FORENSIC APPLICATIONS CONSULTING TECHNOLOGIES, INC.

CENSORED VERSION

INDUSTRIAL HYGIENE EVALUATION FOR THE RESIDENCE LOCATED AT:

xxxxx County Road xxx
Xxxxxx, CO

Prepared for:
Xxxxxx Xxxxxx
Xxxxxx Xxxxxx
Xxxxxx Xxxxxx

Prepared by:
FORENSIC APPLICATIONS CONSULTING TECHNOLOGIES, INC.

September 29, 2012

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EXECUTIVE SUMMARY

On September 26, 2012 FACTs personnel performed an on-site evaluation at the property located at xxxxx County Road xxx, Xxxxxx, CO. The purpose of the evaluation was to assess reports of indoor moulds[1] at the property.

As part of the assessment, FACTs personnel performed a standard structural assessment pursuant to state-of-the-art and standard industry practices[2,3,4] using guidance documents from the US EPA[5], US NIOSH[6], AIHA[7], World Health Organization[8] and pursuant to international standards including:

- ASTM Standard D7338-10 *Standard Guide for Assessment of Fungal Growth in Buildings*[9]
- ASTM Standard E 2418-06 *Standard Guide for Readily Observable Mold and Conditions Conducive to Mold in Commercial Buildings: Baseline Survey Process*[10]

[1] Two accepted spellings exist for filamentous fungi: "mold" and "mould." The latter spelling is preferred in light of international spelling rules, and my role on international standards committees.

[2] Guidelines on Assessment and Remediation of Fungi in Indoor Environment; New York City Department of Health, Bureau of Environmental & Occupational Disease Epidemiology, 2000

[3] Health Canada: *Fungal Contamination in Public Buildings: Health Effects and Investigation Methods*. Health Canada, Ottawa, ON (2004)

[4] Canadian Construction Association; *Mold Guidelines for the Canadian Construction Industry*; CCA; Ottawa, ON; 2004

[5] US Environmental Protection Agency, *Mold Remediation in Schools and Commercial Buildings*, EPA 402-K-01-001 March 2001 (updated 6/25/01)

[6] The CDC Mold Work Group, National Center for Environmental Health, National Center for Infectious Diseases, National Institute for Occupational Safety and Health, Centers for Disease Control and Prevention, October 2005

[7] *Recognition, Evaluation, and Control of Indoor Mold*, Prezant E; Weekes, DM; Miller JD (Eds.) American Industrial Hygiene Association 2008

[8] World Health Organization *Guidelines For Indoor Air Quality Dampness And Mold* (ISBN 798 92 890 4168 3) WHO Regional Office for Europe, Scherfigsvej 8, DK-2100 Copenhagen Ø, Denmark, July 2009

[9] This reviewer (Connell) currently serve on the ASTM D22 Committee which promulgated this standard.

[10] This reviewer (Connell) was instrumental and a contributing author in the promulgation of E2418-06 and wrote some of the language contained in the standard.

FACTs personnel also performed a critical review of the September 17, 2012 report titled "Indoor Air Quality (IAQ) Sampling at xxxxx County Road xxx, Xxxxxx, CO 80107" prepared by Weecycle Environmental Consulting, Inc.[11]

Based on our observations we have found the following:

- There is no valid information from any cognizant mould consultant to indicate the subject property has a mould problem.
- The report prepared by Weecycle constitutes junk science.
- Weecycle never performed any kind of indoor air quality "sampling" as claimed.
- The credentials used by the Weecycle author are not recognized by any regulatory agency, medical organization or any legitimate scientific or Industrial Hygiene organization, and do not carry any statement of proficiency in indoor moulds
- The certification "credentials" used by the author of the Weecycle report are mostly associated with poorly trained junk-science "Toxic Mold Is Gold" practitioners.
- The "samples" collected by Weecycle are entirely invalid.
- The general sampling conducted at the subject property is not accepted as a valid method by any recognized professional organization, regulatory organization, governmental organization or scientific community.
- Most cognizant authorities and professional organization recommend against performing the type of air "sampling" conducted at the subject property by Weecycle.
- At no time were valid scientific sampling theory or acceptable sampling practices or protocols employed by Weecycle at the subject property.
- None of the sample results presented in the documents reviewed are scientifically based, reliable, or tenable from a scientific perspective, and any conclusions based on those results are fatally flawed.
- The work of Weecycle at the subject property exhibited gross technical incompetence and is consistent with that of the "Toxic-Mould-Get-Rich-Quick" practitioners.
- Some portions of the text found in the Weecycle report appear to have been plagiarized from other authors and sources with proper citations.
- The "decontamination" protocol recommended by Weecycle is extreme in nature, unjustified, and not within acceptable standard industry practices for the scientifically based Industrial Hygiene community, or the accepted water damage and restoration industry.
- There is no objective or subjective evidence presented in the documentation which would support the argument that any occupant of the subject property, or the surrounding

[11] 5375 Western Avenue, Suite B, Boulder, Colorado 80301

properties, have been or will be exposed to hazardous or unusual concentrations of indoor moulds or mycotoxins.

- Taken at face value, and ignoring the invalidity of the samples and "testing" performed, the Weecycle documents failed to demonstrate that unusual spore concentrations were even present in the property (e.g. if the samples were valid, they would have demonstrated normal, everyday, anticipated human exposures, that would be typical for virtually every home in Colorado.)

- Lacking supportable documentation of exposure, therefore, forces the conclusion that no adverse physiological effects could be expected from otherwise normal exposures.

- During FACTs assessment, the structure was devoid of unusual odors except a strong odor of marijuana in the northeast bedroom of the second floor.

- The structure was devoid of odors of any fungal activity.

- The basement of the property contains isolated growths of common, ordinary, everyday mould.

- The moulds observed in the subject property would be similar to that found in virtually every property in Colorado.

- The presence of the moulds identified is inconsequential and could not conceivably result in any hazardous exposures to the occupants.

- No kind of “mould remediation” is warranted for the property.

- Normal, everyday, household cleaning practices will be sufficient to remove the colonization and maintain the property.

This discussion provides our observations, and the rationale underpinning our conclusion.

INTRODUCTION to the MOULD INDUSTRY

Currently, in the U.S., there are two competing “industries” involved in indoor moulds:

- A fear-based “toxic mould” industry
- A science and objective fact-based profession

Fear-Based "Toxic Mould" Industry

The fear-based, anti-scientific “Toxic Mould is Gold” industry is a newly formed “industry” based on junk science, myth, hyperbole, “mould testing” (such as that performed at the subject property) and pseudo “standards.” The practitioners of this junk-science based industry include discredited medical practitioners[12] and field

[12] OAH No. L2003120323, File No. 05-2001-124743, In the Matter of the Second Amended Accusation Against: Gary Ordog, M.D. Certificate No. G 43038; Timothy S. Thomas, Administrative Law Judge Before The Division Of Medical Quality Medical Board Of California Department Of Consumer Affairs State Of California; April 11, 2006 (Dr. Ordog was subsequently banned from testifying as an expert witness until 2013).

personnel who frequently refer to themselves as “Certified Mould Inspectors” (CMI) or “Certified Microbial Consultants” (CMC) or other unrecognized, self appointed “certificates.” In this case, the author of the Weecycle report (Ms. Judith Sawitsky) identifies some unrecognized “certification” as “CMC #0607101.” In Colorado (as in most States), a child of 12 years with no training in mould, mycology, Industrial Hygiene, or microbiology, could sit down at their computer and print out a “certificate” on their home computer identifying themselves as a “Certified Microbe Consultant” or “Certified Mycological Consultant” or any number of other self-appointed titles, and lawfully use the initials “CMC” and offer their expertise in mould assessments and sampling.

“Certified” mould consultants are invariably the consultants who collect junk-science "samples" and perform "testing" and ultimately recommend extreme "remediation" protocols that are totally unnecessary. The fear-based industry has no guidelines, no regulatory oversight, no accepted standards of practice and no recognized professional standing or authority. Practitioners of the fear-based industry create their own "standard industry practices" as they progress through a project.

The practitioners of the fear-based industry frequently claim that the indoor mould issue is a “newly discovered” field, and so much is unknown that there are no known standards. In fact, sampling for moulds, human exposure assessments to mycotoxins and the assessments of indoor moulds and their significance dates back well over a century. In the FACTs corporate library, there is an hard bound 400 page indoor air assessment manual[13] dated 1955; even then, occupational hygienists were referencing scientific and medical papers on indoor moulds from the early 1800’s!

Science Based Industrial Hygiene Community

The fact-based, objective, medically accepted and scientifically founded assessment community, on the other hand, is that which is practiced by legitimate Industrial Hygienists, Mycologists, Microbiologists, and other recognized professionals. These legitimate professionals when engaged in mould assessments follow standard accepted practices and according to those practices virtually never collect air samples, tape lift samples, bulk samples or other "tests" for moulds during indoor mould related assessments.

The fact-based scientific community has regulatory oversight, internationally accepted standards, peer reviewed published literature and international recognition. The U.S. Institute of Medicine (IOM) specifically identifies the “Industrial Hygienist” *exclusively* as the professional of choice for assessments for individual patients with suspected indoor-related health problems.[14] The US EPA explicitly references the Industrial Hygiene profession as the profession of choice, and references publications of the AIHA

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13 Wells WF, Airborne Contagion and Air Hygiene, (Harvard Press, 1955).

[14] Institute of Medicine (IOM), National Academy of Sciences *Damp Indoor Spaces and Health*, Section 3, EXPOSURE ASSESSMENT Washington DC, IOM, 2004

and the ACGIH, for mould related issues. Even Weecycle referenced the AIHA (however, contrary to the statements in their report, as demonstrated later, Weecycle did not follow AIHA guidelines and recommendations as claimed).

FACTs' property assessment and review of the available documentation for this subject property was consistent with guidelines from several states including the State of Colorado. This assessment was consistent with guidelines published by the US EPA, the ACGIH,[15] the AIHA,[16] the World Health Organization (WHO) and the US Centers for Disease Control (CDC), and others, as detailed later in this review.

State of Knowledge

Recent media coverage on indoor moulds has raised the mould issue to a fevered pitch: however, virtually all the information being provided by "mould remediation" companies, unscrupulous "environmental" companies, the misinformed news media, and "certified mould inspectors" is in the realm of science fiction, bereft of factual objectivity or scientific validity.

Contrary to common belief, there is no such thing as "toxic mould" or "toxic black mould." The term "toxic black mould" was a recent invention by irresponsible journalists looking for a good scary story to sensationalize what is otherwise a very normal and, usually, mundane occurrence.

Scientifically, there is no such thing as "toxic mould;" the term is used almost exclusively by charlatans and snake-oil salesmen who prey off the fear of the public. For example, in their report, Weecycle refers to the common, ordinary household mould "*Stachybotrys*" as "pathogenic" and "toxic." This is a fabrication and firmly places the Weecycle report within the realm of the "toxic mold is gold" camp. Weecycle's comment that *Stachybotrys* is pathogenic and toxic is a rejection of known toxicology and medical mycology. *Stachybotrys* is a ubiquitous mould[17] found in every house and structure in Colorado and has long been regarded as nonpathogenic[18] at concentrations typically encountered. Since Weecycle has raised the fear-based *Stachybotrys* issue, we will address this organism in detail later.

Similarly, the frequent allusion to "black moulds" is of no significance; there is no toxicological significance in the color of a mould. White moulds, pink moulds and green

[15] C.P. Connell, the author of this discussion, is a Full Member in good standing with the ACGIH

[16] C.P. Connell, the author of this discussion, is a Full Member in good standing with the AIHA.

[17] Ochiai E, Kamei K, Watanabe A, Nagayoshi M, Tada Y, Nagaoka T, Sato K, Sato A, Shibuya K. *Inhalation of* Stachybotrys chartarum *causes pulmonary arterial hypertension in mice*. Int J Exp Pathol. 2008 Jun;89(3):201-8.

[18] Ochiai E, Kamei K, Hiroshima K, Watanabe A, Hashimoto Y, Sato A, Ando A. *The Pathogenicity of* Stachybotrys chartarum. Nihon Ishinkin Gakkai Zasshi. 2005;46(2):109-17 (the original

moulds may all appear black at some point in their existence. Black moulds are of no greater toxicological significance than any other color of mould.

The presence of an indoor water intrusion problem or *excessive* indoor mould is undesirable, and appropriate measures are needed to ensure that it is properly addressed, and the moisture problem is corrected. Sometimes, (such as in this case) that appropriate action is to merely wipe the discolored surface with a damp rag.

Overall, the *fear* of indoor moulds, and the extreme and excessive measures frequently seen in mould "remediation" projects (such as at this property) are unwarranted.

In March of last year, the US Department of Labor, OSHA published *Indoor Air Quality in Commercial and Institutional Buildings*,[19] wherein OSHA referenced the "Indoor Air Quality Investigation" protocol in its Technical Manual. In that document, OSHA points out that all microbial contaminants combined (including viruses, fungi, mould, bacteria, nematodes, amoeba, pollen, dander, and mites) were found to be the primary sources of indoor air quality problems in only 5% (five percent) of documented indoor air quality problems.

The current unwarranted fear of indoor moulds is propagated by a variety of "mould remediators" and "mould inspectors" who usually have no legitimate knowledge in mould or mycology but prey off the public's fear and perform the type of nonsensical and invalid mould "testing" seen at the Xxxxxx, CO property by Weecycle.

It must be said that all structures in the United Stated have mould; every school, every house, every residence, every apartment, every court room, attorney's office, hospital and every other occupied space in Colorado contains millions to *billions* of mould spores, regardless of whether or not there has ever been a water intrusion problem. All houses and occupiable structures in Colorado have the exact same types of moulds that were reported by Weecycle at the subject property.

In their report, Weecycle makes the remarkable claim that they have a "zero-tolerance" for the presence of *Stachybotrys*; therefore, since every structure in Colorado contains this normal, everyday, ordinary organism, according to Weecycle's thought process, every structure in Colorado has an indoor air quality problem.

Mould Inspection Personnel

Because of the unscientific hyperbole generated by media, a plethora of unscrupulous and poorly trained and self-certified "certified mould inspectors" have entered the newly recognized market feeding off the public's fear and providing wildly inaccurate and unscientific consultation regarding mould, its occurrence, remediation, assessment and

[19] US Department of Labor, OSHA Indoor Air Quality in Commercial and Institutional Buildings OSHA 3430-04 (2011)

significance of human exposures.[20] Misleading sampling protocols, such as those used by Weecycle at the subject property, are often submitted to pseudoscientific "laboratories" by untrained (but certified) "mould inspectors," thereby separating money from frightened property managers and homeowners, in return for nonsensical and meaningless "mould tests" and (usually) unnecessary, but expensive, mould "remediation." In this case, the laboratory used in the analysis is in fact a legitimate and respected Denver Laboratory. However the "data" on the report is not "data" and is not interpretable by anyone (not Weecycle, not FACTs, not anyone). Laboratories do not produce "data," laboratories provide results that can only be turned into data within the context of the expertise of the investigator.

Probably due primarily to TV shows such as "CSI," the myth of a laboratory report having some intrinsic meaning has emerged; the results on a laboratory report have no significance beyond the investigator's written data quality objectives (DQOs) and hypothesis testing (as will be described below)– in this case, and contrary to recommendations by the US EPA, the US Centers for Disease Control, the AIHA and the ACGIH, Weecycle had neither DQOs nor any documented sampling plan.

As mentioned, many "mould inspectors" refer to themselves as "certified"; however, there are no valid or recognized certifications for "mould inspectors" in the State of Colorado since there is no governing body which accredits the certifications. Essentially, someone who has bagged groceries for 20 years, may instantly print a certificate on their personal computer and lawfully declare themselves a "certified microbial consultant," and begin performing mould "testing" and design "mould remediation" projects with no specialized knowledge whatsoever of indoor moulds.

In our experience, none of the "certified" mould inspectors with whom we have experience have any legitimate specialized knowledge in mould, mycology, toxicology or sampling theory. In our experience, FACTs has never encountered a legitimate Industrial Hygienist or Microbiologist or Mycologist who has referred to themselves as a CMC, or CMI or any other make-believe title. In our experience, all "certified mould remediation" companies, similarly, have no legitimate specialized knowledge in mycology or toxicology, but, as in this case, tend to attempt to make mould remediation appear to be something exotic and complex, dangerous, and much more costly than necessary.

This situation appears to be the case with the Xxxxxx, CO property, wherein junk science mould "tests" were conducted in an effort to support the foregone conclusion that extreme and expensive (but completely unnecessary) mould remediation would be recommended.

[20] Bardana, E.J. *The environment and allergic disease:* Annals of Allergy Asthma Immunology 2001; 87(Supp l):52-56

Industrial Hygienists

For decades, the practice of Industrial Hygiene has been the traditional profession that deals with human exposure issues. Over the course of the last two decades, the scientific role of the Industrial Hygienist has expanded beyond the traditional workplace, and the Industrial Hygienist, because of our role in human exposure assessments, hazard assessments, toxicology and risk reduction, has become the leading recognized authoritative profession for indoor mould assessments.

Nowhere in the State of Colorado's regulations, or in scientific or medical literature, do we find any credible references to "Certified Microbial Consultants," "CMC" (as used by the author of the Weecycle report.) However, within Colorado's statutory[21] and regulatory[22] language, we do find references to Industrial Hygienists, and in fact it would be a Class VI felony[23] for an individual to represent themselves as an Industrial Hygienist or present themselves for performing Industrial Hygiene if, in fact, they are not legitimate Industrial Hygienists.

Also, to our knowledge, nowhere in the IOM[24] report is a pseudo professional (such as "CMC") recognized as being proficient in human exposure assessments. Similarly, the recent World Health Organization report[25] specifically refers to standard Industrial Hygiene technical manuals for in-depth discussions for sampling and assessment; WHO does not recognize, or even mention, a "CMC" (or other "commonly encountered initials used by "mould inspectors".)

The US Environmental Protection Agency[26] specifically recommends the field of Industrial Hygiene for consultation, sampling and assessment in schools and commercial buildings. In a medical guidance document, written by physicians for physicians and sponsored by the US EPA, [27] the authors again exclusively recommend Industrial

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[21] See for example CRS §24-30-1402 (this reviewer, CP Connell, was the legislative technical representative in the promulgation of this statute).

[22] See for example, 6 CCR 1014-3 (this reviewer, CP Connell, was a significant contributor to the language and promulgation of this regulation).

[23] CRS 18-5-113. Criminal impersonation

[24] Institute of Medicine (IOM), National Academy of Sciences *Damp Indoor Spaces and Health*, Section 3, EXPOSURE ASSESSMENT Washington DC, IOM, 2004

[25] World Health Organization *Guidelines For Indoor Air Quality Dampness And Mould* (ISBN 798 92 890 4168 3) WHO Regional Office for Europe, Scherfigsvej 8, DK-2100 Copenhagen Ø, Denmark, July 2009

[26] Mold Remediation in Schools and Commercial Building EPA 402-K-01-001 March 2001 (updated 6/25/01)

[27] Storey E, Dangman KH, Schenck P, DeBernardo RL, et al, *Guidance for Clinicians on the Recognition and Management of Health Effects Related to Mold Exposure and Moisture Indoors*, Cooperative Agreement No. T 981255, September 30, 2004

Hygienists as the preferred profession of choice for human exposure evaluations to indoor moulds. FACTs is not aware of any Colorado or EPA publications, or other documents, recognizing "CMCs" or other mould "certifications" as competent professionals to perform Industrial Hygiene assessments or mould assessments.

The US Centers for Disease Control[28] specifically recommends that homeowners and business owners alike follow the recommendations and guidelines of the ACGIH in mould related issues.

Other authors[29] charitably recognize the poor training of "mould consultants" and the important role of the Industrial Hygienist in the decision making process to bring a sense of evidence based balance to a project:

> *A current problem in North America is the involvement of persons without appropriate training and experience in the management of mold and moisture problems. Such individuals often have difficulty in distinguishing small from large problems and are often criticized for applying solutions not matched to problem size. In such situations, public health or financial resources may be sacrificed.*
>
> *A good industrial hygienist knows when his or her expertise is necessary and counsels clients about efficient use of resources. Society as a whole looses when efforts are not directed where they do the most good at the least cost. For this reason, it is important that industrial hygienists balance all competing interests in resolving mold and moisture issues.*

In this case, the Weecycle "consultant" appears to be creating her own mould problem out of thin air (literally) in contradiction to established science. However, Weecycle then provides "results" that entirely fail to demonstrate objectively that the property has unusual spore counts or mould related exposures.

Current Assessment Personnel

The field assessment and review of the Weecycle report was exclusively performed by the author of this discussion, Mr. Caoimhín P. Connell, Industrial Hygienist.

I currently work as a consulting Industrial Hygienist with Forensic Applications Consulting Technologies, Inc., Bailey, Colorado and I possess specialized knowledge in several areas of Industrial Hygiene including microbiology, chemical exposures, analytical chemistry, and indoor air quality (IAQ). I have been a continuously practicing Industrial Hygienist, without interruption, since 1987. Since 1987, I have not held any

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[28] MOLD: *Prevention Strategies and Possible Health Effects in the Aftermath of Hurricanes Katrina and Rita*, The CDC Mold Work Group, National Center for Environmental Health, National Center for Infectious Diseases, National Institute for Occupational Safety and Health. Centers for Disease Control and Prevention October 2005

[29] D'Andrea CP, Prezant B, *Accountability of the Industrial Hygienist: Constituencies and Co-Investigators* (Section 3.1.1) Recognition, Evaluation, and Control of Indoor Mold, Prezant E; Weekes, DM; Miller JD (Eds.) American Industrial Hygiene Association 2008

other professional title or position in the private sector. Since 1987, I have not engaged in work in any other profession except Industrial Hygiene in the private sector. Prior to entering the Industrial Hygiene field, I had approximately ten years experience in analytical and research laboratories in the US and abroad as an analytical chemist and laboratory technician. As part of that work, I was engaged in research activities that involved microbial agents.

I have specifically performed hundreds of microbiological and indoor air quality investigations and critical reviews of documentation for approximately 23 years.

I have performed approximately 700 indoor air quality assessments involving microbiological aspects in private residences, hospitals, prisons and in government and commercial structures. I have performed Industrial Hygiene assessments, epidemiological reviews and health hazard assessments for government and private entities including hospitals, colleges, and insurance facilities. I have performed microbial (mould and Bacteria) building assessments for such highly acclaimed organizations as the National Center for Atmospheric Research (where I currently serve as the Contracting Industrial Hygienist).

I have performed single and multi-residential building mould assessments including a 77 residential housing development in Bozeman, Montana; a ten-structure Department of Defense complex in Picatinny, New Jersey; a 56 unit residential housing project in Rifle, Colorado, and a Federal multi-housing complex in Lawton, Oklahoma, as well as several multistory high-rise apartment buildings.

I have performed complex fugitive emission studies[30] of contaminant migration into and through buildings including fugitive emissions and migration of contaminants for the US Department of Defense in classified military installations, private industry, and for the University Center for Atmospheric Research-Mesa Laboratory, and the National Center for Atmospheric Research.

Over the last quarter of a century, I have performed work for the U.S. Geological Survey (USGS), Health and Human Services (HHS), Federal Bureau of Prisons, and the National Institute of Standards and Technology (NIST), (formerly known as the National Bureau of Standards), insurance providers, insurance recipients, private home owners, home builders, hospitals and private physicians.

In addition to testimony in Federal Court, for both criminal cases[31] and civil cases[32] involving indoor moulds, I have also testified before both the Colorado Senate[33] and the

[30] Rasmuson J, Hall D, Birkner AZ; Connell CP, Martyny J., A Computational Fluid Dynamics (CFD) and Tracer Gas Comparison of the Spatial Distribution of an Airborne Contaminant in an Office Space as a Function of General Ventilation Conditions, American Industrial Hygiene Assoc. Philadelphia (2007)

[31] United States of America v. Stylios Alton Trachanas 11-cr-00445-RBJ, July 9, 2012 in Federal District Court, District of Colorado.

Colorado Department of Health[34] on Industrial Hygiene issues involving sampling theory, epidemiology, and human exposures.

I have provided sworn oral testimony in Federal Court successfully challenging the validity of the same type of mould "sampling" and "testing" performed at the subject property, wherein the Courts ruled that the type of sampling performed at the subject property by Weecycle is not scientifically valid, and is not admissible as evidence.[35] I have testified in civil proceedings before a Binding Arbitration Judicial Panel[36] successfully challenging the scientific validity of the same types of "samples" and "tests" performed by Weecycle at the subject property. I have been unsuccessfully Frye challenged in Federal Court and accepted as an expert in Industrial Hygiene and mould related issues in Federal Court as well as accepted as an expert in Industrial Hygiene via *voir dire* in civil arbitration.[37]

In September 2009, I was nominated by the U.S. Centers for Disease Control to serve as an Industrial Hygiene Subject Matter Expert with the Federally Funded Interagency Board[38] where I serve on the "Health, Medical and Responder Safety Subgroup." In June of 2011, I was nominated by the Chairman of the Interagency Board to serve as a full member of the "Health, Medical and Responder Safety Subgroup," to which I was duly elected and where I currently serve.

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[32] See for example 220 W. Rittenhouse Square Condominium Association v. Myrna Stolker. Philadelphia CCP April Term 2009 No. 02446 (Pennsylvania Federal Court), Honorable Gary F. Di Vito presiding (May 2012)

[33] March 6, 2006, Senate Committee On Business, Labor and Technology, Legislative Action, I testified at the request of Senator Schaffer regarding HB, 06-002 *Methamphetamine disclosures and Real Estate Transactions*

[34] January 19, 2005, Colorado Board of Health, Regulatory Action, I testified at the request of Colorado Department of Public Health and Environment, *Proposed Regulations Pertaining to the Cleanup of Methamphetamine Regulations (HB-04-1182)*

[35] 220 W. Rittenhouse Square Condominium Association v. Myrna Stolker. Philadelphia CCP April Term 2009 No. 02446 (Pennsylvania Federal Court), Honorable Gary F. Di Vito presiding (May 2012) – Frye challenge involving Eckardt Johanning, M.D., M.Sc.; courts rejecting Johanning reports and counter challenges by Dr. Chin Yang, PhD. During this challenge Mr. Connell was certified from the bench as an Expert Witness in indoor mould related issues; based on Mr. Connell's testimony, Dr. Johanning was rejected as an expert and the courts found that the report by Dr. Chin Yang failed to present a compelling counter argument.

[36] Fidelity and Deposit Company of Maryland v. Jonathan Reed & Associates, Inc., et al., (Civil Action No. 08-cv-00248-REB-BNB)

[37] 913 Industrial Park v. Colorado Casualty (Claim Number 902597160002)

[38] Sanctioned by the Attorney General of the United States, the InterAgency Board (IAB) was founded by the Department of Defense's Consequence Management Program Integration Office and the Department of Justice's Federal Bureau of Investigation Weapons of Mass Destruction Countermeasures.

I am a member, in good standing, of the following professional organizations:

- American Industrial Hygiene Association (AIHA)
    - Serving on the Clandestine Drug-lab Working Group
- American Conference of Governmental Industrial Hygienists (ACGIH)
- Property Care Association (England)
- Occupational Hygiene Society of Ireland
- Colorado Drug Investigator's Association

In 1997, I was the Industrial Hygienist acting as the technical representative for Colorado State Representative Mark Paschall in the crafting of the language of Senate Bill 97-119 which defined, for the State of Colorado, the term "Industrial Hygienist" and the practice of "Industrial Hygiene." Senate Bill 97-119 was promulgated, with my suggested language, and was codified in Colorado Revised Statutes Title 24, Article 30, Part 1402. I am a member of the ASTM International Standards D22 Committee (Indoor Air Quality), where I was coauthor of the ASTM WK3792 work product titled "*Standard Guide for the Assessment of Fungal Growth in Buildings*." I have served on the Steering Committee for the ASTM D22.08 Subcommittee (Sampling and Analysis for Mold). I have been asked to spearhead the D22.08 subgroup "Standards to Determine the Adequacy and Completion of Mold Remediation" and I introduced that working item in November, 2011 in Tampa, Florida.

I am a former member of the ASTM International D22.08 Program Committee, where I was nominated by my peers and served as the Session Chairman at the University of Vermont, "Johnson Conference" *Standardization of Mold Response Procedures*. At this international symposium, I also presented an original paper titled "*Sampling and Analytical Issues*" at the invitation of Session Chairman, Dr. John Neville, (Senior Mycologist and Technical Director of Laboratory Services for Bureau Veritas North America).

I was instrumental in crafting the language for the ASTM E2418-06 "*Standard Guide for Readily Observable Mold and Conditions Conducive to Mold in Commercial Buildings: Baseline Survey Process*" and I wrote some of the language contained in that standard.

I was instrumental in crafting the language for the ASTM D7338 –10 "Standard Guide for Assessment of Fungal Growth in Buildings" and I wrote some of the language contained in that standard.

I am a member of the ASTM International E50 Committee on Environmental Assessment & Risk Management, and the ASTM International E30 Committee on Forensic Sciences.

I have been an invited speaker on indoor mould and other indoor air quality and ventilation related issues for the AIHA, American Society of Safety Engineers, Building Owners and Managers Association, National Environmental Balancing Bureau; and I have lectured in toxicology and risk assessment at university level.[39]

[39] Lecturer at Denver University, as part of the Masters Degree in Science Program, at the invitation of Professor Rupert C. Burtan, M.D., M.P.H., D.P.H.

I have been a guest lecturer at the University of Arizona (Arizona Health Sciences Center, Zuckerman College of Public Health), on Industrial Hygiene, and a speaker at the University of Colorado (for ASTM), as well as the Environmental Information Association on mould sampling data interpretation; and, in Huntingdon, England, during November, 2011, I provided a five-parted lecture series on toxicology, sampling theory and risk assessment of indoor moulds.

Issues surrounding the recognition, assessment and control of residential indoor air contaminants, their generation, migration and effects, are squarely within both the defined role and globally accepted realm of the professional Industrial Hygienist. The U.S. Institute of Medicine specifically identifies the "Industrial Hygienist" as the professional of choice "…for individual patients with suspected indoor-related health problems.[40]" As already mentioned, The WHO[41] explicitly refers to standard Industrial Hygiene technical manuals for in depth discussions for sampling and assessments of indoor moulds; as does the US EPA[42] for consultation, sampling and assessment of moulds.

The US Centers for Disease Control[43] specifically recommends that homeowners and business owners alike follow the recommendations and guidelines of my professional association, the ACGIH, in mould related issues. Similarly, the State of Colorado Department of Public Health and Environment *Mold Information Sheet*[44] specifically references both the ACGIH and the AIHA as references for determining the credibility of indoor air quality and mould assessment personnel.

The assessment upon which my opinions were formed are based on continuing specialized knowledge derived from my direct experience, and as it appears in published, peer reviewed journals and from attendance at seminars and lectures during the last 25 years, as well as indoor microbial assessment work and research that I have performed for over 23 years.

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[40] Institute of Medicine (IOM), National Academy of Sciences *Damp Indoor Spaces and Health*, Section 3, EXPOSURE ASSESSMENT Washington DC, IOM, 2004

[41] World Health Organization *Guidelines For Indoor Air Quality Dampness And Mould* (ISBN 798 92 890 4168 3) WHO Regional Office for Europe, Scherfigsvej 8, DK-2100 Copenhagen Ø, Denmark, July 2009

[42] *Mold Remediation in Schools and Commercial Building* EPA 402-K-01-001 March 2001 (updated 6/25/01)

[43] *MOLD: Prevention Strategies and Possible Health Effects in the Aftermath of Hurricanes Katrina and Rita*, The CDC Mold Work Group, National Center for Environmental Health, National Center for Infectious Diseases, National Institute for Occupational Safety and Health. Centers for Disease Control and Prevention October 2005

[44] Colorado Department of Public Health and Environment, *Mold Information Sheet*, August 2002

At all times, my work has been conducted pursuant to standard Industrial Hygiene practices, accepted and standard Industrial Hygiene procedures and accepted and standard Industrial Hygiene methodologies. No new methodologies were introduced or used in this work reviewing information regarding the Xxxxxx, CO property. Similarly, no new or untested scientific methodologies were used, and no new applications for otherwise accepted methodologies were introduced or employed. I have interpreted the data generated by the investigations with the highest standard of care, pursuant to legitimate and published literature and standard Industrial Hygiene industry practices.

MOULD ASSESSMENTS – STATE OF KNOWLEDGE

At the heart of the fear-based "mould inspection industry" is meaningless "mould testing" and air sampling. Weecycle performed mould "testing" which is not based on science, and was grossly inappropriate. The sampling and "testing" performed by Weecycle at the subject property lacked technical competency and lacked validity. The sampling performed by Weecycle does not reflect accepted science and entirely failed to follow the sampling recommendations of the US National Institutes of Occupational Safety and Health,[45] entirely failed to follow the sampling recommendations of the ACGIH, failed to follow the recommendations of the US EPA and failed to follow the recommendations of the AIHA. As a result, the "data" thus produced is meaningless and uninterpretable.

Currently, according to legitimate scientific practices, an assessment of moulds in indoor environments is performed almost exclusively on the basis of a visual inspection by a properly trained individual, usually an Industrial Hygienist, or a microbiologist /mycologist.

The State of Colorado Department of Public Health and Environment[46] makes the following statement regarding mould testing:

> *The Colorado Department of Public Health and Environment does **not** recommend testing as a first step to determine if you have a mold problem. Reliable air sampling for mold can be expensive and requires expertise and equipment that is not available to the general public.*

Colorado Department of Health is not alone in this opinion, the Delaware Division of Public Health informs its citizens:

> *The Delaware Division of Public Health does not routinely recommend testing for mold.*

The neighboring state of Pennsylvania, in its "Pennsylvania Mold Management Task Force Report," as amended in 2010, explicitly states:[47]

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[45] NIOSH Manual of Analytical Methods (NMAM), 4TH Edition - 3rd Supplement, 2003.
[46] CDPHE *Mold Information Sheet*, August 2002

[47] Pennsylvania Mold Management Task Force Report to the Pennsylvania General Assembly August 2006, Amended 2010

> *The building history and walkthrough are often sufficient to identify underlying causes of any suspected mold-related indoor air quality problems.*

The Pennsylvania Mold Management Task Force Report then explicitly recommends the practices of the New York City Department of Health, Bureau of Environmental & Occupational Disease Epidemiology. Those guidelines recognize the importance of a visual inspection and state (in part):[48]

> *A visual inspection is the most important initial step in identifying a possible contamination problem.*

The New York City guidelines address the type of air sampling performed at the Xxxxxx, CO property thusly:

> *Air sampling for fungi should **not** be part of a routine assessment. This is because decisions about appropriate remediation strategies can usually be made on the basis of a visual inspection. In addition, air-sampling methods for some fungi are prone to false negative results and therefore cannot be used to definitively rule out contamination*.

Pennsylvania Mold Management Task Force Report also explicitly suggests that Chapter 4 of the ACGIH publication, *Bioaerosols: Assessment and Control* (The Building Walkthrough), be adopted as a supplemental guide to the completion of a thorough facility walkthrough. In another publication by the ACGIH[49] the authors state that the primary emphasis on indoor mould assessments should rest with a thorough visual inspection of the property.

Similarly, the Department of Health and Senior Services in the State of New Jersey makes the following recommendation:[50]

> *Is it necessary to sample for mold? In most cases, if visible mold growth is present, sampling is unnecessary. Air sampling for mold may **not** be part of a routine assessment because **decisions about appropriate remediation strategies often can be made on the basis of visual inspection**.*

This concept of relying on a visual inspection is consistent with US and international standard industry practices such as the ASTM International Standard D7338-10 *Standard Guide for Assessment of Fungal Growth in Buildings* which states:[51]

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[48] Although a new version of the New York City Guidelines is available, the earlier version is considered by most cognizant authorities as that which more closely reflects the industrial hygiene community's adherence to sound scientific principles.

[49] Macher JM, Chatigny MA, Burge HA. *Sampling airborne microorganisms and aeroallergens*. In: Cohen BS, Hering SV, eds. *Air sampling instruments for evaluation of atmospheric contaminants*, 8th ed. Cincinnati, OH: American Conference of Governmental Industrial Hygienists, Inc., pp. 589-617.

[50] Mold in the Workplace Prevention and Control Public Employees Occupational Safety and Health Program

> ***Basic Fungal Growth Assessment***
> *The most important requirement of an assessment for fungal growth is an on-site inspection of the subject building or portion of the building as per the scope of work.*

In general, sampling and "testing" during indoor mould assessments is **not** considered appropriate by cognizant Industrial Hygiene and medical professionals or other *bona fide* experts involved in mould assessments.

International ASTM Standards, such as ASTM Standard E 2418–06 "Standard Guide for Readily Observable Mold and Conditions Conducive to Mold in Commercial Buildings: Baseline Survey Process",[52] and standards under development for the assessment of indoor moulds in buildings, specifically exclude all sampling during mould inspections; thus reflecting current thought. [53]

The document released by the US Government, Centers for Disease Control[54] *Mold Work Group*, in its section "Chapter 2: Assessing Exposure to Mold" states (in part):

> *Sampling for mold is **not** part of a routine building assessment. In most cases appropriate decisions concerning remediation and need for personal protection equipment (PPE) can be made solely on the basis of visual inspection.* (sic)

The CDC recognized the frivolity of the kind of sampling performed at the Xxxxxx, CO property in mould assessments in the same document when it stated:[55]

> *Other than in a controlled, limited, research setting, sampling for biological agents in the environment cannot be meaningfully interpreted and would not significantly affect relevant decisions regarding remediation, reoccupancy, handling or disposal of waste and debris, worker protection or safety, or public health.*

Weecycle, in their report regarding the subject property, recommend following the guidelines of the US EPA – let's see what the EPA says: In 2004, the EPA published the "*Guidance for Clinicians on the Recognition and Management of Health Effects Related*

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[51] D7338-10 *Standard Guide for Assessment Of Fungal Growth in Buildings* §7 Basic Fungal Growth Assessment

[52] CP Connell, the author of this discussion, was instrumental and a contributing author in the promulgation of E2418-06 and wrote some of the language contained in the standard.

[53] Connell C.P. *Mold Rush: A Commentary*, EH&S Solutions, Nov/Dec 2003

54 The CDC Mold Work Group, National Center for Environmental Health, National Center for Infectious Diseases, National Institute for Occupational Safety and Health, Centers for Disease Control and Prevention, October 2005

55 The CDC Mold Work Group, National Center for Environmental Health, National Center for Infectious Diseases, National Institute for Occupational Safety and Health, Centers for Disease Control and Prevention, October 2005

to Mold Exposure and Moisture Indoors," which was a medical guidance document sponsored by the US EPA.[56] In that document, the authors explicitly warn physicians about the poor quality of the "testing results" they are likely to receive from various untrained consultants and warn physicians:

> *The reader should note that the authors do not advocate air sampling to initially address concerns over mold in the indoor environment. This is in part because air test results are often not representative of the biological exposures a patient may face and, therefore, can be misleading and not helpful.*

The US Environmental Protection Agency, in its booklet "*Mold Remediation in Schools and Commercial Buildings*" [57] recommends against the type of sampling performed by Weecycle at the subject property. The EPA states that except in unusual circumstances, such sampling should not be performed but, if it is, then it should only be performed by a legitimate scientist, such as a qualified Industrial Hygienist, *and only if* the Industrial Hygienist has established proper sampling data quality objectives.

Weecycle, in their report for the Xxxxxx, CO property, recommend following EPA guidelines, but the EPA states:

> *Is sampling for mold needed? In most cases, if visible mold growth is present, sampling is unnecessary.*

The EPA warns:

> *Sampling for mold should be conducted by professionals with specific experience in designing mold sampling protocols, sampling methods, and interpretation of results.*

The EPA document continues with:

> *Inadequate sample plans may generate misleading, confusing, and useless results.*

The EPA states:

> *For someone without experience, sampling results will be difficult to interpret. Experience in interpretation of results is essential.*

…

> *Sampling should be done **only** after developing a sampling plan that includes a confirmable theory regarding suspected mold sources and routes of exposure. Figure out what you think is happening and how to prove or disprove it before you sample!*

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56 Storey E, Dangman KH, Schenck P, DeBernardo RL, et al*, Guidance for Clinicians on the Recognition and Management of Health Effects Related to Mold Exposure and Moisture Indoors*, Cooperative Agreement No. T 981255, September 30, 2004

57 EPA 402-K-01-001 March 2001 (updated 6/25/01)

The EPA notes:

> *Sample analysis should follow analytical methods recommended by the American Industrial Hygiene Association (AIHA), the American Conference of Governmental Industrial Hygienists (ACGIH), or other professional guidelines.*

Contrary to legitimate science and standard industry practices, Weecycle failed to follow any documentable sampling plan and clearly lacks any legitimate knowledge or experience in indoor mould related issues.

Weecycle failed to follow EPA recommendations for performing hypothesis testing; and Weecycle failed to follow the EPA recommendations for performing the work pursuant to objective quality assurance-quality control protocols.

State Mould Task Forces across the country similarly advocate the standard Industrial Hygiene practice of following a sampling plan if samples are collected. The state of Pennsylvania warns its citizens:

> *Prior to the commencement of any sampling, the assessor should develop a detailed **written** sampling protocol.*

In violation of legitimate standard industry practices and in violation of the acceptable standard of care, and contrary to the ACGIH, AIHA, US EPA, US Centers for Disease Control, and the States of California, Nevada, New Jersey, New York, Illinois, Connecticut and the Pennsylvania Mold Task Force, Weecycle has not appeared to have developed or followed any kind of sampling plan or developed any kind of data quality objectives or any kind of hypothesis testing. The samples thus collected by Weecycle at the subject property were essentially willy-nilly meaningless "grab samples" whose "results" are entirely meaningless and whose report contains inconsequential numerals and Latin phrases that are merely ink on paper only within the confidence of amateurish guesswork.

Prior to visiting the site, and without seeing the Weecycle report, and without having any knowledge of the site conditions of the property other than that described to us by the home owner over the phone, FACTs successfully and correctly predicted the spore counts represented in the Weecycle report, and successfully predicted the fungal profiles (with the exception of finding *Sporomiella*).

If we look at the methods referenced by the US NIOSH, the US EPA, US CDC, AIHA and ACGIH, we see that those protocols are vastly different than that which was used by Weecycle for the collection of "samples" at the subject property.

Several standard industry practice manuals identify DQOs and their application in environmental sampling. US EPA SW846 document[58] is geared toward environmental

[58] US EPA *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, 1996 (This is the EPA OSW's official compendium of analytical and sampling methods that have been evaluated and approved for use in complying with the RCRA regulations.)

sampling. The sampling precepts and the QA/QC foundations are recognized as being applicable to all kinds of sampling. The SW 846 describes DQOs thusly:

> *Data quality objectives (DQOs) for the data collection activity describe the overall level of uncertainty that a decision-maker is willing to accept in results derived from environmental data. This uncertainty is used to specify the quality of the measurement data required, usually in terms of objectives for precision, bias, representativeness, comparability and completeness. The DQOs should be defined prior to the initiation of the field and laboratory work. The field and laboratory organizations performing the work should be aware of the DQOs so that their personnel may make informed decisions during the course of the project to attain those DQOs.*

The EPA document identifies the foundation of the sampling plan: *precision, bias, representativeness, comparability and completeness.* These are known as the "PARCC" parameters and are generally given as "Precision, Accuracy (which includes bias), Representativeness, Comparability, and Completeness."

Precision

Precision of a result speaks to the confidence one has of the result, and the error associated with that result. Precision asks: "If I repeat the test, will I get the same result?"

If a 150 pound man steps onto a bathroom scale six times in a row, he is very likely to see that the scale roughly reproduces the same weight reading all six times (it may be the *wrong* weight, but it will usually be about the same each time); that is, the scale is reasonably *precise*. The scale may be inaccurate, but if it gives the same reading over and over again, it is precise.

Now imagine the 150 pound man steps onto the scale six times and observes the following readings:

200 pounds
91 pounds
143 pounds
73 pounds
31 pounds
86 pounds

That man will have no *confidence* in any single reading because the scale is neither accurate nor precise. Therefore, if the man steps on the scale and it shows he weighs 257 lbs. (which is within the confidence limits given above), based on that reading, would it be wise for him to conclude he is overweight and needs to begin a diet? Of course not, because the next time he steps on the scale it could indicate that he only weights 31 pounds and is desperately in need of food. In other words, the reading on the scale cannot be used for any decision making.

And yet, this is exactly the kind of precision (and accuracy) associated with the spore traps collected at the subject property by Weecycle. In fact, the values used in the above example are decimals of actual spore trap sample results taken from a normal, clean, ordinary, healthy, dry Colorado home that did not have a mould problem and all the air samples were collected from the same study area within the home. Here are the actual spore trap results: [59]

2,000 spores/m3
912 spores/m3
1,429 spores/m3
728 spores/m3
309 spores/m3
857 spores/m3

The data exhibit the standard, expected lognormal variability associated with any kind of spore trap samples collected by anyone at any location.

Contrary to what is proffered by Weecycle wherein they posit their sample represents the spore count in the Xxxxxx, CO house, Weecycle is apparently unaware that if they collected another sample three minutes later, that sample would have been wildly different, and then wildly different again another three minutes after that.

It has long been known by legitimate Industrial Hygienists and legitimate mould experts that the kind of air monitoring performed by Weecycle at the subject property cannot confidently or reliably produce results that represent actual spore concentrations.[60] (and in fact, as described later, cannot even be used to confidently identify the genus of the mould present). This fact has been re-established over and again in legitimate peer-reviewed journals in the scientific world (as referenced throughout this discussion). However, mould charlatans ignore basic sampling theory and frighten their victims with nonsensical "sample results" that are "interpreted" on a whim, and mean only what the charlatan wants them to mean. In this case, there is absolutely no evidence that the spore counts in the property are elevated, or that the spores are any different than would be expected in any other home, but Weecycle decided to interpret the results to indicate extreme and costly remediation efforts for what is otherwise perfectly normal mould counts and organisms.

[59] The example spore trap results above were collected from an healthy control home in Colorado. The Shapiro-Wilk W test point is 0.7880, Goodness of fit for Gaussian distribution is 0.9470 and lognormal is 0.9543. Lognormal skew is -0.6513. The MVUE ("average") spore count is 1,052 spores per cubic meter of air. The 95% confidence interval is from 697 spores per cubic meter of air to 2,574 spores per cubic meter of air.

[60] US National Institute for Occupational Safety and Health *Preventing Occupational Respiratory Disease from Exposures caused by Dampness in Office Buildings, Schools, and Other Nonindustrial Buildings*, DRAFT March 30, 2011

It is an established and scientific fact that particle migration is mainly influenced by particle properties, ventilation conditions and airflow patterns.[61] Particle concentrations (such as spores), in general,[62] and spore concentrations, in particular,[63] within a structure exhibit extremely large spatial variations[64] which tend to be compartmentalized within a given space. It is a well established fact that spore counts of airborne fungal entities exhibit a lognormal distribution throughout the day.[65] This means that the variation between two or three samples can be ***huge*** and skewed in one direction (as seen in the above example).

Thus for example, where we see that Weecycle collected one single sample in the basement (1,475 spores/m3) and one sample from the outdoors, (1,240 spores/m3), Weecycle not only ignored the fact that the two "results" are virtually identical,[66] Weecycle also ignores the fact that had they collected the exact same samples three minutes later, the numbers would have been completely different and even reversed; the indoor sample could have been 20 spores/m3 (or 2 or 200 or 20,000) and the outdoor sample could have been 20,000 or 200 or 2,000 spore/m3. Furthermore, were the windows in the residence open during sampling? Closed? Would it matter? Can Weecycle explain why this would have been an extremely important consideration?

It's also interesting to ponder where Weecycle actually got the "results" they reported (1,475 spores/m3 and 1,240 spores/m3), since that is not what the laboratory report shows (1,500 spores/m3 and 1,300 spores/m3). Since Weecycle never explains why their reported results are different from the results reported by the laboratory, we will not know where the reported values originated. On a similar note, Weecycle also mentions they collected swab samples, however, they neglected to provide those sample results or explain why they even collected a swab; it is well known that a legitimate mould expert

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61 Li Y; Heng J; and Chen Z *Study Of Particle Movement In Ventilation System Proceedings*: Indoor Air 2002 Anaheim California, 2002

62 Keady PB; Mainquist L; *Tracking IAQ Problems to Their Source*, Occupational Health & Safety, September 2000

63 Connell CP, *Field Measurements for Moulds: Spatial and Temporal Variations*, Presented at the ASTM International Conference: Bringing Science to Bear on Moisture and Mold in the Built Environment, Colorado University, Boulder 2006

64 Macher JM, Chatigny MA, Burge HA Sampling *airborne microorganisms and aeroallergens* In: Cohen BS, Hering SV, eds. *Air sampling instruments for evaluation of atmospheric contaminants*, 8th ed. Cincinnati, OH: American Conference of Governmental Industrial Hygienists, Inc., pp. 589-617.

65 Macher JM, Chatigny MA, Burge HA *Sampling airborne microorganisms and aeroallergens.* In: Cohen BS, Hering SV, eds. Air sampling instruments for evaluation of atmospheric contaminants, 8th ed. Cincinnati, OH: American Conference of Governmental Industrial Hygienists, Inc., pp. 589-617.

66 Relative percent difference between reported values on the laboratory report (which are different from those actually reported by Weecycle is only 14.3%. Duplicate environmental samples is said to exhibit "Good reproducibility" when the RPD is less than 15%.

can look at a growth and adequately identify the organism(s) present to at least genus level.

In fact, Weecycle apparently is unaware of the fact that had they placed ten identical air samplers within the basement of the residence, and collected ten identical samples at exactly the same time, and submitted those samples to the same laboratory, they would have seen ten completely different sample results; the spore counts would be wildly different and even the types of organisms identified would be wildly different[67] (see the discussion on "Accuracy," below). Yet, each sample would have come from the exact same room at the exact same time. Where such studies have been performed, side-by-side, collocate apparatuses are built which allow several sets of simultaneous side-by-side samples:

Photograph 1
Side-by-side Sample Assembly[68]

[67] Connell CP, *Field Measurements for Moulds: Spatial and Temporal Variations*, Presented at the ASTM International Conference: Bringing Science to Bear on Moisture and Mold in the Built Environment, Colorado University, Boulder 2006

[68] Assembled by this author, CP Connell

When we collect such instant side-by-side samples, we see that even if two spore trap samples are simultaneously collected and are collected within only a matter of inches apart from each other, the results are completely different, and the two samples are not comparable (see the figure below):

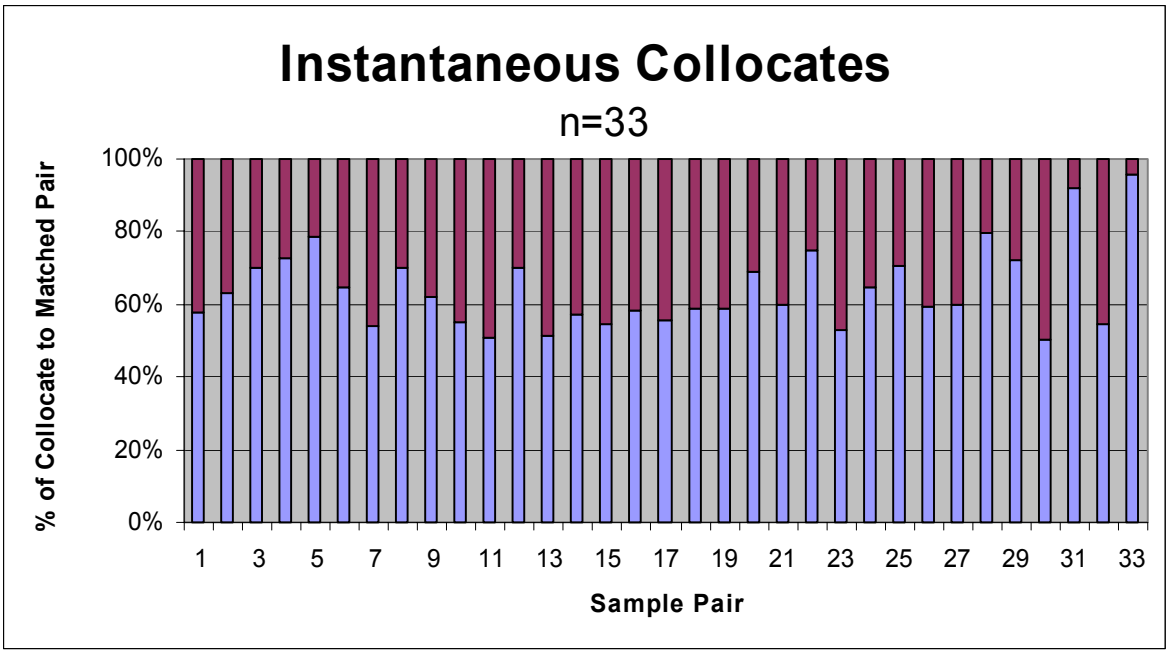

Figure 1
Comparison of Side-by-side Simultaneous Spore Trap Samples[69]

Therefore, by implying that a single sample result obtained from a single room or wall cavity is meaningful, and can be compared with a single sample collected at a different time on the outside, or another single sample somewhere else, Weecycle is rejecting decades of known science and ignoring the fact that they would not have been able to compare two simultaneous inside side-by-side samples taken in the same room at the same time.

Furthermore, the spore trap samples collected by Weecycle at the subject property were exclusively short-term samples (five minutes in duration). It is a well established and standard Industrial Hygiene sampling precept that short term samples exhibit extremely large temporal variations. [70,71] This is to say that if Weecycle had collected ten identical samples within the same room (say the family room), but at different times of the day or

[69] Connell CP, *Sampling Strategies and Data Interpretation,* Environmental Information Association, March, 2010 - Austin, TX

[70] Morris G, Kokki M, *Methods for Sampling Aspergillus spores in air*, Journal of Hospital Infection (2000) 44:81-92 September 1999

71 Ayer HE; Burg J, *Time Weighted Averages Vs. Maximum Personal Sample* (Presented at the AIHA Conference, Boston, MA, 1973)

even just three minutes apart, they would end up with ten completely different sample results; the spore counts would be wildly different and even the types of organisms identified would be wildly different.

We can speak of the precision in terms of "deviation" which indicates the amount of "spread" of results about an "average" concentration (actually a "mean" concentration). Generally, the geometric standard deviation (GSD) of interday and intraday airborne spore concentrations lie between 1.2 and 2.5 geometric standard deviations.[72] These large variations have been known to legitimate Industrial Hygienists for decades,[73,74,75,76,77] and are similar to those seen by other authors, specific to airborne mould concentrations[78,79,80] some of whom have reported even higher fungal variations in indoor air.[81]

Therefore, in the reports where Weecycle declared "The results of this study have shown that, at the time of sampling, the property is outside of acceptable levels." and alluded to a variety of illness, the statements are entirely unsupported since Weecycle never actually determined what the mould spore levels were at the subject property. Rather, Weecycle

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72 NIOSH Occupational Exposure Sampling Strategy Manual, HEW Publication Number 77-173 (1977)

[73] Larsen R.I, A Method for Determining Source Reduction Required to Meet Quality Standards JAPCA, 11, 71, 1961

[74] Larsen R.I, A New Mathematical Model of Air Pollutant Concentration Averaging Time and Frequency, JAPCA, 19, 24 (1969)

[75] Breslin AJ, Ong, Glauberman H, et al, The Accuracy of Dust Exposure Estimates Obtained from Conventional Air Sampling J AIHA, Vol. 8, pp 56-61, (1967)

[76] Sherwood RJ On the Interpretation of Air Sampling for Radioactive Particles Health Physics and Medical Division Atomic Energy Research Establishment, Presented at the AIHA Conference in Philadelphia, 1964 and appearing in its peer reviewed form in J of AIHA Vol. 27, pp 98-109 (1966)

[77] Phinney DE, Newman JE, The Precision Associated with the Sampling Frequencies of Total Particulate at Indianapolis, Indiana JAPCA, 22, 9, (1972)

78 15 Spurgeon, J; Data submitted to the ASTM D22.08.02 Committee for review, October 2005

79 Connell, CP, *Sample results: What do they really tell us?* Presented at the IAQ in Schools Lecture Series, Corpus Christi, TX, 2003

80 Eudey L, Su HJ, Burge HA. *Biostatistics and bioaerosols*. In Bioaerosols, Burge HA, ed. Boca Raton: Lewis Publishers, pp. 269-307. 1995.

[81] Reponen T, Nevalainen A, Jantunen M, et al, N*ormal Range Criteria for Indoor Air Bacteria and Fungal Spores in a Subarctic Climate*; Indoor Air, 2:26-31 (1992). Referenced by Macher JM, Chatigny MA, Burge HA. Sampling airborne microorganisms and aeroallergens. In: Cohen BS, Hering SV, eds. Air sampling instruments for evaluation of atmospheric contaminants, 8th ed. Cincinnati, OH: American Conference of Governmental Industrial Hygienists, Inc., pp. 589-617, but not reviewed by this author (Connell).

used a single meaningless grab sample that produced a single meaningless number on a laboratory report whose variability is not unlike the man stepping on the unreliable scale.

Unlike the man who steps onto a broken scale and looks down and sees that he weighs 14 pounds, Weecycle lacks any competency in mould assessments and was unaware of the huge expected variability of their "results" but, unlike the man on the scale, Weecycle actually believed their numbers had meaning. Weecycle is so poorly trained and technically incompetent that they believe, contrary to known science, that each of their single samples collected for a particular area actually represents the spore concentration for that area.

Nowhere in the Weecycle report do they acknowledge or even address, the huge anticipated variations of their "data," and never actually identified what "acceptable limits" were. How is it that the not a single US regulatory, medical, or scientific organization has established "acceptable limits" -- but Weecycle has apparently established their own make-believe science, with its own make believe "acceptable limits."

Rather, it appears that samples were collected, and then the sample results were ignored, and preconceived conclusions were drawn. Using "data," but ignoring the precision of that data or the confidence surrounding that data, constitutes junk science and is an abdication of established science, standard Industrial Hygiene practices, and the professional standard of care.

Conclusion Regarding Precision:

None of the Weecycle data exhibited characterized or acceptable precision. The lack of precision fatally flaws the data and invalidates the data.

Representativeness

Before moving on to addressing "Accuracy," it is important to address a data quality that is similar in mode to "Precision" and that is "Representativeness."

What did the Weecycle samples actually "represent?"

It is a well known and scientifically accepted fact that air sampling for spores performed at any one time will be applicable **only** for that moment in time that the sample is being collected,[82] and only for that day during which the sampling occurred. Three minutes later or the next day, the results of such testing *will* be completely different. As explicitly explained by the US EPA, even if legitimate sampling is conducted…[83]

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[82] Morris G, Kokki M, *Methods for Sampling Aspergillus spores in air*, Journal of Hospital Infection (2000) 44:81-92 September 1999

[83] United States Environmental Protection Agency "*Mold Remediation in Schools and Commercial Buildings*" EPA 402-K-01-001 March 2001 (updated 6/25/01)

> *Keep in mind that air sampling for mold provides information only for the moment in time in which the sampling occurred, much like a snapshot. Air sampling will reveal, when properly done, what was in the air at the moment when the sample was taken. For someone without experience, sampling results will be difficult to interpret. Experience in interpretation of results is essential.*

Therefore, any sampling that is done any time thereafter, is no longer valid even one day later and at no time thereafter, and neither can the data be used to represent exposures prior to the sample. A legitimate expert in sampling and mould assessments would have known this very basic fact. So what did the single "snapshot" represent if we know that the spore concentration would have been different three minutes later, or even completely different at that same time, but six feet away?

Furthermore, it is a well established fact that mechanical disturbance and activity within a home will significantly increase the overall spore concentrations.[84] Had the vacuum cleaner in the house been operated recently? Had an outside door been recently opened (presumably a door had to be opened to let the Weecycle consultant in – was the spore count not an artifact of that?); Was the Weecycle investigator aware that it is well known our clothing captures, retains and transmits spores[85] and that she brought spores into the subject property on her clothes?

Consider for a moment the following - We know that normal clean, healthy outdoor air can contain spore concentrations that exceed 200,000 spores/m3.[86] We also know that spore concentrations in normal, clean, healthy, outdoor air in agricultural locations can exceed 10,000,000,000 spores/m3.[87] Now imagine the Weecycle investigator moving through this invisible soup of spores, and let's say it is a low spore count of say 100,000 spores/m3 and Weecycle opens the door to the basement to gain access (thereby displacing three cubic meters of indoor air with outdoor air), since the basement contains about 220 cubic meters of air, the resulting spore introduction by the investigator would have been 1,350 spores/m3, not including the spores on her clothes. Weecycle cannot argue that the spore count was not as high as 100,000 since Weecycle never characterized the outdoor air – Weecycle merely collected a single meaningless grab sample whose error bars are massive.

Random Error

Going back to our example of a man on a broken scale - if we ask the question "What does the reading *represent*?" we would have to conclude the reading doesn't represent anything, and certainly doesn't represent the man's weight.

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[84] Levetin E. Fungi (Chapter 5, p. 103), *Bioaerosols*, Burge HA Editor, 1995

[85] Potera C. *Clothing spreads spores*. Environmental Health Perspectives 2001;109:A365.

[86] Levetin E. *Fungi* (Chapter 5, p.99 Bioaerosols), Burge HA Editor, 1995

[87] Levetin E. Fungi (Chapter 5, p. 106), *Bioaerosols*, Burge HA Editor, 1995

If we want to really know the man's weight, even with an accurate and precise scale, we are going to have to ask an *a priori* question "What are we trying to represent?" And we need to ask "Is a "snapshot" going to represent that?"

In this case, we need to know the spore concentrations of two separate locations so we can compare those two locations. We know the spore counts are fluctuating wildly minute by minute and also exhibit huge variations with small changes in weather. We also know that our sampling method is wildly inaccurate (as discussed below) and wildly imprecise, therefore, we will need to collect a lot of samples such that we can characterize those distributions and calculate the errors. Indeed, one researcher notes:[88]

> *The requirement to present an integrated assessment of exposure* [to airborne spores] *implies that the sampling period should be long, perhaps hours or days.*

When using grab samples, such as the spore traps collected by Weecycle at the subject property, accepted classic Industrial Hygiene references[89,90] have estimated that for each daily study period (usually expressed as any eight hour period for a work place or 12 hours for a residential setting) between eight and eleven random grab samples are needed *from each study area* (each bedroom, each foyer, each control area, each living room, and outside etc.), to obtain adequate confidence in determining the variance associated with the study area <u>for just that one day alone</u>. The next day, or any time thereafter, an additional eight to eleven random grab samples are needed *from each study area.* This principle is a basic, foundational principle of air sampling; Weecycle did none of this.

Classic Industrial Hygiene sampling strategy indicates that reasonable confidence in estimating an average ambient airborne concentration is achieved when at least 70% of the exposure time is measured,[91] and states that random "grab samples" (such as those collected by Weecycle at the subject property) are the <u>least</u> desirable technique for estimating the average exposures.[92]

The total sampling time used by Weecycle for the spore traps represents much less than 1/2 of 1% of the anticipated exposure time for any occupant of the residence. This error is known as the "sampling design error," and, if uncharacterized, produces huge uncertainties in the reported results.

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[88] Mo Morris G, Kokki M, *Methods for Sampling Aspergillus spores in air*, Journal of Hospital Infection (2000) 44:81-92 September 1999

[89] NIOSH Technical Information Exposure Measurement Action Level and Occupational Environmental Variability, HEW Publication 76-131, Cincinnati OH, 45226, (1975)

[90] NIOSH Occupational Exposure Sampling Strategy Manual, HEW Publication Number 77-173 (1977)

[91] NIOSH Occupational Exposure Sampling Strategy Manual, HEW Publication Number 77-173 (1977)

[92] Ibid.

Systematic Error

All of the sampling issues described above are a type of error known as “random error.” There is another type of error not yet discussed called "systematic error."

As discussed above, the precision of spore trap collection has been known for several decades to be extremely poor. However, it has also been known for decades that the systematic error associated with spore traps is so high, it even further reduces the reliability of the results, making such data almost impossibly uninterpretable. It is for this reason the US Centers for Disease Control states:[93]

> *Other than in a controlled, limited, research setting, sampling for biological agents in the environment cannot be meaningfully interpreted and would not significantly affect relevant decisions regarding remediation, reoccupancy, handling or disposal of waste and debris, worker protection or safety, or public health.*

Weecycle sent their samples to a legitimate and respected laboratory for analysis. The laboratory is accredited by the AIHA; similarly this reviewer (Connell) sits on the ASTM Committee that wrote the International Standard used for counting spores[94]and was instrumental in crafting the standard.

The AIHA certification is not a statement of veracity of the results. In June of last year, a study was published[95] concerning the same spore counting methods used by Weecycle in their “samples” for the enumeration of spores in the air. The published study concluded what was already known to legitimate Industrial Hygienists: not only are the samples themselves inherently variable (as described above), but the analyzing laboratories to whom the samples are sent for analysis *cannot reliably analyze the samples* to within any reasonable degree of confidence.

The researchers focused on the ability of AIHA accredited laboratories to accurately analyze a sample with confidence. The researchers reported that for the exact same samples that were submitted to seven different AIHA accredited laboratories, the laboratories could not reproduce each other’s results. Each accredited laboratory reported results that were hugely variable among themselves. Sample #1, in their "round-robin," for example, with a probable value of 540 spores per cubic meter of air was analyzed by one accredited laboratory as containing only 40 spores per cubic meter of air, and yet another fully accredited laboratory issued a report stating the result of the EXACT same

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[93] The CDC Mold Work Group, National Center for Environmental Health, National Center for Infectious Diseases, National Institute for Occupational Safety and Health, Centers for Disease Control and Prevention, October 2005

[94] ASTM D7391 - 09 Standard Test Method for Categorization and Quantification of Airborne Fungal Structures in an Inertial Impaction Sample by Optical Microscopy

[95] Robertson LD, et al, A multi-laboratory comparative study of spore trap analyses Mycologia, 103(1), 2011, pp. 226–231. DOI: 10.3852/10-017

sample was 1,933 spores per cubic meter of air – all other laboratories fell somewhere between these two extremes.

The remaining samples in the study were no better, for Sample #3 in the study, one AIHA accredited laboratory reported 1,510 spores/m3 while another, equally qualified AIHA accredited laboratory reported 15,287 spores/m3 for the exact same sample.

So, it begs the question, since Weecycle did not provide any QA/QC for their data, how do they know their laboratory result is correct? In their document Weecycle did not address QA/QC in any manner whatsoever, and therefore, the reader has absolutely no idea if ANY of the data thus reported is even remotely close to representing actual spore concentrations; Weecycle has exclusively relied on the CSI Effect to bamboozle their client.

In the above referenced study, (Robertson) why were all seven participating laboratories "wrong" to the extent they could not reproduce each other's results? Does this information impact the reliability of making decisions based on the air "testing?"

Below, this reviewer (Connell) has summarized the findings of the Robertson report and listed the ranges that the laboratories reported, each analyzing the exact same sample. The laboratories were not capable of determining the actual concentrations of spores in the air; note the large standard deviation (SD) of the counts in the following table:

Sample 1		Sample 2		Sample 3		Sample 4	
Reported Range	SD	Reported Range	SD	Reported Range	SD	Reported Range	SD
40 to 1,933	395	80 to 1,120	290	1,510 to 15,287	3,335	3,700 to 28,959	6,660

Table 1
Comparative Spore Concentrations[96]

Essentially, the Robertson study underscored why legitimate mould assessment personnel do not perform the kind of sampling which was performed by Weecycle at the subject property. The Robertson study also helps to explain how legitimate Industrial Hygienists are able to guess airborne spore counts for a given property that is within the same degree of precision and accuracy as samples collected by Weecycle.

The Robertson study (referenced above) reveals that an indoor mold investigator who was unhappy with his lab "results" could just keep re-submitting the same samples to either the same lab, or to different labs over and over again until he finally gets a laboratory "result" he is happy with, even though the sample remains exactly the same! In this manner, if we were to resubmit the exact same samples collected and reported by Weecycle to another lab, we would get entirely different results; and if we didn't like those data, we could just submit to another, and another, and another AIHA accredited laboratory until we did get "numbers" that we liked.

[96] Robertson LD, et al *A multi-laboratory comparative study of spore trap analyses* Mycologia, 103(1), 2011, pp. 226–231. DOI: 10.3852/10-017

Confidence Intervals

During legitimate Industrial Hygiene sampling and testing, the Industrial Hygienist considers the degree of uncertainty associated with any particular "test" or analysis. The uncertainty is known as the total coefficient of variation (Cv_T), for each method. The Cv_T includes the uncertainty associated with both the sampling and analytical processes. For most methods, the degree of analytical uncertainty (precision) is known and published, and is generally quite small.

In this case, the samples were so poorly collected, if we calculated the confidence intervals of the Weecycle samples pursuant to standard, basic, fundamental assessment techniques, known to legitimate sampling professionals for *decades*[97] we would see that the ranges between the UCL and LCL are so incredibly vast, one could almost just pick a value between zero and 50,000 and one would have as much confidence in the guessed value as either of the two samples collected (which is partially why this reviewer (Connell) actually was able to guess the "results" of the Weecycle "samples" over the phone while talking with the homeowner).

Conclusion Regarding Representativeness

Neither sample collected by Weecycle represents spore counts at the residence. The lack of representativeness fatally flaws the data and invalidates the data. (Even if it was representative, it would show that the counts and genera identified were perfectly normal).

Accuracy

If an Industrial Hygienist is performing an human exposure assessment of say, xylene in the air, and he collects a sample pursuant to NIOSH[98] air sampling protocols, [99] and sent the sample to 10 laboratories, the laboratories won't accidentally confuse, xylene with, say, methyl diisocyanate during the analysis, and report diisocyanate as xylenes, or vice versa. Rather 10 laboratories will all correctly identify the species of the analyte, and report xylene - that is, the method is accurate; the method can correctly identify the material.

However, such is not the case with the mould sampling and testing performed by Weecycle at the subject property. It has long been known (certainly since the mid 1940's) that not only is the precision associated with spore traps extremely poor, but the *accuracy* associated with the method is also extremely poor.

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[97] NIOSH Occupational Exposure Sampling Strategy Manual, HEW Publication Number 77-173 (1977) p. 58

[98] US National Institute of Occupational Safety and Health

[99] NIOSH Manual of Analytical Methods

The above referenced Robertson study[100] concluded that not only are the samples themselves inherently variable and the precision is hopelessly poor, Robertson found something already known to legitimate mould experts, that being that the *accuracy* is also extremely poor. The authors of the study found that 25% of "proficient" AIHA accredited laboratories could not consistently identify *Cladosporium*, the single most common mould on the Planet Earth. The Weecycle consultant, with her "elevated" basement sample, specifically identified *Aspergillus/Penicillium* spores as the preponderance of the extant genera. And indeed, this is not surprising since *Aspergillus/Penicillium* spores are probably the second most common and ubiquitous spore types in the human environment; they are present in every home and building in the country. And yet, Robertson reported that these genera could not be correctly identified by half of the AIHA accredited laboratories that participated in his study. That is, only half the laboratories could consistently and confidently identify the second most prevalent mould known on the planet.

The authors concluded what was already known to legitimate Industrial Hygienists since at least 1976:

> *This research reveals that precision of spore trap analyses, even among laboratories involved with analytical proficiency testing, lack precision and should be interpreted with caution.*

Therefore, not only is there no confidence imparted to the numerical values reported in the reports prepared by Weecycle, but there is similarly no confidence imparted in the reports of the various genera (the fancy Latin names on the laboratory reports) that Weecycle merely *believe* they have found.

In any event, according to the current ASTM International Standards, (and contrary to the information provided by Weecycle, as described later) a legitimate mould assessor understands that the type of mould (the genus or species) that may be present in a building is entirely unimportant, and therefore, there is no benefit to collecting a sample "to see what kind of mould it is."

It is for this reason, the ASTM International Standard D7338-10 states:[101]

> *6.3.2 Fungal growth may be detected by simple visual inspection.*

This is a concept that is reflected by other recognized authorities on mould assessment such as the 2008, AIHA sponsored publication titled "*Recognition, Evaluation, and*

100 Robertson LD, Et all, A multi-laboratory comparative study of spore trap analyses Mycologia, 103(1), 2011, pp. 226–231. DOI: 10.3852/10-017

[101] D7338-10 Standard Guide for Assessment Of Fungal Growth in Buildings §6.3.2

Control of Indoor Mold"[102] In its publication, the AIHA clearly states that a legitimate mould expert can adequately identify a mould to at least genus level by merely looking at it.

In the case of assessing structures for mould, since there is no such thing as "toxic mould," the genus or the species of mould that is present virtually **never** enters the decision making process with regard to corrective actions. That is, knowing which genus or species is present has absolutely no bearing on any subsequent decisions that are made about remediation, corrective actions or even the health implications. Therefore, spending valuable financial resources on laboratory "tests" to identify the genus or species provides no beneficial return.

Therefore, the effort and expense of attempting to identify which moulds were present at the subject property and the conclusions by Weecycle that "*Stachybotrys*" was elevated is undermined by the fact that the identity of the genera present is not germane to any question being asked.

Furthermore, all such impaction spore collectors such as the Air-O-Cell™ sampler used by Weecycle at the subject property have a specific and known "cut-size" associated with the sampler. The "cut-size" is the aerodynamic diameter, in micrometers of a theoretical spherical particle of unit density that has a 50% chance of being captured and is designated "d50." At normal temperature and pressure, the d50 for the "total spore trap" used by Weecycle is reported as around 2.3 µm. [103] This means that a mould spore whose diameter is approximately 2.3 µm has only a 50% chance of being captured. Importantly, the preponderance of organisms that we see in indoor air, as discussed by Weecycle, belong to genera such as *Cladosporium*, *Penicillium* and the *Aspergilli*. The spore diameters for these organisms happens to be exactly within the same range as the cut-size for the samplers. The *Cladosporia* (e.g. *C. cladosporioides*) have a diameter of 2.1 µm, the *Aspergilli* (e.g. *A. versicolor*) 2.4 µm, and members of the *Penicillia* (e.g. *P. brevicompactum*) have a diameter of 2.2 µm.[104]

Although some early authors suggested that real collection efficiency curves may be approximated with a sloping straight line (which would aid in increasing the interpretive value of spore trap data), more recent information indicates the collection efficiency is much more complex. Also, as the sampling altitude increases, and/or the sampling temperature increases, the cut-size also increases; as the airflow rate through the sampler

[102] Recognition, Evaluation, and Control of Indoor Mold, Prezant E; Weekes, DM; Miller JD (Eds.) American Industrial Hygiene Association 2008

[103] Saulius T, Willeke K, Reponen T, Trunov M, *Particle Cut-Size Evaluation –Final Report* Nov 1998, Internal Report by Zefon International-Analytical Accessories, 2860 23rd Ave, St. Petersburg, FL, 33713

[104] Reponen, T., Nevalainen, A., Willeke, K., Grinshpun, S. *Biological Particle Sampling* In: Baron, P., Willeke, K. *Aerosol Measurement, Principles, Techniques, and Applications*, 3rd ed. John Wiley and Sons (2001).

increases, the cut-size decreases[105] and even more curious, the actual effective cut-size for the slit impactor can change as the mixture of spore sizes changes.[106]

The net result is that Weecycle doesn't realize that a spore count of say 1,500 spores/m3 of air inside could come from an atmosphere of, say, 2,000/m3, and the 1,300 spores/m3 for the outside sample could be representative of an atmosphere of 3,000 or 5,000 spores/m3. Since Weecycle never spore-standardized their readings they are COMPLETELY oblivious as to what their results actually mean. Weecycle has blindly, and with profound incompetency, reported values that are nothing but completely meaningless numbers. (Which is precisely why the US EPA, US NIOSH, AIHA, ACGIH, US CDC, States of Colorado, Nevada, New Jersey, Pennsylvania and New York, US Institutes of Medicine and the World Health Organization, and so many organizations, recommend **against** doing the kind of bogus sampling employed by Weecycle.)

Conclusion Regarding Accuracy

None of the data presented for our review exhibit accuracy. The lack of accuracy fatally flaws the data and invalidates the data. Nowhere in their report has Weecycle provided any QA/QC data to establish the accuracy of the results.

Comparability

The next parameter that must be addressed to determine if the data taken by Weecycle at the Xxxxxx, CO residence are valid is to ask "Do the data speak to the question being asked?"

If, for example, a policeman wanted to know if a particular car was speeding, he wouldn't waste any effort in trying to identify the manufacturer of the vehicle. The type of vehicle is not germane to the question being asked. Even if the car was a type of car known to be very fast, say a Ferrari or Maserati; that still would not answer the question at hand regardless of how accurate the identification of the vehicle.

And, if the policeman were to take a properly calibrated, accurate and precise police radar and announce the car is *accurately* travelling at *precisely* 63 mph, he would still be none the wiser - because the original question was not "How *fast* is the car going?" the original question was "Is the car *speeding*?" In order to know if the car is "speeding," the policeman must of course be confident in knowing - with precision and accuracy - the measured speed of the vehicle, and he must know that the measured speed is representative of the vehicle's actual speed. But now he must also address the missing component, for if the policeman doesn't know what the posted speed limit is for that section of road, then knowing the vehicle's velocity with accuracy, precision and

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[105] Saulius T, Willeke K, Reponen T, Trunov M, *Particle Cut-Size Evaluation –Final Report* Nov 1998, Internal Report by Zefon International-Analytical Accessories, 2860 23rd Ave, St. Petersburg, FL, 33713

[106] Cadle RD *The Measurement of Airborne Particles* (1975), (referencing seminal work by Ludwig, FL *Env. Sci. Technology* 2, 1968).

representativeness is useless, since he has nothing against which to compare the vehicle's speed and answer the ultimate question "Is the car *speeding*?"

The posted speed limit becomes the metric for comparison. While sitting on the highway in a 65 mph speed zone, prior to measuring a vehicle's speed, the police officer makes the *a priori* decision criteria that if a vehicle's speed is greater than 65 mph, then that vehicle is speeding and he will take specific, definable, actions. If the measured speed of a vehicle is less than 65 mph, he will decide that no action is required.

In her report, the Weecycle consultant never provided any parameter by which she would compare her "data" to determine if her sample represented "elevated" counts (which they do not). Instead, the Weecycle consultant arbitrarily decided that the estimate of "elevated" would be based on whatever she wanted it to be regardless of scientific validity of the numbers or even reasonableness.

The US EPA addresses this very issue in its discussion on mould sampling. The EPA states: [107]

> *Sampling should be done only **after** developing a sampling plan that includes a confirmable theory regarding suspected mold sources and routes of exposure. Figure out what you think is happening and how to prove or disprove it **before** you sample!*

Similarly, the State of Pennsylvania states:

> ***Prior** to the commencement of any sampling, the assessor should develop a detailed written sampling protocol.*

Nowhere in any of the documents presented for our review did we find where Weecycle followed standard industry practices, acceptable science or good, fundamental, Industrial Hygiene standards of care to develop, use, or implement any kind of a sampling plan or incorporate any *a priori* decision threshold by which they would compare their data. Weecycle appears to have performed sampling, and then, after the fact, made decisions that were entirely unrelated to their data.

For example, in her report, the Weecycle consultant claims that the *Stachybotrys* counts were "elevated" (zero-tolerance). This conclusion is entirely fringe science, entirely unsupportable, and borders on fraud. *Stachybotrys* is present in every structure in the United States; every structure in the United States contains millions to billions of spores of *Stachybotrys*. We have measured airborne spore concentrations in a variety of environments including occupation exposures to workers involved in the installation of clean, dry wallboard. The paper matrix of a single 4' X 8' piece of gypsum wallboard (drywall), contains hundreds of thousands of mould spores including those of *Stachybotrys*. Therefore, when drywallers are installing new drywall into a building, we can expect to see normal total indoor spore counts in the range of 10,000 spores/m3 and,

[107] EPA 402-K-01-001 March 2001 (updated 6/25/01)

of that, we have measured upwards to 700 spores of *Stachybotrys* per cubic meter in normal construction.

Weecycle has merely invented its own brand of science not known or seen anywhere else on the Planet Earth, wherein one air sample that is represented as having FOUR spores of *Stachybotrys* in an house is "elevated." On a particle to particle basis, Weecycle is making the unsupportable argument that *Stachybotrys* is some 3,400 more toxic than asbestos!

In any event, Weecycle does not know what the concentration of *Stachybotrys* is in the residence since Weecycle never measured the concentration of *Stachybotrys* (or any other genus for that matter) in the residence. The exact same sample collected by Weecycle could be submitted to a second laboratory which could report finding NO *Stachybotrys* in the residence, and then to a third lab which could report finding 200 spores/m3 of *Stachybotrys* in the residence.

Even if the sample collected in the subject property by Weecycle was valid, and even if it was determined that the residence contained 27 spores/m3 of *Stachybotrys*, Weecycle Environmental would be entirely incapable of finding a single legitimate scientific or medical article or reference that would support arguing that 27 spores/m3 of *Stachybotrys* is "elevated" or a cause for concern.

Valid and accepted scientific and medical literature contains a vast amount of information on *Stachybotrys* and none of that literature supports the false argument that 27 spores/m3 of *Stachybotrys* is anything other than inconsequential.

Stachybotrys is the "toxic mould" charlatan's cash-cow, and is the ultimate "toxic black mould" used to frighten property owners and get them to separate from their money. The snake-oil "toxic mould" con-artists attempt to frighten people by arguing that the mycotoxin associated with *Stachybotrys* is extremely deadly and presents a threat to human health. However, the argument is **entirely fallacious.**

Some of the toxic compounds in molds that make them "toxigenic" (not "toxic" as commonly reported in the press), or "pathogenic," as stated in the Weecycle report, are called "mycotoxins." Mycotoxins, like other toxic materials and hazardous substances, follow standard and accepted toxicological parameters; there is nothing new or special about molds or their mycotoxins.

All substances exhibit a toxicological level below which, an exposure will not result in any known adverse health effect. Toxicologically, this is known as the "Lowest Observable Adverse Effect Level" (LOAEL). It turns out that even in extremely moldy houses containing massive exposures to indoor moulds, authors have reported that the mycotoxin concentrations are nevertheless millions of times lower than that needed to cause any illnesses.

For example, Brasel, Martin *et al*[108] studied residences that had been heavily damaged by flood waters, and in which there were huge fungal blooms of mold throughout the homes (up to 500 square feet of mural mold growth on the walls). The researchers confirmed that *Stachybotrys* concentrations were in the order of 16,000 spores/m3. Yet, even in these heavily contaminated houses, the daily dose of mycotoxins (expressed as total trichothecenes) was 8.9E-10 below the LC50[109] reported by Wannemacher[110] (that is (89,000,000,000 times less than the LC50) and 5.9E-6 below (5,900,000 times below) the LOAEL[111] reported the by the European Commission Health & Consumer Protection Directorate-General.[112] That is, where trichothecenes were measured even in extremely contaminated properties, the daily dose from the mycotoxin was 168,000 times lower than the dose needed to induce an adverse physiological effect in the animal model used in the study.

Indoor versus Outdoor Comparison Fallacy

Frequently we see toxic mould charlatans claiming to perform an "indoor versus outdoor" comparison – such as that done at the Xxxxxx, CO residence. However, this trick is a logical fallacy of *argumentum ad populum,* and Weecycle collected the outdoor sample, for no apparent reason, and certainly didn't compare the two data (as demonstrated above).

Weecycle states:

> According to the American Industrial Hygiene Association (AIHA), "The levels and types of viable fungi found should be similar indoors (in non-problem buildings) as compared to the outdoor air. Differences in the levels or types of fungi found in air samples may indicate that moisture sources are present and resultant fungal growth may be problematic."

Since Weecycle never referenced the quote, we don't know if someone at the AIHA said this or not, or the context of the statement. However, presuming the quote is legitimate, it creates several problems for Weecycle since, 1) Weecycle never performed ANY determination for viable fungi (and therefore, why use the quote?); and 2) the axiomatic

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[108] Brasel TL, Martin JM, Carriker CG, Wilson SC, and Straus DC; *Detection of Airborne* Stachybotrys chartarum *Macrocyclic Trichothecene Mycotoxins in the Indoor Environment* (Applied And Environmental Microbiology, Nov. 2005, p. 7376–7388)

[109] Lowest Concentration in air needed to kill 50% of the test organisms used in the study.

[110] Wannemacher RW, Wiener, SL, Chapter 34, TRICHOTHECENE MYCOTOXINS; in Medical Aspects of Chemical and Biological Warfare, Textbook of Military Medicine Published by the Office of The Surgeon General Department of the Army, Zajtchuk R, Editor in Chief, Bethesda, Maryland, 1997

[111] Lowest Observable Adverse Effect Level

[112] European Commission Health & Consumer Protection Directorate-General *Opinion of the Scientific Committee on Food on Fusarium toxins. Part 6: Group evaluation of T-2 toxin, HT-2 toxin, nivalenol and deoxynivalenol* (SCF/CS/CNTM/MYC/27 Final 27 February 2002)

tacit statement would be that before one compares indoor to outdoor, one has actually determined the concentrations (which Weecycle did not do).

The sampling rationale of the toxic mould con-artist becomes, "…all the other poorly trained mould consultants are collecting outdoor samples for some reason, and so we should collect outdoor samples as well."

However, the outdoor air is not at issue, and is not part of the decision making process and is not part of the question being asked. The collection of an outdoor sample for comparison is seen exclusively amongst the poorly trained, fear-based "toxic mould for gold" practitioners and not amongst legitimate mould experts or legitimate Industrial Hygienists.

It has long been known that there is no correlation between indoor and outdoor spore concentrations in the circumstances under discussion. Investigators who practice indoor/outdoor comparisons in this manner lack the benefit of technical competence in aerobiology; and therefore, their erroneous statement has no utility in a legitimate assessment.

The myth regarding indoor v. outdoor comparisons probably started with the publication of a hastily prepared document falsely represented as a "standard" and used exclusively by toxic mould charlatans known as the IESO "Standard" (which is not actually a standard at all) which recommended comparing indoor to outdoor samples. The notion began with well respected researchers who alluded to indoor/outdoor generalities[113] and those generalities were then taken out of context and referenced inappropriately and have developed a life of their own outside the original scientific context.

For example, in the 1998 edition of NIOSH's Manual of Analytical Methods, QA/QC Chapter J, NIOSH[114] partially quoted a reference and stated:

> *In general, indoor microflora concentrations of a healthy work environment are lower than outdoor concentrations at the same location.(Macher & Burge 1995) If one or more genera are found indoors, in concentrations greater than outdoor concentrations, then the source of amplification must be found and remedied.*

NIOSH then references the source as: Macher JM, Chatigny MA, Burge HA [1995]. *Sampling airborne microorganisms and aeroallergens*. In: Cohen BS, Hering SV, eds. *Air sampling instruments for evaluation of atmospheric contaminants*, 8th ed. Cincinnati, OH: American Conference of Governmental Industrial Hygienists, Inc., pp. 589-617.

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[113] Burge HA *Bioaerosols in the Residential Environment*, Chapter 21 in *Bioaerosols Handbook* (Cox CS, Wathes CM eds), 1995

[114] NIOSH is the US Department of Health and Human Services, Centers for Disease Control, National Institutes of Occupational Safety and Health.

However, if one goes to the original source (Macher & Burge, 1995), we see that the referenced authors made the first observation (the general comment about indoor v. outdoor concentrations), but did not make the *et sequitur* conclusion.

Placing the comments of the original cited authors back into context challenges the fundamental legitimacy of performing indoor/outdoor comparisons and is contrary to what the originating author wrote elsewhere. On indoor/outdoor concentration issues wherein the same original author (Burge) also in 1995, observed:[115]

> Indoor/outdoor relationships: *Unless there is an indoor source for specific bioaerosols, concentrations indoors will generally be lower than outdoors. This effect is related to the reasons for occupying enclosures, which are designed to protect us from adverse weather and intrusion by vermin or other unwelcome (sometimes human) visitors. The outdoor aerosol penetrates interiors at rates that are dependent primarily on the nature of ventilation provided to the interior. Indoor/outdoor ratios of specific particle types (of outdoor origin) are highest (tending toward unity) for buildings with "natural" ventilation where windows and doors are opened to allow entry of outdoor air along with the entrained aerosol As the interior space becomes more tightly sealed, the ratio becomes lower and lower.*

Therefore, the indoor/outdoor ratio of airborne moulds is primarily a function of building systems (not mouldy conditions), and the indoor to outdoor ratio will rise and fall with the normal ventilation infiltration rate and other factors not related to indoor mould growth.

Unfortunately, poorly trained mould consultants have turned rationale into tautology and have repeated the quote so often (and out of context) it has taken on a life of its own and is misconstrued by the "toxic mould" gang as a normal practice, However, the oft repeated sentence still remains without scientific foundation.

Additionally, the spatial and temporal variations in spore concentrations for indoor samples, already described above, is equally seen in outside samples. The concentrations of outdoor spores vary enormously with species, location, altitude, season, climate and time of day; indeed, many organisms exhibit relatively predictable increases and decreases with time of day.[116] In winter months, and especially at the altitude[117] for the Xxxxxx, CO residence, we already know that normal, clean, dry, healthy houses will typically have indoor counts that exceed outdoor counts during the four months of winter.

Therefore, similar to indoor samples, unless one has collected a sufficient number of samples to properly characterize the outdoor population distribution, one lacks the necessary precision to compare that sample with the indoor contemporaneous sample (let

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[115] Muilenburge ML, *The Outdoor Aerosol*, in Chapter 9 of *Bioaerosols*, (Burge HA, ed) 1995

[116] Madelin TM, Madelin MF *Biological Analysis of Fungi and Associated Molds*; Bioaerosols Handbook, Cox and Wathes, Eds. (1995)

[117] Levetin E. Fungi (Chapter 5, p. 106), *Bioaerosols*, Burge HA Editor, 1995

alone a single sample that was collected hours before, or hours after the single outdoor sample).

That is - while the indoor spore concentrations are fluctuating wildly, the outdoor spore concentrations are doing the exact same thing, but in a different direction and at different times making indoor-outdoor comparisons a comparison of two moving targets; and therefore, completely meaningless. Imagine a mould consultant who concludes that an house with 500 spores/m3 inside is bad and the concentration indicates a problem, because the outside count was only 200 spores/m3; but the same consultant says that 500 spores/m3 inside is O.K. and doesn't indicate a problem, because the outside count was 3,000 spores/m3. The question becomes an absolute - is 500 spores/m3 acceptable or unacceptable? And what difference does the outside count have on determining if the exposure inside is acceptable or unacceptable?

At the subject property, Weecycle tried to compare a single meaningless indoor sample with a single meaningless outdoor sample. However, if one looks at the actual NIOSH recommendation for comparing indoor to outdoor samples, they also explicitly state:[118]

> *Select at least three sites, one each to represent complaint area, a noncomplaint area and outdoors.*
>
> *In turn at each site, sample simultaneously for fungi, mesophilic bacteria, and thermophilic actinomycetes.*
>
> *Before moving to the next site, repeat twice to obtain triplicate, consecutive samples.*
>
> *Collect another complete set of samples and blanks on the next day.*

Therefore, at the end of the sampling period, in order to compare indoor and outdoor samples, the consultant would have collected six samples for fungi, six samples for mesophilic Bacteria, and six samples for thermophilic actinomycetes from the study area; and six samples for fungi, six samples for mesophilic Bacteria, and six samples for thermophilic actinomycetes from an indoor control area, and six samples for fungi, six samples for mesophilic Bacteria, and six samples for thermophilic actinomycetes from the outside. However, Weecycle invented their own magical brand of nonsensical sampling protocol at the subject property and never did any of this. Instead, Weecycle ignored established validated methodology and merely collected one meaningless spore trap from inside of the residence and one meaningless spore trap from outside, and fraudulently claimed they could compare two unreliable moving targets (and then even more remarkably, even though the two samples were the same, Weecycle falsely claimed the sample results were different!)

Imagine our example of a policeman running radar on the highway; he is measuring the speed of vehicles; however, the posted speed limit sign keeps changing and one moment

[118] NIOSH Method 0800, BIOAEROSOL SAMPLING (Indoor Air) Culturable organisms: bacteria, fungi, thermophilic actinomycetes, Issue 1, January 1998

the posted speed limit on the highway is 75 mph and the next moment it is 15 mph. Since the policeman can never be sure of the posted speed limit he can never be sure of whether the car is speeding or not speeding - therefore of what value is measuring a car's speed to ANY degree of accuracy, precision or representativeness?

It is for this reason that the samples presented by Weecycle claiming that the basement of the subject property had elevated mould since it was higher than the outside, is an invalid conclusion. Weecycle never actually determined the spore loading in the basement and never determined what the spore loading in the outdoors was and never determined the fungal profile of which spores were present. Therefore, Weecycle simply could NEVER have compared the two as claimed.

Contrary to the recommendations by the States of Pennsylvania, NY, NJ, Colorado and California, the ACGIH, the AIHA, the US EPA and the US CDC, Weecycle never provided any kind of standard against which they were going to compare their data to determine exactly what the data indicate or what the data mean. Indeed, nowhere in the reviewed documentation do we find where Weecycle actually used any of their data to make a decision.

Remarkably, Weecycle just invented its own brand of fringe science and declared:

> The results of this study have shown that, at the time of sampling, the property is outside of acceptable levels.

This statement is entirely make-believe science and cannot be supported by any known science, any known risk assessment protocol, or any legitimate organization – Weecycle has just invented its own brand of fringe science and made this statement up out of thin air.

In fact, as already given in the example provided above, an ordinary, clean, dry home that has never had a mould problem or a water intrusion problem can very often have single spore counts well over 20,000 spores per cubic meter[119] of air and yet still just have an average (MVUE) spore concentration of less than 500 spores per cubic meter of air.

Indeed, an ordinary, clean, dry home that has never had a mould problem or a water intrusion problem can very often have an average spore concentration greater than 5,000 spores per cubic meter of air, and can even have an average spore concentration that exceeds the outdoor air on any given day. In winter months at altitude, homes typically have spore concentrations that are twice the outdoor concentration.[120]

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[119] Solomon WR. *A volumetric study of winter fungus prevalence in the air of midwestern homes*. Allergy Clin Immunol. 1976 Jan;57(1):46-55 (this reviewer, Connell, has only read the National Library of Medicine abstract of this article).

[120] Ebner MR, Haselwandter K, Frank A, I*ndoor and outdoor incidence of airborne fungal allergens at low- and high-altitude alpine environments* Mycological Research , vol. 96, no. 2, pp. 117-124, 1992 Referenced in Levetin E. Fungi (Chapter 5, Bioaerosols, Burge HA Editor, 1995)

In the example below, I have presented commonly seen spore trap results for mouldy houses, clean houses and outdoor samples.[121] As can be seen, the argument that an air sample whose indoor result is greater than outdoor indicates a "problem" is pure fear-mongering fantasy on the part of Weecycle. In the following graphic each single point (spores count) is actually the minimum variance unbiased estimate of the total number of counts collected for each study area (usually six or seven samples per site) with stratification broken for homogeneity; that is, each "point" is the statistical MVUE of multiple samples.

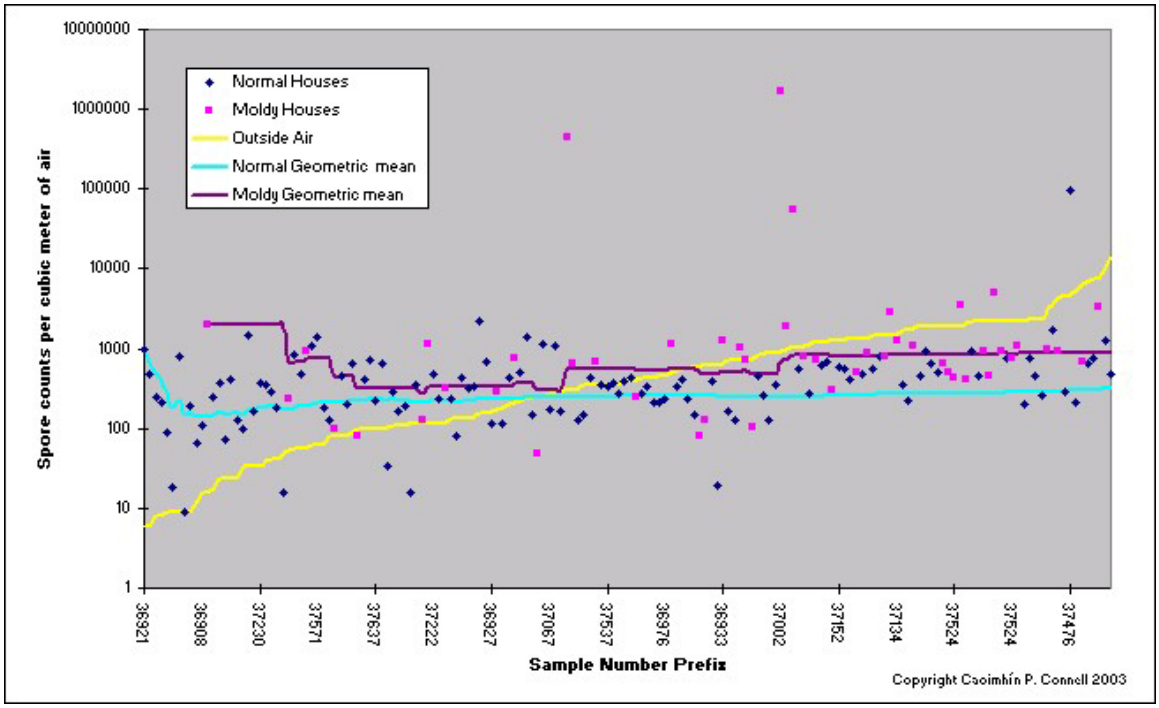

Figure 2
Comparison of Spore Traps
Indoor and Outdoor

Although Weecycle has relied on make-believe levels of concern (in this case 1,500 spores/m3) when legitimate experts use benchmarks against which to compare one's data, it is customary to rely on published data or internally validated QA/QC values. One such source would be the American Academy of Allergy and Immunology and the Delaware Department of Natural Resources and Environmental Control;[122] both of whom classify general levels of concern as follows:

[121] Connell CP, *Sampling Strategies and Data Interpretation*, Presented in Huntingdon, England (Nov. 2011)

[122] Delaware Department of Natural Resources and Environmental Control, 89 Kings Hwy Dover, DE 19901 Mold Count Chart: http://apps.dnrec.state.de.us/Pollencount/PollenCount.aspx June 28, 2012

Total Spore Count/m3	Classification	Allergy sufferers who are allergic to these molds may experience symptoms of hay fever
0	Absent	No Symptoms
1- 6,499	Low	Only individuals extremely sensitive to these moulds will experience symptoms
6,500 - 12,999	Moderate	Many individuals sensitive to these moulds will experience symptoms.
13,000 - 49,999	High	Most individuals with any sensitivity to these moulds will experience symptoms.
50,000	Very High	Almost all individuals with any sensitivity at all to these moulds will experience symptoms. Extremely sensitive people could have severe symptoms.

Table 2
American Academy of Allergy and Immunology
Levels of Concern for Those Hypersensitive to Moulds

Alternative comparisons for normal, generally regarded as safe, human exposure assessments can be derived from the clean, healthy outdoor air, wherein normal, healthy outdoor air may frequently contain upwards to 81,000 spores per cubic meter of air.[123]

In fact, we took a quick look at outdoor spore counts from around the country on September 17, 2012, when Weecycle issued its report – here is what we found:

[123] National Resources Defense Council

Location and Reference	Reported	Outdoor Spore Count (9/17/12)
New Castle, Delaware[124]	4,972	spores/m3
Springfield, Missouri[125]	16,587	spores/m3
Houston, Texas[126]	9,579	spores/m3
Milwaukee, Wisconsin[127]	9,350	spores/m3
Rochester and Olmsted County, Minnesota [128]	5,449	spores/m3
Chattanooga, Tennessee[129]	1,153	spores/m3
Anchorage Alaska[130]	6,363	spores/m3
Kansas City, Missouri[131]	3,236	spores/m3
Plano Texas[132]	9,767	spores/m3

Table 3
Reported Outdoor Spore Counts
September 17, 2012

Even normal occupational exposures to much more elevated spore counts are not considered to warrant an health concern. Employees working at potting sheds may be exposed daily to 7,500 spores per cubic meter of just *Stachybotrys*; [133] literature has shown that farmers[134] are regularly exposed to daily exposures of greater than 1,000,000 spores/m3 and lumber mill worker's daily exposures to mould spores are in excess of 100,000,000 spores/m3 without any known adverse health effects.

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[124] Delaware Department of Natural Resources and Environmental Control http://apps.dnrec.state.de.us/Pollencount/PollenCount.aspx

[125] Springfield County Health Department Springfield, http://health.springfieldmo.gov/index.aspx?NID=145

[126] City of Houston, Health and Human Services http://www.houstontx.gov/health/Pollen-Mold/index.html

[127] Dr. Gary C. Steven, M.D., Ph.D Milwaukee County Pollen and Mold Counts http://www.milwaukeepollen.com/

[128] Rochester and Olmsted County Minnesota http://www.mayoclinic.org/allergy-rst/pollencount.html

[129] Chattanooga Air Pollution Control Bureau, http://www.pollutionsolution.org/air_monitoring/daily.aspx

[130] Anchorage Air Quality Program Department of Health and Human Services, http://www.muni.org/Departments/health/environment/AirQ/Pages/AirQualityPollen.aspx

[131] The Children's Mercy Hospital, http://www.childrensmercy.org/Pollen/Count/count.asp?city=1&page=

[132] Dr. Jeffrey Adelglass, M.D., F.A.C.S., http://www.entdocs.com/thismonthspollen.htm

[133] Dill and Trautmann *Massenentwicklung von Stachybotrys chartarum auf kompostierbaren Pflanztöpfen aus Altpapier* Mycoses 40 (Suppl 1) p. 110-114, (1997)

[134] Swan JRM, Blainey D, Crook B. *The HSE Grain Dust Study - workers exposure to grain dust contaminants, immunological and clinical response*. RR540. Health and Safety Executive, 2007

Regardless of the benchmark by which one may compare spore trap data, one thing is certain: Even if the air testing performed at the subject property by Weecycle was valid, none of the data indicated that excessive human exposures or "elevated " conditions were present at the residence or constitute any kind of health threat, and none of the information in the Weecycle report indicated a mould problem at the residence and certainly Weecycle presented no information that warranted the extreme, fringe, and completely bizarre "remediation" protocols recommended. The extent of Weecycle's technical incompetence simply cannot be overstated.

Conclusion Regarding Comparability

None of the data presented for our review were presented with *a priori* decision criteria; or indeed, any decision criteria. The lack of decision criteria translatable to the question being asked resulted in the poor quality of the data and invalidates the data.

REMEDIATION

The remediation recommendations presented by Weecycle are extreme and entirely inconsistent with legitimate water damage restoration and mould restoration industry practices. Weecycle states:

> Weecycle recommends microbial remediation (following EPA protocol) to insure adequate drying of structural components and the remediation of contaminated areas.

And then, in complete contradiction to the EPA recommendations, Weecycle provides its own extreme and unnecessary protocols.

> Removal of walls in basement.

We would like to ask Weecycle, where within the EPA guidelines does the EPA recommend removing perfectly good walls? Weecycle provides no explanation or justification for the removal walls.

Weecycle states:

> • Cleaning of all structural components, walls and windows following EPA protocol.
> • Scrub ceiling in basement and 1st floor subfloor with a wire brush and treat with anti-bacterial solution.

But if we look at what the EPA says, we see that the EPA recommends against using biocides during mould remediation projects.[135]

> *The use of a biocide, such as chlorine bleach, is not recommended as a routine practice during mold remediation, although there may be instances where professional judgment*

[135] US EPA "*Mold Remediation in Schools and Commercial Buildings*" (2001)

> *may indicate its use (for example, when immuno-compromised individuals are present). In most cases, it is not possible or desirable to sterilize an area, as a background level of mold spores comparable to the level in outside air will persist. However, the spores in the ambient air will not cause further problems if the moisture level in the building has been corrected.*

It begs the question if Weecycle has ever actually read the EPA guidelines it thinks it is following. It would appear that, like other "toxic-mould-is-gold" charlatans, Weecycle references documents it has never read. In fact, peer reviewed articles[136,137] have demonstrated that a variety of disinfectants and follow-up treatments on wallboard that had been colonized with a variety of moulds were not effective. The disinfectants included amines, stabilized high-oxygen solutions, chlorine dioxide solutions, etc. In every case, mould growth returned to wet wallboard sections that had been treated with each of the disinfectants.

Publications from the American Industrial Hygiene Association recommend against the use of fungicides during mould remediation projects, and the World Health Organization recommends against the use of fungicides during mould remediation projects.[138]

FACTs personnel have been writing mould remediation scopes-of-work for approximately 23 years. In all that time, we have automatically prohibited the use of all disinfectants, biostats and fungicides. In 23 years, we have not seen a single project where the moisture problem was properly addressed but the mould returned. In no cases have we ever seen mould growth occur in the absence of a water or moisture intrusion problem.

Fungicides and disinfectants are virtually worthless in the realm of indoor mould remediation as typically employed. The application of such products is almost exclusively within the realm of the "toxic mould is gold" industry intended to significantly increase the costs of the "remediation," but otherwise not found within the legitimate water restoration/mould abatement industry.

Weecycle demonstrates its profound incompetence again regarding *Stachybotrys* and moulds in general and disinfectants when discussing Stachybotrys Weecycle states:

> …finally, the spores and mycelium (equivalent to the root in a plant) often have a protein in their cell walls that make it immune to chlorine (i.e. bleach).

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[136] Price DL; Ahearn DG; *Sanitation of Wallboard Colonized with Stachybotrys chartarum*; Current Microbiology Vol 39 (1999), p.21-26

[137] Recognition, Evaluation, and Control of Indoor Mold, Prezant E; Weekes, DM; Miller JD (Eds.) American Industrial Hygiene Association 2008

[138] World Health Organization Guidelines For Indoor Air Quality Dampness And Mould (ISBN 798 92 890 4168 3) WHO Regional Office for Europe, Scherfigsvej 8, DK-2100 Copenhagen Ø, Denmark, July 2009

First of all, the mycelium are not equivalent to roots. Second, there is no protein in *Stachybotrys* that makes it immune to chlorine; this is fantasy make-believe science invented by the Weecycle author bereft of rationality and with disregard for objective facts.

Weecycle recommends conducting a magical fishing expedition in the search for "hidden moulds" when it states:

> Remove two (2) foot flood cut of drywall and investigate under carpet on 2nd floor northwest corner.

Flood cuts are used during floods to facilitate the drying of a structure. No evidence of flooding was documented as occurring on the second floor. In the second floor bedroom, there is no evidence of water intrusion, there is no evidence of mould nor is there evidence of water damage. Below is a photograph of the area in question; in the photograph, the carpet and the padding had been pulled up to expose the flooring beneath.

Photograph 2
Second Floor Bedroom Northwest Corner

"Hidden" mould is the toxic mould con-artist's dream. Mould remediation companies, and "Certified Microbial Consultants" can make a lot of money by first frightening the homeowner and then embarking on fishing expeditions for mould hidden in wall cavities, in crawlspaces and other generally inaccessible areas. Certainly, the concept of hidden mould is an ideal fear inducer, since it incorporates the unfounded idea that somehow there is a lurking harmful thing hidden away from the view of the occupant, waiting to pounce. A "good" toxic mould inspector can easily spend needless tens of thousands of dollars hunting down this imaginary human predator.

However, contrary to concerns raised by such companies chasing down and remediating hidden mould has never been an acceptable practice in the legitimate mould assessment /remediation industry. Many scientific studies, some included below, demonstrate that even if mould colonization is hidden in wall cavities, ceiling plena, crawlspaces and other restricted access areas, the colonization does **not** result in increased human exposures, pose any known threat to human health and there is no rational reason to attempt to find and abate hidden mould.

Dr. Harriet Burge, arguably the Earth's most preeminent scholar and researcher in indoor moulds, in an article titled *Can Mold Be Safely Left Inside Walls?*[139] stated the following:

> *However, removal based on the mere fact of its presence, or based on nonspecific symptoms that are not related to mold exposure, is often not appropriate.*

Similarly, other notable researchers have also concluded the same:[140]

> *…it is reasonable to infer that small amounts of mold enclosed in walls, floors, or ceilings will not have a large impact on the indoor air quality.*

The Wisconsin Department of Health and Family Services investigated the relationship between mould on surfaces of oriented strand board (OSB) siding and mould levels inside the home; the result of the study indicated mould levels in the affected homes were not significantly higher than those measured in "non-exposed" homes.[141]

Authors for the American Industrial Hygiene Association have made similar observations:

> *If a properly conducted fungal assessment shows that the indoor air quality is not degraded with respect to culturable or countable fungal spores, it is unlikely that additional risk exists over outdoor exposure and that, if visible or hidden fungal growth exists, it is not affecting the indoor air quality when sampling is done.* [142]

Generally, searches for hidden mould in a structure are not considered acceptable practice; according to fact-based standard industry practices as described by the AIHA:

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[139] Burge, H. *Can Mold Be Safely Left Inside Walls?* The Environmental Reporter, Vol. 3, No. 11, November 2005

[140] Robbins C, Morrell J; *Mold, Housing and Wood* (Article prepared for the Western Wood Products Association), Jan 2006.

[141] Daggett DA, Chamberlain M, Smith W. *Effects of Exterior Decay and Mold on Indoor Mold and Air Quality*. Proceedings of the 2nd Annual Conference on Durability and Disaster Mitigation: November 6, 2000; Madison, WI

[142] *Documentation and Reporting* (Chapter 6) *Recognition, Evaluation, and Control of Indoor Mold*, Prezant E; Weekes, DM; Miller JD (Eds.) American Industrial Hygiene Association 2008

> *Finding hidden mold is difficult and expensive. An exhaustive search is justified **only** if there are good reasons. If there are no smells (sic), no complaints, and no indications of significant moisture damage, we can be reasonably sure that there is no problem and no reason for further investigation.*[143]

The above position is the widely accepted position of the fact-based mould remediation voice of authority as reflected by other AIHA authors:[144]

> *Special requirements for remediation of hidden mold are triggered only when there is a reason to investigate more aggressively.*

We were informed that the occupant of the subject property is concerned there is mould in the wall cavity. There is no need to look - We already know for a fact there is mould in the wall cavity – there is mould in every wall cavity in every structure in Colorado. If one samples for mould in a wall cavity one will find mould in a wall cavity since mould is present in all wall cavities – that is the normal state of affairs in wall cavities.

What is supported by legitimate science is the fact that it is impossible to remove all mould from any occupiable space, and all structures contain mould anyway, and there is no evidence to demonstrate that "hidden" mould creates a problem. Therefore, the legitimate remediation question actually becomes "How much mould should be removed and how much mould can be left behind before the area is 'clean'?"

Studies and investigations performed by this investigator (Connell) and other researchers have not observed a correlation between hidden mould and a degradation of indoor air quality, or a correlation between mould hidden in walls and an increase in spore counts in occupied spaces. Weecycle would not be able to find any legitimate study to support their fear-based "hidden mould" agenda.

Weecycle's extreme recommendation even includes extreme measures to "clean" surfaces that have absolutely no indications of any kind of surface contamination:

> Scrub ceiling in basement and 1st floor subfloor with a wire brush and treat with anti-bacterial solution.

Why would someone recommend wire-brushing perfectly clean subflooring and then treating it with an anti-microbial? Weecycle gives an insight to its bizarre and extreme fringe recommendations when it states:

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[143] D'Andrea CP, Prezant B, *Accountability of the Industrial Hygienist: Constituencies and Co-Investigators* (Section 3.1.1) Recognition, Evaluation, and Control of Indoor Mold, Prezant E; Weekes, DM; Miller JD (Eds.) American Industrial Hygiene Association 2008

[144] Reynolds SJ, Baker R, Haisley P, Remediation: *Procedural Considerations* (Section 17.5.1) Recognition, Evaluation, and Control of Indoor Mold, Prezant E; Weekes, DM; Miller JD (Eds.) American Industrial Hygiene Association 2008

> To insure a living environment free of microbial growth and safe from fungal contamination,…

And herein lies the justification for its strange recommendations and actions – Weecycle apparently believes in a fantasy world that is "…a living environment free of microbial growth and safe from fungal contamination…" In 2001 the US EPA[145] reminded the US public of something legitimate experts in microbial aspects have known for over 100 years:

> *It is impossible to eliminate all mold and mold spores in the indoor environment.*

Contrary to what the "Mould is Gold" industry would like to promote, according to the American Industrial Hygiene Association in *Judging the Effectiveness of Remediation*: [146]

> *… the goal of mold remediation is to return material surfaces to a satisfactory condition. The goal is not to produce a near-sterile or abiotic condition.*

Apparently, the Weecycle consultant disagrees with the entire global scientific community and believes she can create a "…a living environment free of microbial growth and safe from fungal contamination…"

Another clue to the bizarre, junk-science, fringe actions of Weecycle is found in its "zero-tolerance" policy regarding the common, ordinary, everyday organism known as "*Stachybotrys*." Weecycle states:

> Weecycle has adopted a "**zero-tolerance**" policy regarding the presence of *Stachybotrys sp.* spores in inside samples (both air and swab).

Stachybotrys is found in EVERY home and EVERY occupied structure in Colorado. And yet, the toxic mould charlatans continue to use fear based "toxic terror" with regard to this organism. Regarding *Stachybotrys*, Dr. Emil J. Bardana, Jr., M.D. of the Oregon Health Sciences University in Portland, OR stated:[147]

> *This contemporary public health problem has frequently been discussed in the media and cyberspace without the benefit of scientific peer review. As a result, there has been distortion and exaggeration of the facts, and promotion of a brand of "toxic terror" among the population; ie, "babies dying of black mold exposure" is much more dramatic and fear-evoking than "babies dying of unknown causes."*

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[145] Mold Remediation in Schools and Commercial Buildings U.S. Environmental Protection Agency (EPA 402-K-01-001, March 2001 updated June 25, 2001)

[146] Morey PR, Prezant B, Weekes D, *Judging the Effectiveness of Remediation* (Section 18.5.3) Recognition, Evaluation, and Control of Indoor Mold, Prezant E; Weekes, DM; Miller JD (Eds.) American Industrial Hygiene Association 2008

[147] Bardana, E.J. *The environment and allergic disease:* Annals of Allergy Asthma Immunology 2001; 87(Supp l):52-56

A generally true statement is that the popular media has greatly inflated the indoor mould issue into the realm of science fiction and the Weecycles of the world jump on that train and ride it through ruination of unsuspecting homeowners. There is no such scientific term "toxic mould" outside of the mould charlatan's industry. The term "toxic mould" is not a legitimate mycological term, not a legitimate toxicological term, not a legitimate microbiological term and not a legitimate medical term.

News media hype notwithstanding, in general, the academic, scientific, and medical communities do not support the current high profile concerns regarding *Stachybotrys*, Dr. Abba Terr M.D. summed up the medical field's opinion in a peer-reviewed journal when he wrote:[148]

> *No convincing cases of human allergic disease or infection from this mould* [Stachybotrys] *have been published*. [He concluded] *The current public concern for adverse health effects from inhalation of* Stachybotrys *spores in water-damaged buildings is not supported by published reports in the medical literature.*

The US Centers for Disease Control also performed a review of the available medical literature regarding moulds and mycotoxin exposures in the indoor environment and in the peer reviewed journal for the American Industrial Hygiene Association, the authors concluded: [149]

> *This review of the literature indicates that there is inadequate evidence to support the conclusion that exposure to mycotoxins in the indoor (nonindustrial) environment is causally related to symptoms or illness among building occupants.*

In a similar literature review by Frederick Fung with the Sharp Rees-Stealy Medical Group and University of California San Diego, Dr. Fung reported in the Journal of Clinical Toxicology[150] that:

> *A critical review of papers, reports, and studies on* Stachybotrys *mycotoxins revealed only descriptive reports of suspected animal and human poisoning secondary to consumption of mould contaminated foods. No studies of good toxicologic and epidemiologic designs answer whether airborne mycotoxins produced by* Stachybotrys *could produce specific human toxicity.*

Dr. Harriet Burge, the world's preeminent authority on indoor moulds, also performed a review[151] of available literature and her assertion was: The review yielded many studies

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[148] Terr, A. I. *Stachybotrys: relevance to human disease* Annals of Allergy Asthma and Immunology (87, Supp l: 57-63)

[149] Page, EH; Trout, D.B, *The Role of* Stachybotrys *Mycotoxins in Building-Related Illness* Journal of the American Industrial Hygiene Association, September, 2001

[150] Fung F, Clark R, Williams S, Stachybotrys*, a Mycotoxin-Producing Fungus of Increasing Toxicologic Importance*; Clinical Toxicology 36 (1&2)79-86, 1998)

[151] Burge H. A, Fungi: toxic killers or unavoidable nuisances? Annals of Allergy Asthma Immunology 2001; 87(Supp l):52-56

of the role of fungi in allergic disease, but none that systematically documented such a role for mycotoxins or fungal volatiles. Many case studies were found, but none of these unequivocally document a cause/effect relationship between mycotoxin exposure by inhalation and human disease in residential, school, or office settings. Dr. Burge concluded:

> *The review led to the conclusion that that the primary result from fungal exposure is allergic disease, and that the evidence for inhalation disease resulting from mycotoxin exposure in residential and office settings is extremely weak.*

Finally, perhaps one of the most thorough and comprehensive reviews of contemporary literature on the subject (replete with 465 references), was the Kuhn and Ghannoum review[152] which concluded that:

> *While many papers suggest a similar relationship between* Stachybotrys *and human disease, the studies nearly uniformly suffer from significant methodological flaws, making their findings inconclusive. As a result, we have not found supportive evidence for serious illness due to* Stachybotrys *exposure in the contemporary environment.*

Against the backdrop of the initial alarmist "toxic black mould" report,[153] the US Centers for Disease Control and Prevention asked the Institute of Medicine to convene a committee of experts to review the situation of indoor moulds. *The National Academy of Sciences* is a private nonprofit corporation chartered by an 1863 act of Congress, and the Institute of Medicine was formed in 1964 under that congressional charter which also included the *National Academies Press*, *National Academy of Engineering*, and *National Research Council*. The CDC provided the following charge to the Institute of Medicine:

> *The Institute of Medicine will conduct a comprehensive review of the scientific literature regarding the relationship between damp or moldy indoor environments and the manifestation of adverse health effects, particularly respiratory and allergic symptoms. The review will focus on the non-infectious health effects of fungi, including allergens, mycotoxins and other biologically active products. In addition, it will make recommendations or suggest guidelines for public health interventions and for future basic science, clinical, and public health research in these areas.*

In 2004, The National Academies Press issued an Institute of Medicine study that reflects both state of the art and overall consensus positions. The IOM committee found that there was ***insufficient*** evidence to demonstrate a causal association between the presence of moulds and any of the commonly reported health effects (of which they studied 21 of the most common reported illnesses).

Legitimate health professionals have known for decades that indoor moulds, compared to outdoor moulds, were considered only a minor, (albeit important) factor in the

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[152] Kuhn, DM, Ghannoum MA; *Indoor Mold, Toxigenic Fungi, and* Stachybotrys chartarum*: Infectious Disease Perspective* Clinical Microbiology Reviews, Vol 16, No 1, Jan 2003, pp. 144-172

[153] Dearborn DG, et al. *Acute Pulmonary Hemorrhage/Hemosiderosis Among Infants — Cleveland, January 1993–November 1994*. MMWR December 09, 1994 / 43(48);881-883

development of allergic airway disease[154] and that indoor exposures to cats, dust mites, termites and cockroaches probably causes more health problems than do indoor moulds.[155]

During the latter part of the summer of 2007, the prestigious *International Union of Toxicology* held an *International Congress of Toxicology* meeting in Montreal, Canada. The opening line from one of the presentations given during that meeting of internationally recognized toxicologists, representing the global scientific and medical opinion in such matters was:

> *Despite the findings of learned bodies, there continue to be concerns throughout North America and Northern Europe about mycotoxins from mold spores in indoor environments.*[156]

In fact, in this paper, the authors reported that by merely dropping a single mouldy lemon into the trash, they reported the resultant *Penicillia* spore count was 286,755 spores/m3. Presumably then Weecycle would recommend negative pressure enclosures, respirators, sampling, and the removal of walls and spraying of disinfectants, and wire brushing a kitchen if one of the hideously dangerous mouldy lemons was found!

In general, as scientists, we are not mystified about the health effects of moulds so much as mystified about the public's continued irrational fear of indoor moulds, in spite of the vast, overwhelming current and historical knowledge that has placed those risks into perspective, and have concluded that those fears are unfounded. One of the reasons the fear continues is because of the baseless and self-serving statements made by untrained "certified microbial consultants" who run around collecting bogus samples generating fear, but otherwise lack legitimate knowledge in moulds, mycology, toxicology, and other aspects of Industrial Hygiene.

FACTs ASSESSMENT

On the day of our assessment, the weather was seasonal (approximately 65°F during our visit) with no appreciable breeze.

Upon our arrival, the basement doors (two doors) were wide open. Although we did not check the official spore count for that day in the area, our historical data indicates that the typical outdoor spore count[157] for that area, for that season is 2,933 spores/m3.

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[154] *Ibid.*

[155] Horner WE, Helbling JE, et al *Fungal Allergens* Clinical Microbiology Reviews, April 1995, p. 163

[156] Chan CY, Robbins CR, Fallah P, Hardin BD, Kelman BJ, *Risk From Inhaled Mycotoxins From Mold-Infested Produce*, IUTOX ICT—Montreal, Canada (July 15-19, 2007) Abstract #PT6.105

[157] n= 48 (Air-O-Cell represented in this discussion since that is the type of sampler used by Weecycle). The value expressed is the minimum variance unbiased estimate; Shapiro-Wilk W one-tail percentage point was 0.947 and goodness of fit was rejected for Gaussian (0.7717) and not rejected for lognormal (0.9595); Land's LCL(95%) was 2,228 spores/m3 and Land's UCL(95%) was 4,373. Exceedance test point of

Upon entry into the subject property, there were no odors of geosmins,[158] MIB[159] or any other odors associated with fungal activity. The residence had a slight odor of incense, and there was a strong odor of marijuana in the second floor northeast bedroom.[160]

As a side observation, it is interesting to note on Weecycle page, they claim to have a certification in "Clandestine Drug Lab Decontamination Training , and they have aligned themselves with a "meth-lab cleanup" company who has a very poor reputation and is known for multiple violations of State regulations.[161] Weecycle falsely claim they are certified for performing clandestine drug laboratory assessments in Colorado. Not only are they not so certified (the claim is false), and not only would it be unlawful for them to perform such assessments, but if they were proficient in clandestine drug lab operations, how did they miss the marijuana in the house?

During our assessment, we used a Tramex® PTM 6005 conductivity style moisture meter to measure the moisture content of several areas of structural timber and drywall in the residence. We measured the moisture in building components in approximately 70 locations. At no time did we observe unusual or elevated moisture levels in any of the locations assessed. During the use of the instrument, we performed calibration verifications on several substrates and performed a precision check and determined that the readings were +/- 1%.

10,000 spores/m3 was 10% (that is 10% of randomly collected samples would be greater than 10,000 spores/m3 for that outdoor area).

[158] Typified by (1a, 10ß-dimethyl-9a-decalol)

[159] 2-methylisoborneol

[160] This investigator, Connell, is also an active, sworn law enforcement officer in the State of Colorado and is a recognized authority in clandestine drug laboratory and marijuana operations and is a Certified Meth-Lab Safety Instructor through the Colorado Regional Community Policing Institute (Colorado, Department of Public Safety, Division of Criminal Justice). Mr. Connell was the lead instructor for the Colorado Division of Criminal Justice Clandestine Drug Laboratory Training Program). Mr. Connell is Colorado's only private consulting Industrial Hygienist certified by the Office of National Drug Control Policy High Intensity Drug Trafficking Area Clandestine Drug Lab Safety Program, and P.O.S.T. certified by the Colorado Department of Law; he is a member of the Colorado Drug Investigators Association, has received over 144 hours of highly specialized law-enforcement sensitive training in marijuana grow operations, and clan-labs through the Iowa National Guard/Midwest Counterdrug Training Center and the Florida National Guard/Multijurisdictional Counterdrug Task Force, St. Petersburg College as well as through the US NHTSA, and the U.S. Bureau of Justice Assistance (US Dept. of Justice) and is currently NHTSA ARIDE Certified. Mr. Connell has conducted clandestine laboratory investigations and performed risk, contamination, hazard and exposure assessments from both the law enforcement (criminal) perspective, and from the civil perspective in residences, apartments, motor vehicles, and condominia. Mr. Connell has personally sought, obtained, and executed search warrants leading to the discovery of marijuana and marijuana grow operations based on the theory of law known as "plain smell."

[161] See for example http://forensic-applications.com/meth/Critical_review_Race.pdf

Second Floor Northwest Bedroom

Upon entering this room, we did not observe any unusual odors. We were shown the northwest corner of the bedroom. Moisture reading indicated dry conditions. There were no signs of water damage, and there was no evidence of fungal or other microbial growth. There appeared to be slight "ghosting" along the northwest interior corner; possible as a result of burning incense.

We lifted up the carpet and pad to expose the underlying floor. There was no indication of fungal growth or extant water intrusion problems.

Second Floor Northeast Bedroom

Upon entering the room, we observed a strong odor of marijuana and "masking fragrances" but no odors associated with water damage or fungal growth. Moisture readings indicated dry conditions. There were no signs of water damage, and there was no evidence of fungal or other microbial growth. There was no indication of fungal growth or extant water intrusion problems.

Second Floor Southwest Bedroom

Upon entering this room, we did not observe any unusual odors. Moisture readings indicated dry conditions. There were no signs of water damage, and there was no evidence of fungal or other microbial growth. There was no indication of fungal growth or extant water intrusion problems.

Basement

Upon entering this area, we did not observe any unusual odors. Moisture readings of the drywall components as well as the structural timbers indicated dry conditions. There were signs of historical water damage throughout; all areas were dry at the time of our assessment; the time frame of the water intrusion was not determined and could have been a result of water intrusion during the construction of the building in approximately 1978.

Along the west side of the basement we observed a drywall (gypsum board) wall. In several locations, we observed small isolated colonies of the common indoor mould, *Stachybotrys*. The largest of the colonies was (as normally expected) on the northern end and covered approximately nine square inches. The surface was easily wiped free of vegetative matter by swiping with a bare hand.

In one area toward the north end of the drywall we also observed a slight, isolated colonization by members of the common, ordinary indoor mould *Penicillia*.

The presence of the colonization was determined to be "inconsequential." Simple, normal, everyday housekeeping techniques will adequately remove the colonization. Once the surface is wiped, black staining due to enzymatic staining may remain. There is no need to attempt to remove the black stain except for aesthetic purposes if deemed

necessary. The surface can then be prepped as normal and painted or left in its current state.

During our assessment, the above referenced organisms were dormant. Unless the gypsum board becomes wet, the organisms will not return to amplification.

Based on the totality of circumstances, the initiating water source was due to condensation as a result of thermal bridging (improper insulation, coupled with high humidity in the basement). A time frame of growth was not determined and the colonization could have occurred at any time after installation of the wall board.

We also observed a small amount of colonization of *Stachybotrys* under the stairs. Again the colonization appeared to be dormant and the building materials were dry. Unless the materials again get wet and are not promptly dried out, the colonization will remain dormant.

The structural timbers of the basement ceiling were completely and entirely devoid of any signs of mould, fungi, or any other type of microbial growth. Visual evidence indicated that both historical and extant conditions were not conducive for the initiation of amplification of fungal growth.

RECOMMENDATIONS

We recommend that normal, ordinary, housekeeping activities be used to keep surfaces dry and devoid of mould growth when it is observed.

Since it is impossible to remove all mould from any occupiable space, and all structures contain mould, and there is no evidence to demonstrate that "hidden" mould creates a problem; the legitimate remediation question becomes "How much mould should be removed and how much mould can be left behind before the area is 'clean'?"

As already referenced, the most recent document on dampness, moulds and indoor air is the globally accepted *World Health Organization guidelines for indoor air quality: dampness and mould*. The WHO document specifically addresses remediation; and specifically, WHO stresses remediation of moisture – not the elimination of mould. The WHO document recognizes that two primary factors control the decision making process in remediation of mould:

1) It is impossible to eliminate mould from the living space of humans.

2) Whereas damp, (not mould) *may* have a causal association with adverse health effects, indoor mould, as commonly seen, has not been shown to have a causal association with adverse health effects.

Since it is patently infeasible to eliminate mould from buildings, WHO recognizes that it must necessarily be acceptable to leave mould in buildings. The concept of leaving contaminated materials in place is not only consistent with WHO guidelines, it forms a

central part of the decision making process. The World Health Organization explicitly states:[162]

> *The main challenge of field investigations is to decide which contaminated materials should be removed and which can be left in building assemblies with a reasonably low risk of indoor climate problems.*

In Section 3.9 of the WHO document, the WHO explicitly recognizes that moisture control, not the removal of building materials is the main method for controlling exposure to indoor contaminants. Throughout the WHO document, the organization stresses that mould has not been shown to be the problem, but rather, it is the entire combined problems associated with *dampness*. As such, the World Health Organization does not stress or advocate mould remediation, but rather damp remediation, control and prevention.

The 2004 IOM document does not address remediation in any great detail. As reported in the IOM document, visible mould had only been weakly associated with measured concentrations of fungi. Nevertheless, the IOM concluded that:

> *Visible mold, although not a precise measure of exposure, is probably the clearest risk indicator for potential exposure.*

Like the WHO, the US EPA, and the US Centers for Disease Control, the AIHA concurs that, similar to an initial assessment, a visual assessment, by a cognizant authority, will virtually always be adequate to determine the adequacy of remediation or corrective actions. The aforementioned AIHA publication cites the *Guidelines on Assessment and Remediation of Fungi in Indoor Environment*; (New York City Department of Health, Bureau of Environmental & Occupational Disease Epidemiology, 2000) and Health Canada, and the Canadian Construction Association *Mould Guidelines* and states:

> *The **primary** objective of mold remediation, based on guidelines published between 1993[163] and 2004[164,165] is to remove **visible** mold growth and return material surfaces to a satisfactory condition.*

The 2008 AIHA document continues with:

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[162] World Health Organization Guidelines For Indoor Air Quality Dampness And Mould (ISBN 798 92 890 4168 3) WHO Regional Office for Europe, Scherfigsvej 8, DK-2100 Copenhagen Ø, Denmark, July 2009

[163] Guidelines on Assessment and Remediation of Fungi in Indoor Environment; New York City Department of Health, Bureau of Environmental & Occupational Disease Epidemiology, 2000

[164] Health Canada: Fungal Contamination in Public Buildings: Health Effects and Investigation Methods. Health Canada, Ottawa, ON (2004)

[165] Canadian Construction Association; Mould Guidelines for the Canadian Construction Industry; CCA; Ottawa, ON; 2004

> *Current mold remediation guidelines support the concept that project success depends on verification primarily through inspection that visible mold growth and associated debris and dust were appropriately removed.*[166, 167, 168]

The section concludes with:

> *A difficulty associated with using air sampling as the primary means of achieving final clearance is the absence of numerical guidelines for airborne fungi and for bioaerosols in general.*[169,170,171] *IOM*[172] *concluded that, although there is an association between respiratory health effects and dampness, the exact causal agents of irritation and respiratory disease are obscure. Thus, from a health effects viewpoint it remains uncertain whether the EHS investigator should sample during final clearance for total spores, culturable spores, hyphal fragments, specific allergens, glucans, endotoxins, or other agents.*

The practice of conducting an assessment and a post remediation verification based exclusively on visual inspections, in the absence of other subjective or objective indicators is not new. The AIHA states that:

> *… the basic practice for identifying mould damage and the process of remediation has been stable since the appearance of the New York City Guidelines in1993 and all cognizant authorities since then have endorsed those approaches.*

Professional judgment is stressed by other authors as the key factor in understanding completion of a moisture remediation project:

> *There is general agreement that professional judgment should play a key part in both assessment and remediation.*[173] *… Typically professional judgment is employed to determine the most effective endpoint for a specific project.*[174]

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[166] Health Canada: Fungal Contamination in Public Buildings: Health Effects and Investigation Methods. Health Canada, Ottawa, ON (2004)

[167] Canadian Construction Association; Mould Guidelines for the Canadian Construction Industry; CCA; Ottawa, ON; 2004

[168] Guidelines on Assessment and Remediation of Fungi in Indoor Environment; New York City Department of Health, Bureau of Environmental & Occupational Disease Epidemiology, 2000

[169] US Environmental Protection Agency, in its booklet "Mold Remediation in Schools and Commercial Buildings, EPA 402-K-01-001 March 2001 (updated 6/25/01)

[170] American Conference of Governmental Industrial Hygienists, (ACGIH), *Data Interpretation*, In Bioaerosols: Assessment and Control, Macher J (Ed), Cincinnati OH, 1999

[171] Storey E; ***et al*** *Guidance for Clinicians on the Recognition and Management of Health Effects Related to Mold Exposure and Moisture Indoors*, Farmington CT, University of Conn. Health Center, 2004

[172] Institute of Medicine (IOM) *Damp Indoor Spaces and Health*, DC, IOM, 2004

[173] Kolb L, McNeel SV, *Guidance for Assessment and Remediation of Indoor Microbial Growth;* Section 2.5) Recognition, Evaluation, and Control of Indoor Mold,, Prezant E; Weekes, DM; Miller JD (Eds.) American Industrial Hygiene Association 2008

Therefore, consistent with scientifically valid, global practices and procedures, FACTs begins the recommendations of establishing appropriate remediation activities by recognizing the end point is to address: 1) moisture, and 2) visible vegetative masses of mould growth.

Explicit here, with regard to ALL of our recommendations, is the stated goal that the source of moisture that lead to the growth of mould has been identified and corrected.

"Remediation" therefore is primarily to return the surfaces of the drywall in the basement to a normal acceptable visual condition (except for the drywall under the stairs, since it is largely not visible anyway). In some locations, the structural integrity of the gypsum board has been severely compromised due to physical damage and some water damage. In those cases, the wall board should be removed for aesthetic purposes (it looks ugly). During the removal, normal construction practices are adequate – there is no need for negative air machines, negative pressure enclosures or any of the nonsense found in the Weecycle's report.

If wallboard is removed, the colonized wallboard is not hazardous waste. The colonized materials are not an hazardous material, they are not restricted or regulated by federal or State environmental regulations and can be simply discarded according to normal construction practices.

--**END**--

[174] Kolb L, McNeel SV, *Guidance for Assessment and Remediation of Indoor Microbial Growth;* Section 2.5.1) Recognition, Evaluation, and Control of Indoor Mold, Prezant E; Weekes, DM; Miller JD (Eds.) American Industrial Hygiene Association 2008