

American Idolatry: The Mold Rush Comes to Canada ©

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The presence of mold, and litigation arising therefrom, has been escalating in the United States for the past few years. Since mold constitutes 25% of the world's biological mass, it is, by that definition alone, worth studying. However, the U.S. Plaintiffs' Bar, as it is often wont to do, has taken mold science, tried to turn it on its head, and is attempting to foment fear and fan the mold litigation fires. With the Canadian legal community, including the courts, often following suit on the heels of American litigation trends, and given the moist environments of British Columbia and elsewhere, Canadian defense lawyers should be on the look-out for this evolving litigation trend.

I. Mold: What is it?

Molds are organisms found within the kingdom of fungi (*myceteae*). Alexopoulos, C.J.; Mims, C.W.: Introductory Mycology, 3rd Ed. (John Wiley & Sons, 1979). Fungi which one might recognize include rusts, molds, smuts, mushrooms, and potentially slime molds. Lichens, often found on rocks and rotting trees, are organisms that consist of a combination of a mold and algae. *Id.* Fungi have no chlorophyll, but typically reproduce by spores (seeds) through both sexual and asexual mechanisms. It is the spore that can produce a new individual.

The classification of fungi is based on many things, and their classification is complex because of the large number and variety of these organisms. In fact, there are major disagreements about the classification of fungi among mycologists. *Id.* However, there are three major divisions of fungi:

- A. GYMNOMYCOTA - cellular and slime molds;
- B. MASTIGOMYCOTA – the lower fungi water molds; and

- C. AMASTIGOMYCOTA – the true fungi yeast, molds, mildews, rusts, smuts, cup fungi, bracket fungi, puff balls and mushrooms.

The classes of molds in the Amastigomycota classification are of interest in the litigation arena because they are the common toxin-producing molds and these classes of molds are typically found in indoor environments. The three main classes of molds are grouped based on the differences in the spore producing structures (zygomycetes, ascomycetes and basidiomycetes). The last class (deuteromycete) is a catch-all group for which the sexual state is unknown. A more detailed discussion of the classes of molds and indoor air can be found in Burge H.A.; Otten, J.A.: *Fungi.: Bioaerosols: Assessments and Control*, Pages 19.1 – 19.13, J. Macher, H.A. Ammann; H.A. Burge; et al, Eds. American Conference of Governmental Industrial Hygienist (ACGIH). Cincinnati, OH (1999). Essentially, then, there are hundreds of thousands of types of mold which reproduce by their tiny spores that matriculate through the air.

Molds need four things to grow: food, air, the right temperature and water. While, obviously, the vast majority of fungi naturally grow outdoors, molds are very commonly found in buildings and homes where there is sufficient moisture. Molds prefer damp, dark, warm environments and can grow on almost anything from basement walls, cement, garbage cans, house plants, and a multitude of building materials. Moisture in buildings can come from water damage, excessive humidity, condensation, water leaks, flooding, leaking roofs, faulty plumbing, sewer back-ups, overflowing washing machines, and rain water which penetrates the building envelope.

II. Health Concerns of Molds in the Indoor Air

Molds and their spores contain allergens, which in some people with sensitivity to fungi can cause allergic reactions. Certain molds can cause infection in the same way as do

bacteria. Molds can also produce volatile organic compounds (VOCs) which manifest themselves as musty odors and can cause irritation to the eyes, nose and throat.

Possible health effects from mold and other fungi fall into 3 groups. The best known are **allergic** reactions or abnormal reactions to ordinarily harmless substances, i.e., allergens. When an allergen such as pollen is absorbed into the body of an allergic person, the bodily immune system is triggered. White cells produce antibodies which attach themselves to mast cells, causing a release of the body's defense chemicals such as histamine. It is these chemicals, not the allergens, which cause symptoms such as runny nose, watery eyes, itching, sneezing and coughing.

People can be allergic to one or more allergens, but the most common include pollens, molds, dust mites, animal dander, food, medications, cockroach droppings and insect stings. There are a variety of allergic reactions which are well known: seasonal allergic rhinitis (often called hay fever); allergic rhinitis (a generalized term describing nasal congestion, sneezing and runny nose due to allergies); eczema or atopic dermatitis (a non-contagious itchy rash which can cover the entire body); contact dermatitis (a reaction involving red, itchy and inflamed skin after contact with allergens or irritants); and urticaria or hives (itchy, red swollen areas on the skin that can appear anywhere). About 25% of the U.S. population will experience an episode of hives at least once in their lives.

www.aaaai.org/nab/index.cfm?p=faq (American Academy of Allergy, Asthma and Immunology). See also Rom, W.N.: Environmental and Occupational Medicine. Little, Brown & Co. Boston (1983).

Molds can also cause an **infectious** response which consists of growth in or on the body. Aspergillosis or histoplasmosis are examples of such an infectious response. Walker

T.S.: Microbiology. W.B. Saunders Co. Philadelphia (1998). Finally, mold can have a **toxic** effect. Such a response results in disruption of cellular function and interaction with DNA, as occurs with certain toxigenic effects including aflatoxin-induced cancer. Siegler, A.; Bennett J.W.: *Mycotoxins and Mycotoxicoses*. BioScience 30: 512-515 (1980). The many diseases and illnesses associated with fungi are the source of innumerable publications.

Defense lawyers and their clients should concentrate on property damage and toxic bodily effects of molds associated with the production of mycotoxins indoors. Mycotoxin has been defined "as a mold-produced secondary metabolite that is injurious to vertebrates upon ingestion, inhalation or dermal contact." Robbins, C.A.; et al.; *Health Effects of Vicotoxins in Indoor Air: A Critical Review*. Appl. Occup. Environ. Hyg.: 15(10):773 – 784. (Applied Industrial Hygiene 2000).

III. *Stachybotrys*: What's the Fuss?

Stachybotrys chartarum, also known as *stachybotrys atria*, is a greenish black mold which is slow growing and needs a constantly wet environment to grow. It grows only on wood, paper and cotton products and is found in 2% - 5% of all American homes. Under certain conditions, *stachybotrys* can produce mycotoxins. However, there is currently no legitimate evidence that small levels of exposure in an indoor environment are harmful to humans. www.aaaai.org/nab/index.cfm?p=faq (2005). However, in sufficient amounts *stachybotrys* can engender responses of coughing, wheezing, runny nose, irritated eyes or throat.

At one time *stachybotrys* was causally connected to pulmonary hemosiderosis (bleeding in the lungs) in a small number of infants. In December, 1994 and January, 1997, articles described a cluster of 10 total infants from Cleveland, Ohio with acute idiopathic

pulmonary hemorrhage (also known as pulmonary hemosiderosis)(AIPH). Center for Disease Control (CDC). *Acute Pulmonary Hemorrhage/Hemosiderosis Among Infants – Cleveland, Ohio, January, 1993 – November, 1994*. MMWR 1994; 43: 881 – 3; CDC. *Update: Pulmonary Hemorrhage/Hemosiderosis Among Infants – Cleveland, Ohio, 1993 – 1996*. MMW 1997; 46:33 – 5 (the “Cleveland Study”). The children resided in contiguous property and had one or more hemorrhagic episodes, resulting in one death. Preliminary results of a CDC case – control study seemed to indicate that the hemorrhage was associated with major household water damage during the six months prior to illness and increasing levels of *stachybotrys*. “The hypothesis from the findings of the investigation was that infant pulmonary hemorrhage may be caused by exposure to potent mycotoxins produced by *S. Chartarum* or other fungi growing in moist household environments.” www.cdc.gov/mmwr/preview/mmwrhtml/mm4909a3.htm (2000).

Upon further reflection and analysis with both government-sponsored and outside experts, the working hypothesis was rejected and it was determined that: “the associations should be considered not proven; the etiology of AIPH is unresolved.” *Id.* The reviewers found multiple problems with the clinical presentation of “hemosiderosis.” There was an acute presentation in all cases among a narrow age distribution of six weeks to six months and there was an absence of iron deficiency among the subjects which made the diagnosis distinct from idiopathic pulmonary hemosiderosis (IPH). Moreover, subsequent similar cases did not conform to the clinical patterns of cases in the original cluster. Both groups of reviewers also concluded that the evidence did not substantiate the reported epidemiological associations between household water damage and AIPH or between household fungi and AIPH; nor did it support any inferences regarding causality. There was a lack of standard criteria for water

damage and an absence of a standard protocol for inspecting and recording water-related information from home to home. There was also no accurate assessment of exposure which distinguished between contamination and clinically meaningful exposure. Additionally, no blood evidence or isolates of any kind of either fungi or mycotoxins were obtained among any of the infants in the cluster.

Finally, the analytical methods used were suspect. There were statistical problems. Samples were collected many months apart. There were significant differences in sampling technique, lab procedure and environmental conditions at the time of sampling. Matching on age in such a small data set created a suspect odds ratio and thus the strategy to match controls and cases based on age was misleading. Investigator bias was also discovered, despite the fact that sampling was done in a blinded manner (one investigator inferred the identity of many case homes and collected double samples therefrom versus those from the control homes.) Aggressive, non-standard methods for sampling were also used. Finally, the amounts of cultured *stachybotrys* were similar in percentage for both case and control homes.

The CDC found insufficient evidence to support an association between *stachybotrys* and AIPH. There was limited evidence from other sources supporting the causal connection, as AIPH is inconsistent with the historic accounts of animal and human illness caused by *stachybotrys* and other clusters of AIPH have not been reported in other flood prone areas. Also, the mold-disease association suggested in the Cleveland investigation was not observed during the investigation of a similar cluster in Chicago (unpublished CDC data from May, 1997). Thus, the CDC is still studying the issue and the CDC does not support a causal connection between *stachybotrys* or any toxigenic fungi and AIHP. Copies of the Cleveland Study report of the working group and a summary prepared by CDC of the reports submitted

by the external experts can be accessed at <http://www.cdc.gov/od/ads>, then click on “Pulmonary Hemorrhage/Hemosiderosis Among Infants.”

IV. Mycotoxins

Recall that mycotoxins are a secondary metabolite or chemical which can be injurious upon ingestion, inhalation or skin contact. They exercise their effects on organisms in numerous ways, including interference with cell respiration, interference with metabolism, and direct binding with DNA and RNA. D’Mello J.P. Handbook of Plant and Fungal Toxicants. CRC Press, Boca Raton, Fl. (1997). Mycotoxins occur in a variety of matrices and consist of many diverse compounds. A single mold species may produce multiple mycotoxins, while different mold genera can produce the same mycotoxins. (*Id*; Ciegler, A., *supra*.) The production of mycotoxins in a given species is extremely dependent on growth conditions such as humidity, temperature, and nutrient availability, as noted above. The production of mycotoxins and their health effects on animals and humans are the subject of countless articles and texts. See Robbins, C.A. *supra* at 774, for citations to numerous of those texts.

The Robbins article provides a good summary of a few of the mycotoxins and their human effects. Detailed analysis of this topic is beyond the scope of this paper, but an overview follows.

A. *Aspergillus*

The multiple *aspergillus* molds produce aflatoxins as their mycotoxins. Thirteen have been identified. Burge W.R., et al: *Measurements of Airborne Aflatoxins During the Handling of Contaminated Corn*. Am.Ind.Hyg.Assoc.J. 42:1-11 (1981). While *aspergillus flavus* best grows at 77 – 86°F, and 80 – 85% humidity, it can produce mycotoxins from 54 -

106°F at a relative humidity of up to 99%. *Id.* Foods that can be contaminated with aflatoxins include corn, barley, grain, sorghum, wheat, cotton seed, peanuts, pecans, peas, bread, cheese and rice. Aflatoxins have also been found in the milk, eggs and livers of animals which have ingested contaminated feed. Ciegler, A. et al: *Mycotoxins: Occurrence in the Environment*. In: *Mycotoxins and N-nitroso Compounds: Environmental Risks*, Pages 1 – 50. R.C. Shank, Ed. CRC Press, Inc., Boca Raton, FL. (1981). Oral ingestion of aflatoxins has been shown to be teratogenic and carcinogenic in animals and also carcinogenic via inhalation in animals. Jakab, G.J., et al: *Respiratory Aflatoxicosis: Suppression of Pulmonary and Systemic Host Defenses in Rats and Mice*. *Toxicol. Appl. Pharmacol.* 125: 198-205 (1994); Zarba, A. et al: *Aflatoxin B1 – DNA Adduct Formation in Rat Liver Following Exposure by Aerosol Inhalation*. *Carcinogenesis* 13 (6N): 1031 – 1033 (1992); Louria, D.B., et al: *Aflatoxin – Induced Tumors in Mice*. *Sabouraudia* 12: 371-375 (1974). Aflatoxin and its disease nexus was discovered in the 1960's when hundreds of thousands turkeys died after eating aflatoxin – containing peanut meal, hence the name Turkey X Disease. Ciegler, A., et al: *Mycotoxins and Mycotoxicoses*. *Bio-Science* 30: 512 – 15 (1980). Ingestion of aflatoxin has been implicated in human liver cancer and indirectly associated with liver cirrhosis and Reye's Syndrome. An epidemiology study suggested higher cancer rates in peanut processing workers. Bruce, R.D.: *Risk Assessment for Aflatoxin: II. Implications of Human Epidemiology Data*. *Risk Analysis* 10: 561-69 (1990); Ciegler, A. *Mycotoxins, supra*; Burg, W.R. *supra*.

B. *Fusarium, Stachybotrys, et al.*

The trichothecene mycotoxins are extremely toxic, have been extensively studied, and over 100 isolated compounds have been identified. D'Mello, J.P., *supra*. Trichothecene

poisoning can result in skin irritation, vomiting, anorexia, diarrhea, hemorrhage, convulsions and even death. Ciegler, A., et al. *Mycotoxins and Mycotoxicoses, supra*.

Fusarium is the mold thought to be responsible for Alimentary Toxic Aleukia (ATA) through the T-2 Toxin. At the end of WWII, thousands in the USSR were starving and ate over-wintered cereal grains. It is believed that hundreds of thousands of people died. Early symptoms of gastritis were followed several months later by progressive bone marrow damage, blood disorders and death due to hemorrhage. The original outbreaks were thought to be diphtheria or cholera. Marasas W.F.O., et al: *Toxic Fusarium Species: Identity and Mycotoxicology*. Pennsylvania State University Press, University Park, PA (1984); Linsell, C.A.: *The Mycotoxins and Human Health Hazards*. *Pure & Appl. Chem.* 49: 1765 – 69 (1997).

Fallout from *stachybotrys* exposure was first reported in 1931 in Eastern Europe and Russia. Moldy straw containing *stachybotrys* killed horses and other farm animals and in people caused dermatitis, bloody rhinitis, cough and severe respiratory tract irritation. It was described as a fatal hemorrhage disease of horses, with farm workers and those using the straw for bedding reporting symptoms as well. Ciegler, A.: *Mycotoxins, supra*; Forgacs, J.: *Stachybotrytoxicosis*. *Microbial Toxins*. In: *Fungal Toxins*, pages 95 – 128, S. Cartus, et al., Eds. Academic Press, New York, (1972); Mirocha, C.J., et al.: *Chemistry of Fusarium and Stachybotrys Mycotoxin*. In: *Mycotoxic Fungi, Mycotoxins, Mycotoxicoses: An Encyclopedic Handbook*, pages 365 – 420, T.D. Wyllie, et al. Eds. Marcel Dekker, Inc., New York (1977); Newberne, P.M.: *Mycotoxins: Toxicity, Carcogenicity, and the Influence of Various Nutritional Conditions*. *Environ. Health Prospect.* 9: 1-32 (1974). Human symptoms of exposure to *stachybotrys* include fever, dermatitis, blood disorders, chest and upper

respiratory symptoms and other effects found in farm workers, workers in cotton seed oil plants and grain elevators, and workers at facilities which process multi-grains, reprocess moldy grain, textile mills using plant fibers and twine factories. Croft, W.A. et al.: *Airborne Outbreak of Trichothecene Toxicosis*. Atmos. Environ. 20 (3N): 549 – 552 (1986); Hodgson, M.J., et al.: *Building – Associated Pulmonary Disease from Exposure to Stachybotrys Chartarum and Aspergillus Versicolor*. J. Occup. Environ. Med. 40: 241-49 (1998).

C. Penicillium

Penicillium produces several mycotoxins, including ochratoxin A which has been shown to be teratogenic and cause kidney damage in animals. Ciegler, A., et al.: *Mycotoxins and Mycotoxicoses*. Bio-Science 30: 512-15 (1980). Believed to be caused by chronic exposure through ingestion of contaminated foods, ochratoxin A has been implicated in Balkan nephropathy, a chronic fatal kidney disease in the Balkan Valley. *Id.*

D. Alternaria

This ubiquitous mold is known to produce about 125 secondary metabolites, 25% of which are toxic in animals or cell culture systems. D'Mello, J.P., *supra*; Alexopoulos, C.J., *supra*. While *alternaria* itself is relatively benign, it does have some role in allergic disease, although the extent of its relationship to human disease is unknown. This is because studies regarding the relationship between human inhalation exposure and the mycotoxins of different mold species are relatively few and far between.

V. Animal and Human Studies

Animal mycotoxin inhalation studies are many. Certain studies have been trumpeted by the Plaintiffs' Bar because their results indicate that mycotoxins are more toxic through inhalation than ingestion. See Creasia, D.A., et al.: *Acute Inhalation Toxicity of T-2*

Mycotoxin in Mice. Fund. Appl. Toxicol. 8: 230 – 35 (1987); Creasia, D.A., et al.: *Acute Inhalation Toxicity of T-2 Mycotoxin in the Rat and Guinea Pig*. Fund. Appl. Toxicol. 14: 54 – 59 (1990). The defense practitioner should carefully sort out the studies being relied on by plaintiff's counsel and their experts. Even the animal studies seem to suggest a minimum threshold level for effects of mycotoxins.

Case reports abound of links between inhalation exposure and mycotoxin-induced illness in humans. Only a few reports arise from indoor settings; more exist regarding agricultural exposure. Case reports are one hit incidents reported for their general medical value, but are the least scientific forms of reporting. However, they do tend to show that clinically important health effects occur after high level exposure to mycotoxins in bio-aerosols. Direct contact with *stachybotrys*-contaminated straw does result in health effects, but it is unlikely that these extremely high exposure conditions occur as a result of surface mold growth in the indoor home or work environment. Mouilleseaux, A., et al.: *Airborne Fungi in Several Indoor Environments*. In: Health Implications of Fungi in Indoor Environments, pages 155 – 68, R.A. Sampson, et al., Eds. Air Quality Monographs. Elsevier, Amsterdam (1994).

There are only a few human epidemiological studies, some of which were done by the most prolific plaintiff's experts, the results of which are highly suspect. Johanning, E.; Biagini, R.; Hull, D.L.; et al.: *Health and Immunology Study Following Exposure to Toxicogenic Fungi (Stachybotrys Chartarum) in a Water-Damaged Office Environment*. Int. Arch. Occup. Environ. Health 68: 207 – 18 (1996). Obviously the Cleveland Study raised national fear in the U.S. Having ultimately concluded that the association between AIPH and exposure to *stachybotrys* "was not proven," the CDC continues to study the possible

associations and etiologies. Clearly, epidemiological studies have linked ingestions of aflatoxin-containing foods to liver cancer in humans, but the exact role in its development is unclear due to the concomitant presence of hepatitis B virus. Bruce, R.D.: *Risk Assessment for Aflatoxins, supra*; Kelly, J.D.; et al.: *Aflatoxin B1 Activation in Human Lung*. Toxicol. Appl. Pharmacol. 144 (1): 88 – 95 (1997).

VI. There is Mold Afoot: What's a Soul to do?

Mold growing in homes and buildings, whether *stachybotrys* or otherwise, indicates a problem with water or moisture which should to be immediately addressed. **The key to mold control is moisture control.** The mold needs to be cleaned and the excess moisture or water removed. Maintaining the relative humidity between 30% - 60% helps control mold.

The publications regarding mold control and remediation are legion. Rather than attempt to synthesize them, some of the better, and sometimes more interesting, sites are included herein. These resources all discuss the problems of mold and fungi within homes and buildings and each have their benefits in terms of education and remediation strategy and execution.

First is the United States Environmental Protection Agency's (USEPA) website on indoor air quality regarding mold: <http://www.epa.gov/iaq/molds/moldresources.html>. This is a good introduction to mold in the indoor environment coupled with numerous resources, sites and links. It is attached at the conclusion of this article as Exhibit A. Other general sites regarding mold in the environment abound.

<http://www.cdc.gov/nceh/airpollution/mold/moldfacts.htm>;

<http://www.cdc.gov/nceh/airpollution/mold/stachy.htm>.

Indoor air quality and mold remediation at schools is a hot button issue in both Canada and the United States. The U.S. EPA's "Mold Remediation in the Schools and Commercial Buildings" is the world's recognized resource on the topic and is attached hereto as Exhibit B. Health Canada also sponsors its IAQ "Action Kit for Canadian Schools," admittedly derived from the U.S. EPA's information. The cover page to this 192 page document is attached as Exhibit C. The U.S. EPA likewise has its "Tools for Schools Kit," only a small portion of which is attached hereto as Exhibit D.

Besides schools and commercial buildings, homes are obviously of particular importance in the control of molds and moisture. The U.S. EPA addresses this issue in its publication "Biological Pollutants in Your Home." That publication is attached in its entirety as Exhibit E. The Canada Mortgage and Housing Corporation (CMHC) has two publications of interest to homeowners and condominium owners. The first is its publication CE 30, "Water Damage, Mold and House Insurance," attached below as Exhibit F. Note that the first action to be taken upon the discovery of mold is: "first, call your insurance broker or agent and report the water damage." The CMHC's publication CE 36, "The Condominium Owners' Guide to Mold," gives a basic background on mold and remediation techniques. Note its statement that "over 275 species of mold have been identified as living in Canadian homes." It is attached as Exhibit G.

VII. National Allergy Bureau (NAB)

The National Allergy Bureau is a section of the American Academy of Allergy, Asthma and Immunology's Aeroallergen Network and is responsible for reporting current pollen and mold spore levels to the general public. The Aeroallergen Network consists of pollen and spore counting stations staffed primarily by AAAAI volunteers. The NAB

currently provides the most accurate reliable pollen and mold counts from approximately seventy-five (75) counting stations throughout the United States and two (2) counting stations in Canada. The stations use air sampling equipment to collect airborne pollen and spores which are then examined. The information is used for research in the diagnosis, treatment and management of allergic diseases. The pollen and mold counts are electronically forwarded to local, regional and national media outlets (which can include your own firm) whenever counts are updated by stations, as requested.

The two Canadian counting stations are both located in Ontario. The first is the London Health Sciences Center, and the station head is James Anderson, MLT. The address is 375 South Street, RM E211 NR London, ON N6A4G5, Canada, phone number 519.685.8500, extension 75940, fax number 519.667.6841. The other AAAAI certified counting station is located in Niagara Falls. Its station head is Dr. Michael Alexander. The address is 5673 North Street, Suite 102, Niagara Falls, ON L2G1J4, Canada. The phone number is 905.374.1405 and the fax is 905.374.1428. For more information regarding the NAB, the contact information is as follows:

Manager, National Allergy Bureau
AAAAI Executive Office
555 East Wells Street, 11th Floor
Milwaukee, WI 53202-3823
Phone: 414.272.6071
Fax: 414.272.6070
Email: nab@aaaai.org

Examples of each reporting stations' pollen and mold reports are attached below as Exhibits H and I. However, one should be aware that the Canadian reporting stations seem to focus on trees and often do not report the mold count.

The NAB utilizes a scale with respect to mold concentrations, attached as Exhibit J. Note the caveat that “these mold levels were determined to outdoor exposure to naturally-occurring spores in the environment and should not be applied to indoor exposure which may represent an entirely different spectrum of spore types.” Additionally, the definitions “are based on ecological measurements not health effects.”

VIII. Conclusion

The existing scientific and medical literature does not support a causal connection between health effects and exposure to mycotoxins indoors, except in limited high exposure scenarios. As all defense lawyers know, extrapolating animal study results to humans is suspect at best. So that mold litigation does not replicate the asbestos debacle, more studies are needed, empirical data regarding indoor and outdoor molds of different types, in different settings, in different areas of each country are necessary. There are no current disease or health related exposure standards for mold in either the United States or Canada. Nevertheless, the issue of mold exposure is becoming an increasing focus of litigation, with plaintiffs’ lawyers and their experts attempting to advocate exposure limits and standards. The Canadian defense lawyers should be on a vigilant watch for this evolving litigation trend and associate with experienced counsel and seasoned experts to avoid the creation of negative precedent for their clients and any of the nation’s provinces.