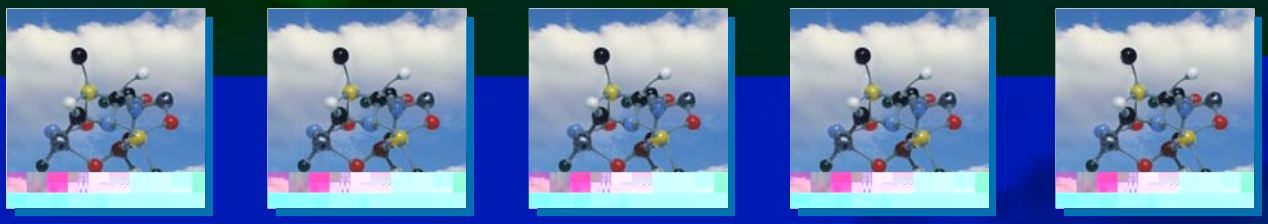
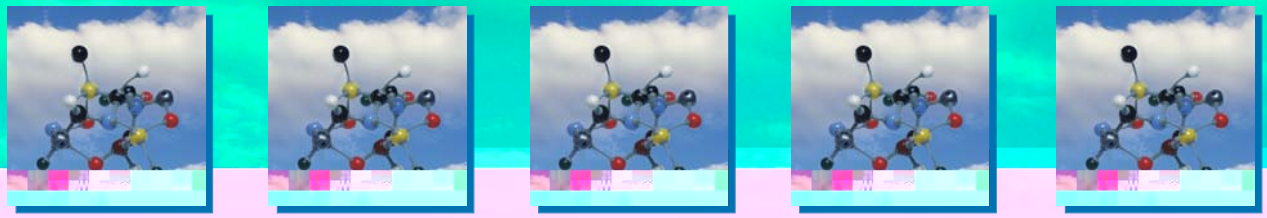
MANAGING THE RISK OF MOLD IN THE CONSTRUCTION OF BUILDINGS





Over the last few years, the discovery of mold in homes, schools, churches, courthouses and other public and private buildings has fueled a legal firestorm. Trial lawyers have started filing claims and cases at an alarming rate. The defendants include building owners, construction contractors, design professionals and other parties to the construction process.

One might think that mold is something new, or that today's mold is somehow different. The truth, however, is that molds are among the oldest forms of life on earth. The most obvious of the often-overlooked facts is that molds are naturally occurring organisms. There are thousands of different molds, and none of them are new.

On the other hand, many questions about the potential health effects of various molds remain difficult to answer. The appropriate protocols and procedures for dealing with these molds are just as far from certain. Different molds affect different individuals in different ways, complicating any effort to set exposure limits. Certain molds can produce "mycotoxins," but the scientific community has yet to develop convincing evidence that these chemical compounds have toxic effects when inhaled in the relatively low concentrations being found in buildings.

Nevertheless, the claims and the litigation are real, and the costs of both are enormous. Moreover, it has become clear that neither building owners nor construction contractors can count on the insurance industry to cover those costs. Property insurance policies have long excluded any property damage or bodily injury resulting from building operation or maintenance. Going forward, builders risk and other property insurance policies are very likely to exclude mold arising from the perils that they do cover. Both building owners and construction contractors are also likely to find mold excluded from their commercial general liability policies. For some period of time, building owners and construction contractors will need to find some other way to manage the risk of mold claims or litigation.

The critical if limited purpose of this document is to help the primary parties to the construction process manage that risk largely on their own, and without the benefit of the insurance coverage they have enjoyed in the past. This document proceeds from the basic premise that building owners, construction contractors and design professionals will all be more successful if they systematically sort through the major issues that mold raises. Construction contractors are responsible for the way they handle and store construction materials on the site of the work, and for ensuring that their employees and subcon-

involved in the construction process. By the time that property owners file their own lawsuits or insurance claims, these owners have already suffered losses. At the same time, it is clear that the only program that can effectively avoid either claims or litigation is a risk management program that all of the parties are prepared to implement. No one party can take all of the steps necessary to protect its interests. It is most important to get all of the parties to the process on the same page.

The keys to success are communication and collaboration.[2] Buildings owners, construction contractors and design professionals should discuss the subject of mold before the construction of any building begins, and as necessary, they should continue to talk and work together throughout the course of construction. Each party has an important role to play. Each one needs the others to succeed.

PART I

,DA D, A C

Scientists classify living organisms several different ways, taking into account their genetic makeup, cellular structure, ecological niche, similarities and other factors. Most common schemes recognize anywhere from five to seven “kingdoms” of life. In addition to plants and animals, these schemes put viruses, bacteria, other microbes, and “true” fungi into their own kingdoms. While the classification schemes vary in their detail, all of the modern schemes consider fungi to be a kingdom of life—a separate and distinct component of life on earth.

The “true” fungi fall, in turn, into three major subgroups: the mushrooms, the yeasts, and the molds. Typically, mushrooms have a pulpy or woody structure and a mycelium base. Yeasts are unicellular organisms that do not normally form either woody structures or mycelia. Molds are a bit different from both. Molds do not have the stems, caps, or other structures that characterize mushrooms, but they are generally more complex than yeasts. Some molds are “dimorphic” organisms capable of taking more than one shape or form. At times, dimorphic organisms are single-celled organisms or simple clusters of cells. At other times, they are complex structures not very different from the simpler mushrooms.

Like animals, fungi consume organic compounds. Fungi depend on their external environment for the complex carbon-based molecules they need to survive and grow. Neither animals nor fungi can make their own food from the relatively simple compounds found in the soils. Neither animals nor fungi have chloro-

ph (i ha)19.7(v)14.ua sepa0odernveot00.ie(baseIbu)Tj040cmu2 -1.05 TD-0.cel56339 Twei
t[(96 ngim106 Tc0.0887 mycsprop0.0or)]TJ.7(v)14.8u2 - mekTc0.358 wss0animals nor

inhaling these compounds in even these concentrations can have serious and even toxic health effects. On the other hand, several recent studies have found little evidence to support that conclusion.

The environmental conditions under which various molds will produce mycotoxins are also far from certain.[4] When, how and even whether a particular species will actually produce mycotoxins all seem to depend on several things, including but not limited to the food source, the ambient temperature, and the amount of available moisture. Even the most suspect molds may or may not produce any mycotoxins at all, depending on the environmental conditions.

The Texas Medical Association has found that "[a]dverse health effects from inhalation of Stachybotrys spores in water-damaged buildings is not supported by available peer-reviewed reports in medical literature."[5] The American College of Occupational and Environmental Medicine (ACOEM) has similarly found:

> Molds growing indoors are believed by some to cause building-related symptoms. Despite a voluminous literature on the subject, the causal association remains weak and unproven, particularly with respect to causation by mycotoxins.[6]

In its position paper on mold, the ACOEM adds:

> Levels of exposure in the indoor environment, dose-response data in animals, and dose-rate considerations suggest that delivery by the inhalation route of a toxic dose of mycotoxins in the indoor environment is highly unlikely at best, even for the hypothetically most vulnerable subpopulations.[7]

In addition, peer-reviewed studies in the scientific literature have shown that Stachybotrys is frequently found in the outdoor air in certain geographic areas, and further, that this mold is found at levels that may generally exceed the levels found in the indoor air of some of the buildings of current concern. [8]

The bottom line is that the scientific community has yet to reach anything approaching a consensus on the health effects of inhaling mycotoxins in the relatively low concentrations found in some buildings. Different researchers have come to different conclusions.

That molds play a significant role in human health is, however, well documented. The U.S. Environmental Protection Agency has accurately reported that many and perhaps all molds can have health effects. Molds can trigger a wide range of allergic reactions in sensitive individuals, including eye, nose and throat irritation, dermatitis, and a generalized worsening of asthma or respiratory distress. In recent years, the country has also seen an increase in the number of opportunistic infections, primarily among people with compromised immune systems.

Several species of mold can also cause infections to the surface of the skin. Ringworm (tinea) and athlete's foot are common examples. Thrush (oral candidiasis) is another example, common among newborn infants. Molds can also cause subcutaneous infections, such as sporotrichosis, particularly in tropical and near-tropical climates, where higher humidity levels may encourage fungi and fungal growth.

Fungi can also cause systemic infections, such as histoplasmosis, a pulmonary infection endemic to the Mississippi and Ohio valleys, where as many as 40 million people may have had the disease—most without evenous gn4.8(w)0.

feeding off organic matter that the wind carries to them or capturing the food they need in other ways. Some risk of a mold infestation would still exist.[9]

The point, however, may be little more than academic. In the vast majority of cases, it would be impossible to find cost-effective substitutes for all organic building materials. Common examples of such materials include the paper that clads drywall, all lumber and acoustic tiles, and all of the many other materials that contain some form of cellulose. In the past, the manufacturers and suppliers of these materials often treated them with formaldehyde or other chemicals that would inhibit the growth of mold. Today, things are different. For environmental and other reasons, manufacturers and suppliers have stopped using such chemicals, and as a result, the risk that these building materials will support the growth of mold is actually higher that it used to be. As noted below, the parties should consider substitutes for organic building materials on a case-by-case basis, but it would be too much to expect the parties to find cost-effective substitutes for all of them.

All molds also require a certain amount of moisture. They need water to absorb nutrients into their cells and to release extra-cellular enzymes, metabolites and waste products. Molds also need water to maintain their form and shape. Different mold species require different amounts of water, and some species are amazingly tolerant of drought, but all molds require some amount of water to grow and reproduce. Many of the so-called “toxic molds” can tolerate conditions well below those that cause wilting of most common plants. All molds, however, require water, and some of the “toxic molds” seem to need more water than other matT*-0.0[(The /06 Tc5-0.0103 8990.095 Twremaile pare ok)96(v)1. The

of a building, perhaps at certain times, but nothing would seem to justify any kind of blanket rule.[10]

On the other hand, it would be reasonable to expect one or more of the parties to react, in some fashion, to any visible sign that mold is growing on building materials. As already noted, mold grows exponentially. The sooner someone takes action, the smaller any problem will be.

Exactly who should react, and exactly how, will depend on many things, including when, where and how the mold is discovered. Contractual arrangements are critical to consider. And so are the amount and nature of the mold. While it is important to act, it can be very costly to overreact.

Unfortunately, there are few guidelines for mold assessment or remediation. In the past, it was common to clean moldy materials with bleach. In the future, much more will be expected. Bleach simply cannot kill the mold inside a material. It cannot prevent a mold problem from recurring.

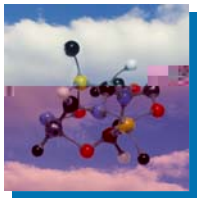
The most commonly cited guidelines for mold remediation are the guidelines that New York City has published.[11] They are entitled "Guidelines on Assessment and Remediation of Fungi in Indoor Environments" and they are posted on the city's web site at www.ci.nyc.us/html/doh/html/epi/moldrpt1/html.

The U.S. Environmental Protections Agency (EPA) has also published guidelines, entitled "Mold Remediation in Schools and Commercial Buildings." They are posted on the agency's web site at www.epa.gov/ iaq/molds.

PART III

It is relatively simple to suggest that we have to control the various ways that water may enter or accumulate in a building. It is quite another thing to exert such control. Water is a tireless foe that will forever seek to enter buildings and accumulate in unwanted areas. Design professionals, construction contractors and building owners can and should minimize the risk of high humidity, condensation or other water in a building. Product manufacturers should also do their part. But no one should equate such an effort with a guarantee of success.

To minimize the risk that a tenant or other occupant will nevertheless leap from any discovery of mold to the conclusion that someone must have been negligent, the owner and its design professional should start raising questions about mold during the design and development phase of the project. The decisions made during this early period can and do affect everyone's legal risks, and indeed, they may affect those risks just as greatly as the actions taken during the actual construction, operation and maintenance of a building. As the owner and its design professional conceive and draft the plans for the building envelope, and begin to identify the materials and products they will specify, they should appreciate that many of their early decisions will either increase or decrease the risk of mold.



At this point in the process, the owner and its design professional have a golden opportunity to consider all of the potential causes of excessive moisture and ultimately mold. Proper attention to the design and detailing of the building can make a big difference. The owner and its design professional can systematically consider the climate, temperature, relative humidity, type of envelope, dew points, outside air requirements, and intended occupancy. A "tight" building envelope is obviously desirable. A good design will, however, include a "contingency plan" to allow the interior to dry out if—and inevitably, when—water does enter. Owners and their design professionals can also address the many internal sources of water, including the HVAC and plumbing systems.

During this phase of the project, the owner and its design professional should also consider the pros and cons of arranging for a peer review of the designs they develop and the materials and products they specify, including the envelope and HVAC system. While such a peer review is likely to have some cost, it could also put both the owner and the design professional in a much better position to demonstrate—if necessary—that they took every step that a reasonably prudent person would normally take.

In any case, such a peer review would help the owner and the design professional ensure that they have fully considered all of the many trade-offs between the cost of construction and the risk that the mold in the building will reach levels later considered to be excessive. Some building materials are less expensive than others, and specifying those materials can cut the cost of construction. In the process, however, the owner and its design professional may also increase the ultimate cost of keeping the mold spores in the building under control. While some of the newer and mold-resistant drywall costs more, it may still be the most cost-effective way for a particular owner to go. Such drywall is among the materials that at least promise to reduce the risk that the mold will ever get out of control.[12] Owners and their design professionals also have the option of specifying that the contractor shall spray microbial inhibitors to any wood framing in areas that will enclose plumbing. Humidistats are another option. At relatively little cost, these devices may help the owner exert direct and consistent control over the relative humidity inside the building.

Unfortunately, the trade-offs between cost and risk are easy to overlook. The design, development and construction phases of a project are all stressful. Once the drawings are 75% complete, many an owner learns that its project is over budget. Hoping to save money, the owner may, for example, consider changing the brick or stone veneer to a synthetic stucco product. What does such an owner really need to consider? Is it enough for the owner to determine and compare the cost of constructing its two alternatives?

The answer, of course, is no. Notwithstanding the pressure to meet its construction budget, the owner has to recognize that the total cost of changing the building envelope may be much greater than the immediate savings in the cost of construction. Whether acknowledged or not, the

total cost includes at least the cost of ensuring that the veneer continues to perform in the intended manner over the life of the building. It could include, in the worst case, the cost of mold remediation and/or litigation. In this hypothetical situation, some of the questions that the owner would need to discuss with its design professional and even its construction contractor include the following:

- ❑ Is the new exterior surface more likely to crack?
- ❑ If it did crack, how difficult and expensive would it be to repair? And how would any repair affect the appearance?
- ❑ How would the design professional account for the fact that this building—like all others—is certain to move?
- ❑ Could the contractor (or its subcon-

the owner does, the roofing system may not, however, meet the owners' expectations. Manufacturers are continuously updating their products and revising installation details to improve their results. In addition, HVAC systems, plumbing systems and skylights and the like often require a bewildering pattern of penetrations through the roof system. The construction contractor should be sure to install the system in accordance with the contract documents, and should avoid damaging a completed roofing system, but everyone needs to note that many external factors affect the way that a roof ultimately performs.

. Virtually all vertical enclosure systems absorb moisture or permit it to penetrate, not because they are poorly designed or constructed, but because virtually all of

C . The scope of the construction work should expressly include any site work necessary to move water away from the building during its construction (and meet all legal requirements for erosion and sediment control). The contractor may have some suggestions for the owner to consider, based on its actual experience with the site, but a fundamentally sound plan is something that the owner and its design professional need to include in the specifications.

D . The owner and its design professional also need to ensure that the civil plans and actual conditions will drain moisture and water away from the building after the contractor completes it. Important details include landscaping, backfill and soil compaction. Moisture is in virtually all soil. Along with any induced moisture (from irrigation, or broken water or sewer pipes, or other sources), this naturally occurring moisture needs to have a way to drain off.

D . The contractor has to pay attention to the foundation work, making sure, for example, that the ground has been properly leveled and properly covered with gravel, mirafy cloth, and the like. The contractor also has to pay attention to any crawl space that has a dirt floor. To cut down on the transmission of moisture and other naturally occurring gases from such a floor, the design documents may require the contractor to place an elastomeric, polypropylene or other plastic barrier over it (and then seal the covering to the lower walls). Before any work begins, the owner and its design professional have to select any waterproofing membrane that may need to go below the concrete slab at the very base of the building. What product and what thickness will perform best? It is important to keep moisture in the soil and out of the building.

. Paper-backed gypsum board contains adhesives and cellulose on which mold can feed. Other compos-

6 T0311 Tw[(It is imp*-7racse]TJT*s anr[(I Tc(ow)Tj1.1561 0-)TjT*0.014D0.211)T0311h0D0.u7r
plsup0.06 T03. V tue
F

selswwilTanwith ls.

longed contact with concrete, prior to its installation. To the extent necessary to protect such materials from water damage, it would be reasonable to expect a contractor to remove standing water from decks, and to keep deck openings covered or dammed. It would be similarly reasonable to expect contractors to use dunnage to create space between concrete decks and any drywall stored on them. It would not, however, be reasonable to expect a contractor to keep everything from ever coming into contact with concrete. Indeed, in a concrete structure, this material largely defines the area within which the work must proceed.

C[illegible]. The second phase of construction has much in common with the first. During this phase, building materials and components normally have some protection from the elements, but that protection is far from complete. Naturally ambient mold spores can still come to rest on building materials and components. Rain and snow remain threats, and ambient moisture is still impossible to control. Certain construction processes will still require water, and to make matters worse, any charged water pipes could break. In addition, the materials and components used and installed during this phase may be more porous, or have more organic content, than the materials and components used and installed during the "exposed" phase of construction. On the other hand, it may still be reasonable to expect the natural ventilation of the site to be enough to dry out any areas that do get wet. One could argue that a construction contractor should not load or install drywall or any other porous materials or components, or anything that has a high organic content, into a building that is only partially enclosed. That could, however, extend the time required to complete the building and ultimately its cost. It would be reasonable to expect the contractor to protect building materials and components from flowing or standing water, but not to expect protection from high humidity, or blowing rain or snow, or leaks in the incomplete envelope.

If the owner wants to implement an aggressive risk management program, it needs to specify that the contractor shall not load or install any such materials into the building before the construction has reached the "controlled" phase. Given the cost and other implications of waiting for the "controlled" phase to load drywall and other finishes into the building, it would not be reasonable to expect a construction contractor to make a unilateral decision to wait that long.

In general, during this phase of the work, the contractor should keep interior spaces, and any materials or components stored in those spaces, reasonably clean and protected from water damage, periodically collecting and removing waste that contains cellulose or other organic matter, such as paper, wood, sawdust and adhesives. The contractor should also discard or replace any materials that water actually damages, and should discard, replace or clean any stored materials that actually begin to grow mold.

Fireproofing is a good example of a material that contractors normally have to install during either the first or the second phase of construction even though this material may have a high potential for absorbing and retaining moisture and could serve as a substrate for mold. Contractors can spray and install fireproofing materials on and around steel and other structural members of the building only while these members are open and exposed. During these phases of construction, the most that owners and others can reasonably expect is for construction contractors to perform the work in a sequence that will give any wet materials adequate time to dry, before enclosing the material in drywall or other interior finishes.

lize desiccant dehumidifiers or indirect fired heaters to dry areas where they are installing or applying certain finishes, particularly if water is visible in those areas. It is not, however, common for contractors to use such equipment just to control temperature or ambient moisture.

The contractor should have a plan for protecting materials from water damage. The contractor should pay attention to the way it procures materials, schedules their delivery and then stores them, particularly on the construction site. The contractor may, for example, establish procedures for checking materials for any water damage before accepting their delivery. The contractor should also have procedures for keeping drywall, ceiling tiles, insulation and other porous materials dry and for dealing with any porous materials that do get wet. Such materials cannot be protected from ambient moisture but, once delivered, they can and should be protected from other sources of water. Contractors may also need to think about the sequencing of work that requires water. As water-based materials dry, where will the water go? The contractor should not permit new or additional work to cover or enclose any fireproofing, insulation or other porous materials that are clearly wet.

The contractor should also have some kind of protocol for dealing with any large and unexpected water intrusion into any completed portion of the building. Such a protocol could include procedures for investigating its cause and effects, and for dealing with both.

Unfortunately, the most appropriate way for dealing with any visible mold remains far from certain—in large measure because medical effects of exposure to mold are so intensely debated. The most commonly cited guidelines for the assessment and remediation of mold remain those published by the New York City Department of Health.[15] Many experts also cite the guidelines published by the

U.j lh0140 ronartm5320.000otectinn oAg men5 e e0 0 7 128.0089 0 783 m-0.6 -1.052d re0 Tw(15)Tj10 0 0 10 1406483 233.6714 Tish202

essential component of a facility functional or master program to provide a safe environment of care. The ICRA shall be conducted by a panel with expertise in infection control, risk management, facility design, construction, ventilation, safety and epidemiology. The panel shall provide updated documentation of the risk assessment throughout planning, design and construction.[18]

Not every building is a hospital or health care facility, and it would be unreasonable to expect every owner to treat every building as if it were such a facility. These guidelines do, however, demonstrate that an owner that either wants or needs to launch an aggressive effort to manage the risk of a mold infestation does have options to consider. Construction contractors do not have all of the expertise necessary to design or implement every option. They cannot, themselves, conduct an ICRA. To the extent qualified, and the contract documents so provide, contractors can, however, expand the scope of the work they perform. They can also work with any experts that an owner may engage. During the design and development phase of a project, many contractors can also help owners identify both the immediate and the long-term costs of various alternatives, and to that extent, many contractors can also help owners sort out their priorities.

In today's legal environment, the owner should always consider at least the option of either taking or requiring special efforts to limit the risk of what could become a mold problem. Without going so far as to meet the standards for the design and construction of health care facilities, the owner can take or require any number of procedures or protocols. As already mentioned and suggested, the owner can retain a third party to peer review the plans and specifications for appropriate design detail. Recognizing the benefits as well as the costs of doing so, the owner can also specify that its contractor shall:

- ❑ use desiccant drying techniques to the extent necessary to keep the ambient moisture in all or any identified portions of the interior below specified levels at specified times;
- ❑ install specific materials—that the owner has determined to be more resistant to mold—in all or any portion of the building, such as elevator shafts;
- ❑ not load or install any drywall or

and maintenance of a building include at least the following:

- ❑ procedures for operating and maintaining the HVAC system in accordance with the current guidelines of the American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc. (ASHRAE), including procedures for maintaining:
  - ❑ filters and any other air cleaning devices;
  - ❑ outdoor air dampers and actuators;
  - ❑ humidifiers;
  - ❑ cooling coils and drain pans, and any adjacent areas;
  - ❑ outdoor air intake louvers and adjacent surfaces;
  - ❑ sensors used to control outside air; and
  - ❑ air handlers.
- ❑ procedures for maintaining floor drains and other sewer systems;
- ❑ procedures for drying and sanitizing any areas where water intrudes or excess moisture accumulates;
- ❑ procedures for quarterly inspecting building surfaces for evidence of mold growth;
- ❑ procedures for removing any mold that might be found and for treating any affected area(s);
- ❑ procedures for identifying and correcting any sources of excess moisture; and
- ❑ procedures for responding to any complaints that occupants might have.

Molds are prolific organisms that will float into and through a building for as long as it stands.

Water will persist in its effort to enter and accumulate in a building from the day its construction begins to the day it day

Air Quality and Climate, International Academy of Indoor Air Sciences, July 2002
Environmental Health Directorate, Health Canada, *Exposure Guidelines for Residential Indoor Air Quality*, 1987; Rev. 1989, Publication No. EHD-TR-156, 1989, Ottawa, Ontario, Canada

Environmental Health Directorate, Health Canada, *Fungal Contamination in Public Buildings: A Guide to Recognition and Management*, June 1995, Ottawa, Ontario, Canada

Environmental Health Directorate, Health Canada, *Indoor Air Quality in Office Buildings: A Technical Guide*, revised 1995, Publication No. 93-EHD-166, 1995, Ottawa, Ontario, Canada

Foundation of the Wall and Ceiling Industry, *Mold: Cause, Effect and Response*, March 2002

Fung, Frederick MD, *Toxic Mold: Science or Speculation?* Defense Research Institute, Publication Bi, 2001-0050 C, 2001, Chicago, IL

Kendrick, Bryce, *The Fifth Kingdom* 3rd ed., 2000, Focus Publishing, Newbury Park, MA

Macher, Janet, ed., *Bioaerosols: Assessment and Control*, American Conference of Governmental Industrial Hygienists (ACGIH), 1999, Cincinnati, OH

Maryland State Task Force on Indoor Air Quality, *Final Report*, July 1, 2002, Maryland Department of Legislative Reference, Annapolis, MD

McNeel, Sandra, and Kreutzer, Richard, "Fungi and Indoor Air Quality," *Health and Environment Digest*, May/June 1996, Vol. 10, No. 2, p. 9 et seq., available at *www.dhs.ca.gov/ps/deodc/ehib/EHIB2/topics/fungi_indoor.html*, accessed November 25, 2002

New York City Department of Health, Office of Environmental and Occupational Epidemiology, *Facts about Mold*, available at *http://nyc.gov/html/doh/html/ei/eimold.html*, accessed November 22, 2002

New York City Department of Health, Bureau of Environmental and Occupational Disease Epidemiology, *Guidelines on Assessment and Remediation of Fungi in Indoor Environment*, available at *http://nyc.gov/html/doh/html/epi/moldrpt1.html*, accessed November 22, 2002

Texas Counsel on Scientific Affairs, *Black Mold and Human Illness*

Blac, Richard, "Funhtvm(vir)6-,ailServi02 ,ease Epidemiology