



FORENSIC APPLICATIONS CONSULTING TECHNOLOGIES, INC.

*Respirator on a Pig*

LinkedIn Article

March 18, 2016

Caoimhín P. Connell

Forensic Industrial Hygienist



**I HAVE OFTEN** encountered personnel wearing respirators for no apparent reason. When asked why, the persons usually tell me their Boss told them to wear it. The “Boss” often has no required respiratory program in place, no medical surveillance, no assurance the PPE is maintained or donned appropriately and very often no rationale whatsoever to wear a respirator in the first place.

The above is almost a universal trait associated with self-identified “mould remediation” companies during mould related work. However, the practice of donning respirators during “mould remediation” projects is based mostly in an attempt to impress and/or scare the client (often the victim of economic fraud), rather than any sincere attempt to protect the worker.

In my limited experience of 30 years as an Industrial Hygienist, the use of respirators by mould remediators is part and parcel of the standard fear-based “dog-and-pony-show” that usually includes other unnecessary pieces of equipment such as moon suits, negative air machines and plastic enclosures (all conveniently borrowed from the asbestos and lead abatement industries, but without any notable benefit in “mould remediation” activities).

The decision of using PPE should be based on facts and evidence-based criteria designed to protect workers – not on how well the equipment may impress the client (and justify the outlandish fees being charged). As such, in my experience, the selection of respirators by mould remediation companies is contrary to good Industrial Hygiene practices; born, not of science, but rather of ignorance and (usually) hype.

I say “hype” because in my experience, so very often, once the remediation crew is out of sight of their client, the respirators instantly come off, and are only donned again when there is a possibility these cleaning personnel will be seen.

### BAD SCIENCE in the PUBLIC SECTOR

Many law enforcement colleagues were recently dragged into the fear-based mould issue by an astonishingly bad piece of junk-science (1) published by staff at the National Jewish Hospital in Denver, Colorado, who, relying on phony “data,” falsely exaggerated the fungal hazards associated with indoor marijuana grow operations. Newspaper headlines blared the following nonsensical silliness:

*A team working with National Jewish Health researcher Dr. John Martyny reviewed conditions in 30 marijuana- growing operations in Denver, Littleton and Larimer County and found mold levels at times 100 times higher than considered safe and in a few cases so high that their instruments could not read the levels.*  
Jason Pohl, The Denver Post, September 11, 2012

The question posed to me by Law Enforcement personnel was would N95 cartridges provide protection against mould spores at marijuana grow operations. Yet, in general, similar to a “mould remediation” projects, respiratory protection in a marijuana grow operation would not necessarily be warranted. Therefore, the question concerning the efficacy of the N95 cartridge is predicated on a false premise that such protection is even needed.

Spore concentrations in remediation projects have been reported to range from about 1,000 CFU/m<sup>3</sup> (2) to about one million CFU/m<sup>3</sup> (3) and/or spores/m<sup>3</sup> (4). That is to say, the concentrations are about the same as the spore concentrations observed when Mrs. Smith vacuums her living room carpet and fluffs the household pillows, or seen in other industries with massively higher concentrations but wherein we would never dream of placing employees in respiratory protection.

An Industrial Hygienist who proscribes respiratory protection for a mould remediation project because spore concentrations may be as high as 100,000 spores/m<sup>3</sup>, entirely ignores the fact that it has been reported elsewhere that merely throwing a mouldy lemon into a kitchen trashcan results in a spore concentration three times greater (286,000 spores/m<sup>3</sup>). (5) Are we then to begin recommending homeowners don respirators when cleaning out their refrigerators? If not, why not?

Consider for a moment that literature has shown that normal daily exposures to just *Stachybotrys* alone in a greenhouse potting shed are reported (6) as high as 7,500 spores per m<sup>3</sup>. In this operation, there were no reported illnesses associated with the *Stachybotrys*. Brasel, Martin *et al* (7) studied residences that had been heavily damaged by flood waters, and in which there were huge fungal blooms of mould throughout the homes (up to 500 square feet of mural mould growth on the walls). The researchers confirmed that airborne *Stachybotrys*



concentrations were in the order of 16,000 spores/m<sup>3</sup>. Yet, even in these heavily contaminated houses, the daily dose of mycotoxins (expressed as total trichothecenes) was 8.9E-10 below the LC50 reported by Wannemacher (8) (that is (89,000,000,000 times less than the LC50) and 5.9E-6 below (5,900,000 times below) the LOAEL reported by the European Commission Health & Consumer Protection Directorate-General. (9) 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.

US employees working at lumber mills (10) are daily exposed to mould spore concentrations in the *millions* of spores/m<sup>3</sup>, ranging from 1,000,000 spores/m<sup>3</sup> to 100,000,000 spores/m<sup>3</sup> daily – yet no respirators are used, and no known adverse health effects from those exposures have been reported. It has been reported that shepherds in outdoor sheep paddocks (11) are exposed to mould spores in excess of 300,000 spores/m<sup>3</sup> – who would recommend respiratory protection for shepherds?

Human exposures on normal healthy farms (12) can be millions of times greater than those “hazardous” levels reported in the NJH study; as high as 1,200,000,000 spores/m<sup>3</sup> (that is, one point two *billion* spores per cubic meter of air). (13) In the cited Malmberg (1993) article, the author(s) point out that these farms were selected by the Respiratory Division, National Institute of Occupational Health, (Sweden) precisely because there were no reported illnesses from those locations.

However, even those extremely elevated concentrations are not the highest found in the literature; other authors (14) reported finding even higher spore counts, in excess of 10,000,000,000 spores/m<sup>3</sup> (that’s ten *billion* spores per cubic meter of air) on farms. The “*extremely high*” occupational exposures reported by the NJH team (a mere 100,000 spores/m<sup>3</sup>) pale in comparison to the normal daily (safe) occupational exposures experienced throughout the United States, Canada, Britain and other cognizant Western cultures.

One individual stated that he had determined the spore concentrations during remediation projects to be as “high” as 650,000 spores per cubic meter, and therefore, in his mind, not only was respiratory protection obviously needed, but the N95 were woefully inadequate and the employees should be required to wear SCBAs. Really? “Why?” asked I. To understand the decision criteria, it’s important to put the question into perspective. To do that let’s use airborne asbestos fibers as an example.

### COMPARATIVE TOXICOLOGY

I think most Industrial Hygiene professionals can agree on the validity and volume of literature supporting the toxicity of asbestos and the legitimacy of controlling those exposures through engineering controls and respiratory protection.



I think most Industrial Hygiene professionals also understand that asbestos fibers are naturally ubiquitous in the Earth's atmosphere and virtually all humans are exposed to background concentrations of asbestos on a daily basis. Although there are some notable exceptions, such as some outdoor exposures identified in South Africa, Montana and California, the ambient exposures tend to be extremely low. Thus, one would not generally consider donning a respirator to reduce asbestos exposures for the Banker in his office in Sydney, or the farmer sitting atop a tractor in an Iowa cornfield, or the shepherd walking among his sheep in Wyoming and so forth.

From a regulatory perspective, in the US, it is consistent with OSHA standards for an employee wearing a full face APR fitted with HEPA filters exposed to asbestos fibers at a concentration of 5 million fibers per cubic meter. Five million! Not a mere 500,000, but 5,000,000!

Thus to argue that wearing a similar device is necessary to protect against 650,000 mould spores per cubic meter, one necessarily (however tacitly) argues that on a particle-to-particle basis, mould spores are inherently eight times more toxic than asbestos. Who could possibly support such an argument?

How did we get to this point? Has the collective Industrial Hygiene community forgotten how to do simple math? Has the newly emerging IH community forgotten the basic tenets of toxicology and need to provide appropriate protection founded on evidence-based hazard evaluations?

What is the point in hiring a "Certified Industrial Hygienist" if they have no greater technical abilities and no greater knowledge base and no greater decision making capabilities than a three-day wonder running around calling himself a "Certified Mould Inspector"?

If we take this logic of imposing such stringent PPE requirements on mould spores, our effective exposure control would be 0.01 mould spores per cc of air. As such, we see that if respiratory protection was needed at these levels, we would have to require employees to wear half-face respirators just to go OUTSIDE their houses anywhere in the country -- since the summer outdoor air in Downtown Denver is twice that concentration, and the spore concentrations measured in the ambient air in New Orleans can be fully eight times higher!

Some, people are very confused about the whole N95 thing. One Certified Industrial Hygienist with whom I spoke incorrectly believed that an N95 cartridge implied that only 95% of mould spores would be trapped and retained, and a person wearing the respirator in an atmosphere of 650,000 spores/m<sup>3</sup> would therefore be exposed to 32,500 spores/m<sup>3</sup>, and therefore the N95 offered inadequate protection. Even if their misconceptions was true, what of it? Why would a knowledgeable, responsible IH be concerned about a measly spore concentration of 32,500 spores/m<sup>3</sup>, when the nice clean outdoor air may be almost twice that amount?



The EPA guidelines identifying the use of respirators during mould remediation were made in a vacuum without any data, and apparently without any consideration to reality or facts regarding normal, every-day human exposures to mould spores

The foundationless presumption made in the EPA guidelines is that smaller areas of remediation surfaces necessarily equate to smaller overall exposures. However, that is simply not valid, and a ten square foot confluent growth could easily, easily result in thousands of times the exposure as that presented by a 10,000 square foot remediation. It is frustrating to see such overly simplistic, baseless and flawed tautologies enter professional critical PPE selections processes.

In my day-to-day activities, I am seeing a decline in the technical capabilities of Industrial Hygienists entering the field – younger IHs are more prone to make decisions based on what other people are doing rather than starting with first principles using good analytical skills and evidence-based science to properly evaluate human exposures and implement appropriate controls – if needed.

If the Industrial Hygiene community wants to regain some credibility, it needs to dump the operational principle of relying on nonsensical popular myths and return to professional decision making based on objective rationale - otherwise, it appears that there is nothing to distinguish the professional Industrial Hygienist from the three-day wonders.

#### Refs:

- 1) Martyny JW, Van Dyke MV, et al *Health Effects Associated with Indoor Marijuana Grow Operations*, September 13, 2012 not peer reviewed, not published in any reputable journal.
- 2) Rautiala S, Reponen T, et al *Exposure to airborne microbes during the repair of moldy buildings*. Am Ind Hyg Assoc J 1996;57:279-284.
- 3) “Hameed 2004” was referenced by Tony Havics in “*Exposure Limits for Bioaerosols: et seq.*” at the AIHCE Philadelphia, PA June 2007. I have not reviewed the Hameed article.
- 4) Rautiala S, Reponen T, et al *Exposure to airborne microbes during the repair of moldy buildings*. Am Ind Hyg Assoc J 1996;57:279-284.
- 5) 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



- 6) Dill and Trautmann *Massenentwicklung von Stachybotrys chartarum auf kompostierbaren Pflanzttöpfen aus Altpapier* Mycoses 40 (Suppl 1) p. 110-114, (1997) – translated from the original German by this reviewer, Connell
- 7) 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)
- 8) 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
- 9) 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)
- 10) Gots RE, M.D., Ph.D. (International Center For Toxicology And Medicine), *The Medical Aspects Of Mold Litigation*, presented to the ASTM International Johnson Conference, University Of Vermont, July 13, 2009.
- 11) Smith JD, Crawley WE, Lees FT, *Seasonal variation in spore numbers of Pithomyces chartarum in 1960 and 1961 in the Waikato*, New Zealand Journal of Agricultural Research, 4:5-6, 538-551 (1961)
- 12) Malmberg P, Rask-Andersen A, Rosenhall L, *Exposure to Microorganisms Associated With Allergic Alveolitis and Febrile Reactions to Mold Dust in Farmers*, Chest No. 103 Vol. 4 (1202-1209) April 1993
- 13) Ibid.
- 14) Karlsson K, Malmberg P, *Characterization of exposure to molds and actinomycetes in agricultural dusts by scanning electron microscopy, fluorescence microscopy and the culture method*; Scand J Work Environ Health 1989;15:353-359

