects will have an advantage of a thorough post-completion inspection that may uncover favorable conditions for mold growth. DIY homeowners not using licensed contractors will not benefit from the inspection.

Public comment was opened to Lindsey Lewis (GNOHA). Ms. Lewis noted that her organization has a number of older residents with mold complaints and spoke on their behalf. She provided a list of questions (see attached and below), to which task force members replied, some with standing task force positions.

Q &A:

1. We believe blood tests for detection of mold-related illnesses in individuals with reoccurring symptoms should be available at state-run clinics free of charge. Provided: Fungal Panel 3, Aspergillus, Blastomyces, Candida, and Coccdiones, are not covered by health insurance, as there are few means of prevention from the sickness currently. Has the task force considered advocating that the five primary blood tests for detection being provided through the State's Department of Health and Hospitals?

*Meeting response:*

*There is not blood test for an exposure to mold; primary effects are allergenic and symptoms should be treated by a physician.*

**After** the meeting, interim task force member, Dr. Louis Trachtman, followed up with Dr. Stephen Martin, Director of the Louisiana Office of Public Health Laboratories to clarify the availability of laboratory blood tests available to detect the presence of fungi in people. Dr. Martin's response:

*There are some antigen and antibody tests for fungi that are usually used to identify people with allergic pulmonary disease or a systemic mycosis. These are not widely available but, there are some reference laboratories. For example, ARUP Laboratories in Utah has some CF testing still listed as does the Mayo clinic. I doubt that any of these tests are FDA approved, they are probably test developed and validated in those laboratories. The OPH Lab sends all mycology testing to the CDC because our mycology laboratory was shut down due to budget cuts in the 1990s. Also, neither DEQ or DHH actually does any testing for "sick buildings" anymore; that has been determined to be the building owners' responsibility. Since the state is not inspecting or looking into these complaints we receive almost no requests for fungal testing in the OPH Laboratory. As always with common organisms you should generally test both acute and convalescent serum because we all have been exposed to so many different fungi that a single titer is not that useful.*

*Standing position:*

*There is little value in offering fungal panel blood tests at LDHH health units due to the scarcity of blastomycosis and coccidioidomycosis cases in Louisiana; further, candidiasis is a common condition related to varied sources; and aspergillosis is usually diagnosed in a hospital setting due to intensity of illness and not commonly diagnosed in a primary care setting.*

2. We would like to see laws that address mold inspections and mold certifications in both rental and homeownership units. We believe inspections should be required in rehabbed or water damaged buildings during construction before walls are closed. Also, that certifications be provided for homebuyers at the time of their purchase and for renters when beginning a lease. What legislation is in place to date that address mold or requires mold inspections?

*Meeting response and standing position:*

*Water damaged homes that have been renovated are inspected prior to closing interior walls. Citation: International Residential Code R 109.4 Approval required. Work shall not be done beyond the point indicated in each successive inspection without first obtaining the approval of the Building Official. The Building Official upon notification shall make the requested inspections and shall either indicate the portion of the construction that is satisfactory as completed, or shall notify the permit holder or an agent of the permit holder wherein the same fails to comply with this code. Any portions that do not comply shall be corrected and such portion shall not be covered or concealed until authorized by the Building Official.*

3. What is the status House Bill 545, which requires certification by landlords that rental properties are free of toxic mold?

*Meeting response:*

*HB545 is to be reintroduced in a later legislative session.*

*Standing position:*

*Due to the ubiquitous nature of mold in the environment, it is impossible to certify a home as a mold-free residence. Often during inspections, mold cannot be seen. Visual and olfactory observations can be noted; however, the best course of action is to conduct an inspection that identifies sources of moisture and lack of proper ventilation in order to prevent mold growth and potential irritant/allergenic indoor air conditions.*

4. Has funding been made available to the task force or Department of Health and Hospitals for outreach and education? If so, how can GNOHA most effectively help you advocate for this type of funding?

*Meeting Response:*

*The Task Force on Mold in Louisiana is an unfunded legislative mandate. GNOHA can keep the task force posted of any funding opportunities that become available.*

5. Has there been any progress on pushing for enforcement of new 2015 International Building Code standards that may aid in mold detection, and how can GNOHA most effectively go about advocating for this?

*Meeting Response:*

*Ms. Lewis deferred this question as it had already been discussed during the meeting. Updated building codes promote inspections that are inclusive of mold concerns; however, DIY homeowners refraining from contractor help will not benefit from these standards.*

6. How can GNOHA most affectively assist the task force in carrying out its objectives?

*Meeting Response:*

*Chairman Morse suggested that GNOHA be used as a distribution center for education materials. GNOHA agreed to distributing materials and collaborating with the group to leverage their education resources.*

The next task force meeting remains unscheduled. Future meeting dates will be suggested via email. Chairman Morse will reach out to task force members in the near future to begin the process of creating the education sub-committee.

Task Force on Mold in Louisiana  
November 20, 2015, 1:30 pm- 2:15 pm

Task Force Members in Attendance:

Frank Morse, Louisiana Home Builders Association  
Matt Ritchie, Louisiana Realtors Association  
Chris Styron, Louisiana Department of Justice  
Louis Trachtman, Louisiana Department of Health and Hospitals (LDHH)  
Doug Traylor, Louisiana State Licensing Board for Contractors (LSLBC)  
LuAnn White, LDHH, TUSPH&TM

Task Force Members in Absence:

Buddy Amoroso, Apartment Association of Louisiana  
Jonathan Chapman, Louisiana Primary Care Association  
Todd Folse, Louisiana Housing Corporation  
Angela Gaines, Southern University Law Center  
Blake Hudson, Louisiana State University (LSU) Law Center  
Felicia Rabito, Tulane University School of Public Health & Tropical Medicine (TUSPH&TM)  
Raoult Ratard, LDHH  
Liz Sumrall, LSU Office of Health Affairs and Medical Education  
Jeff Williams, Louisiana State Medical Society

Attendees:

Dianne Dugas, LDHH  
Jocelyn Lewis, LDHH  
Darcie Olexia, LDHH  
Melanie Ramson, LDHH  
Jose Serrano, LDHH  
Collette Stewart-Briley, LDHH

Following introductions, Chairman Morse initiated discussion of agenda items that included the need to update the legislature on task force progress. The (year 2) legislative summary report is due on or before January 1, 2016. The chairman requested that the updated report include a summary or reference to the Environmental Law Institute's March 2015 database of state indoor air quality laws and the 2000-2013 literature review publication (*Indoor Environmental Exposures and Exacerbation of Asthma: An Update to the 2000 Review by the Institute of Medicine. Environmental Health Perspectives January 2015*) citing provisional causal relationships between indoor air allergens, including mold, and exacerbation of asthma in various target populations (see attachments).

Task force sub-committees were established to leverage member expertise in the following areas:

- Health: Dr. LuAnn White, Dr. Louis Trachtman

Task force members noted the importance of clarifying that there are many indoor air allergens exclusive of mold that can trigger or exacerbate asthma attacks/conditions. Substandard home

conditions are often overlooked as major triggers. The Centers for Disease Control (CDC) and other health agencies have an abundance of ready to use education materials on asthma triggers.

- Building standards / code enforcement: Frank Morse, Chris Styron  
Chairman Morse shared that there are increased efforts to regulate and standardize HVAC installation/maintenance requirements in many Louisiana parishes in order to improve indoor air quality conditions.

- Media / promotion: Doug Traylor  
Mr. Traylor referenced previously shared education materials geared towards various target populations.

#### **EPA Publications:**

Mold Remediation in Schools and Commercial Buildings

<http://www.epa.gov/mold/pdfs/moldremediation.pdf>

A Brief Guide to Mold, Moisture, and Your Home

[www.epa.gov/mold/pdfs/moldguide.pdf](http://www.epa.gov/mold/pdfs/moldguide.pdf)

EPA Mold Web Course

[www.epa.gov/mold/moldcourse](http://www.epa.gov/mold/moldcourse)

Guidance for Clinicians on the Recognition and Management of Health Effects Related to Mold Exposure and Moisture Indoors

[http://doem.uchc.edu/consultation\\_outreach/indoor\\_environments/pdfs/mold\\_guide.pdf](http://doem.uchc.edu/consultation_outreach/indoor_environments/pdfs/mold_guide.pdf)

#### **LSU AgCenter Publications:**

Mold: Important Questions, Objective Answers

[http://www.lsuagcenter.com/en/family\\_home/home/health\\_safety/indoor\\_air\\_quality\\_mold/Mold+Fact+Sheet.htm](http://www.lsuagcenter.com/en/family_home/home/health_safety/indoor_air_quality_mold/Mold+Fact+Sheet.htm)

Hiring a Mold Remediation Contractor

[http://www.lsuagcenter.com/en/family\\_home/home/health\\_safety/indoor\\_air\\_quality\\_mold/](http://www.lsuagcenter.com/en/family_home/home/health_safety/indoor_air_quality_mold/)

Mold Removal Guidelines for Your Flooded Home

[http://www.lsuagcenter.com/en/family\\_home/home/health\\_safety/indoor\\_air\\_quality\\_mold/Mold+Removal+Guidelines+for+Your+Home.htm](http://www.lsuagcenter.com/en/family_home/home/health_safety/indoor_air_quality_mold/Mold+Removal+Guidelines+for+Your+Home.htm)



Avoiding Mold Hazards in Your Water-damaged Home

[http://fcs.tamu.edu/housing/healthy\\_homes/indoor\\_air\\_quality/avoiding\\_mold\\_hazards.pdf](http://fcs.tamu.edu/housing/healthy_homes/indoor_air_quality/avoiding_mold_hazards.pdf)

**Centers for Disease Control Publications:**

Population-Specific Recommendations for Protection from Exposure to Mold in Flooded Buildings

[http://emergency.cdc.gov/disasters/mold/report/pdf/2005\\_moldtable5.pdf](http://emergency.cdc.gov/disasters/mold/report/pdf/2005_moldtable5.pdf)

**Building Science Corporation**

Mold Remediation in Occupied Homes

[www.nwcleanair.org/pdf/aqPrograms/indoorAir/Mold\\_Remediation.pdf](http://www.nwcleanair.org/pdf/aqPrograms/indoorAir/Mold_Remediation.pdf)

(based on New York City Health Department Guidelines)

**NIOSH (National Institute of Occupational Safety and Health)**

Preventing Occupational Respiratory Disease from Exposures Caused by Dampness in Office Buildings, Schools, and Other Nonindustrial Buildings <http://www.cdc.gov/niosh/docs/2013-102/>

**LDHH (Louisiana Department of Health and Hospitals)**

Mold: What You Need to Know About Your Health and Your Property

[http://www.dhh.state.la.us/assets/oph/Center-EH/envepi/Indoor\\_Air/Documents/MoldBro\\_English.pdf](http://www.dhh.state.la.us/assets/oph/Center-EH/envepi/Indoor_Air/Documents/MoldBro_English.pdf)

It was suggested that the previously drafted education framework also be revisited as a bridge to outline target audiences, needed education materials and outreach strategies. Please see below; extracted from the June 16, 2015 meeting summary:

Discussions focused on the importance of promoting sound building maintenance and remediation practices and the development and marketing of targeted education materials. As the task force operates without a budget, task force members agreed it would be necessary to leverage existing resources to successfully execute a multi-faceted education program. A task force sub-committee will be established to collect education materials and to refine a distribution/marketing plan. Preliminary suggestions noted as follows:

Target Audiences:

- DIY homeowners
- General public including renters
- Healthcare providers
- HVAC contractors
- Mold remediators
- Commercial/residential building maintenance professionals

#### Material Suggestions:

- EPA, LSU AG, CDC, NIOSH, LDHH, etc. publications (see attached list provided by LSLBC)
- Public Service Announcements (PSAs)

#### Distribution Suggestions:

- Public libraries, repositories
- LA Association of Broadcasters
- LA Press Association and Advertising Club
- News stations
- County agents
- State and local agency websites with task force affiliations
- Big box improvement stores (Lowe's, Home Depot, Sears)
- LA Attorney General's Office hotline
- LDHH Indoor Air Quality hotline
- LA Morbidity Report (LDHH infectious epidemiology)
- GOSEP (post flood emergencies)
- Fire Marshall's Office
- List serves (highlight taglines)
- Public Health Training Center: free online, on-demand 1-hour course for healthcare providers
- Greater New Orleans Housing Alliance

Task force sub-committee members will directly coordinate with Chairman Morse to update their respective sections of the year 2 legislative summary report due on or before January 1, 2016.

The next task force meeting will be held in Baton Rouge on February 26, 2016 at 10:30 am.

Closing comments were open to Dr. Jocelyn Lewis, LDHH, who presented information on adult asthma hospitalizations in Louisiana (*A Review of Adult Asthma Hospitalizations in Louisiana, 2006-2011, Journal of the Louisiana State Medical Society, March/April 2015*) (see attached).

Meeting adjourned at 2:15 pm.