A PRACTICAL AND PHILOSOPHICAL SHIFT AWAY FROM A VISUAL APPROACH TO DETERMINE THE APPROPRIATE RESPONSE TO MOLD REMEDIATION

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Introduction

In 1993 The New York City Department of Health (NYCDOH) ". . . *convened an expert panel on Stachybotrys atra in Indoor Environments. The purpose of the panel was to develop policies for medical and environmental evaluation and intervention to address Stachybotrys atra (now known as Stachybotrys chartarum (SC) contamination.*" In 1999 the document was revised to include all mold contamination but retained its visual assessment criterion (NYCDOH, 1999). The original document was designed primarily to provide guidance for the New York City janitorial staff that maintained city buildings. In the remediation section of the current version of the policy, it was decided that there were to be five levels of response (<10 ft^2, 10-30 ft^2, 30-100 ft^2, >100 ft^2, HVAC). According to this document, "*The size of the area impacted by fungal contamination primarily determines the type of remediation*" and that "*. . . sampling for fungi should not be part of a routine assessment. This is because decisions about appropriate remediation strategies usually can be made on the basis of a visual inspection."* Therefore, each level of response was based on the extent of fungal contamination using a visual inspection arbitrarily reported in square foot dimensions, without apparent scientific basis.

The American Conference of Governmental Industrial Hygienists (ACGIH) likewise published *Bioaerosols: Assessment and Control,* a comprehensive document addressing all forms of biological contamination in indoor environments (ACGIH, 1999). Conventional wisdom at that time apparently was based upon the same information that was used by the NYCDOH in establishing their remediation response to mold problems in buildings. In section 15.2 of "*Bioaerosols*" it states: "'*Extensive' visible fungal growth has been defined as surface areas greater than 3 m^2 (32 ft^2)*". In the footnote to TABLE 15.1 it reads "'*Visible contamination' means that fungi are readily observable on surfaces . . . .*"

In 2001, the U.S. Environmental Protection Agency published a document entitled, "*Mold Remediation in Schools and Commercial Buildings*" (EPA, 2001). This publication continued the practice of determining remediation response

based upon the extent of mold contamination as it was visually detected and reported in square feet. Thus, EPA defined response levels as small, medium and large based upon <10 ft^2, 10-100 ft^2, and >100 ft^2, respectively.

These latter publications started addressing the evaluation of mold contamination problems in buildings. The use of visually detectable amounts of mold growth as the criteria for describing the extent of contamination was easy to understand and implement. As a result, this strictly visual approach unfortunately became a popular method for determining a remediation response.

In 2005, The National Institute of Environmental Health Sciences (NIEHS) introduced *Guidelines for the Protection and Training of Workers Engaged in Maintenance and Remediation Work Associated with Mold* (NIEHS 2005). This document reviewed the size recommendations made by NYCDOH, EPA, Health Canada and ACGIH. NIEHS chose to follow the same path of using a visual assessment with the caveat that this assessment needed to be considered along with work practices and duration of exposure. There was no reference to pre-remediation sampling as a component in determining the scope of work or identifying areas of concealed mold growth or contamination due to dispersed settled spores. However, there was a reference to ensuring that areas of settled spores and fungal fragments be thoroughly cleaned.

Mold remediation frequently has been compared to asbestos abatement. There has been perhaps an unintentional attempt to apply asbestos abatement regulations and procedures to the remediation of mold. This might be a reason why the issue of size, based upon a visual inspection, has gained momentum. There are some regulations that deal with asbestos abatement that are based on the size of the area that is to be removed. A major problem with using asbestos as a model for mold remediation is that asbestos is an applied material that generally stays where it was installed unless disturbed. This results in a consistent ability to predict the size of the area requiring asbestos abatement. Since mold can grow in virtually any area to which water migrates and remains damp over time, mold remediation by its nature usually ends up less predictable with respect to the size of the area of growth and the location in which it can grow.

Limitations and Consequences of a Visual Approach

The publications mentioned above, rely on locating visible mold growth without consideration given to the dispersion and settling of spores that could result in contamination to adjacent areas. However, they do provide some warnings about hidden or concealed mold growth. Generally, the inclusion of pre-remediation sampling was not recommended as part of the assessment.

There are at least two major limitations in only using a visual approach to determine the “size” or “extent” of contamination and for determining the

appropriate remediation response. The first is that it does not take into consideration hidden, concealed (not readily visible) mold growth and the second is that it does not take into consideration contamination resulting from settled spores that were dispersed from areas of actual growth. Failing to address these two limitations prior to beginning remediation can result in a variety of undesirable consequences. They include but are not limited to:

1. An inaccurate scope of work;
2. Containment being erected in the wrong locations;
    a. containment might not include all areas of contamination, resulting in failed post-remediation sampling, extra work and prolonged project time;
    b. containment might include a greater area than is actually contaminated resulting in additional and unnecessary work and expense;
3. Customer dissatisfaction, and
4. Potential litigation.

Without sampling, areas that are contaminated with dispersed spores either will be disregarded or inaccurately estimated. Additionally, containment will most likely be located in inappropriate locations and areas of hidden or concealed mold growth may or may not be discovered as the remediation proceeds. The problem with discovering concealed mold within the workspace is that, first, it must be in the work area or it will be missed; second, in following some of the guidelines mentioned above, containment may not be specified or used. When areas of concealed or hidden growth are then accessed, mold spores and fragments can be dispersed throughout the uncontained area.

The most widely accepted interpretation of the NYCDOH and the EPA publications is that they do not recommend sampling as part of determining the presence and extent of contamination, nor to determine the scope of remediation. Therefore, determining the remediation response level is based upon a visual inspection only; however, this is not specifically what the documents state.

The New York City Guidelines (1999) state:

"2.1 Visual Inspection

A visual inspection is the most important initial step in identifying a possible contamination problem. The extent of any water damage and mold growth should be visually assessed. This assessment is important in determining remedial strategies.

2.2 Bulk/Surface Sampling

a. *Bulk or surface sampling is not required to undertake a remediation. Remediation (as described in Section 3, Remediation) of visually identified fungal contamination should proceed without further evaluation.*

2.3 Air Monitoring

a. *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.*

c. *Air monitoring may be necessary if there is evidence from a visual inspection or bulk sampling that the ventilation systems may be contaminated. The purpose of such air monitoring is to assess the extent of contamination throughout a building. It is preferable to conduct sampling while ventilation systems are operating.*

d. *Air monitoring may be necessary if the presence of mold is suspected (e.g., musty odors) but cannot be identified by a visual inspection or bulk sampling (e.g., mold growth behind walls). The purpose of such air monitoring is to determine the location and/or extent of contamination."*

It has become widely recognized that, in problem buildings, it is more likely that there will be hidden or concealed mold. In support of the position, the American Industrial Hygiene Association (AIHA) has stated, "*Studies of microbial problems in large buildings have shown that perhaps 50% of microbial problems are not visible*." (AIHA, 1996) Similarly, a recent study indicated that out of 100 problem (mold contaminated) homes that were investigated for mold-related problems, only 16% of their inspections had visible mold and 84% had no visible mold (Lorenz, 2002). Therefore, it is a reasonable argument that based upon 2.3.d of the NYCDOH document, that sampling is needed to "*determine the location and/or extent of contamination."*

As mentioned, one limitation of a visual inspection is that it cannot determine the potential for contamination of the surrounding indoor environment caused by dispersed *"mold spores, whose identity, location and quantity are not reflective of a normal fungal ecology for similar indoor environments, and which may produce adverse health effects, cause damage to materials and/or adversely affect the operation or function of building systems"*. (IICRC S520) Therefore, the statement made at 2.3.d. in the NYCDOH guidelines that: "*The purpose of such air monitoring is to determine the location and/or extent of contamination,"* would support the need for sampling. Thus, to determine an appropriate scope of mold remediation, sampling is necessary to delineate Conditions 1, 2 or 3.

Likewise the **EPA's *Mold Remediation in Schools and Commercial Buildings*** states**:**

"Sampling

Is sampling for mold needed? In most cases, if visible mold growth is present, sampling is unnecessary. In specific instances, such as cases where litigation is involved, the source(s) of the mold contamination is unclear, or health concerns are a problem, you may consider sampling as part of your site evaluation. Surface sampling may also be useful in order to determine if an area has been adequately cleaned or remediated."

The same arguments can be applied to the EPA's position on sampling as was applied to the NYCDOH document. Interestingly the EPA makes the following statement: *"If microbial problems are visible, a program of sampling is still often justified because in most circumstances it is useful to the building owner and to the affected occupants to know the precise nature and extent of the contamination."*

The *Field Guide for the Determination of Biological Contaminants in Environmental Samples* (AIHA 2005) states that sampling for biological agents can assist complaint investigations by helping, *"to resolve doubts, facilitate the success of the investigation, or document the seriousness of reported hazardous conditions or suspected exposures."*

Liability Exposure When Using a Visual Approach

The inability of the visual approach to accurately identify hidden or concealed mold and to take into consideration contamination from dispersed spores, exposes remediators to potential liability. Incomplete or failed remediation results in higher costs and projects delays. Another potential problem is inadvertent exposure of occupants that can then lead to litigation. There is also the potential consequence of unnecessary remediation. When the scope has not been accurately determined, the containment and subsequent remediation might be applied to areas that are not in need of remediation. The cost for this unnecessary work can result in additional monetary losses to property owners, insurance companies or landlords.

Therefore, when only using a visual approach for establishing mold remediation procedures, one must assume that a job scope and placement of containment will, more often than not, be wrong. Professional remediators generally cannot afford, and usually will not be absolved from, the liability and consequences of their decisions. Indoor environmental professionals (IEP) frequently disclaim responsibility for hidden, unanticipated, and changing conditions. Professional remediators should recognize and anticipate that a scope of remediation may change. Even when an IEP has been retained to provide oversight on a project, a remediator remains responsible for recognizing, reporting and responding to these unanticipated situations by exercising professional judgment.

The NYCDOH document includes an appropriate warning under the "Remediation" heading that reads: "*The goal of remediation is to remove or clean*

contaminated materials in a way that prevents the emission of fungi and dust contaminated with fungi from leaving a work area and entering an occupied or non-abatement area, while protecting the health of workers performing the abatement."

The EPA has a similar warning under the subheading "Hidden Mold". **"***You may suspect hidden mold if a building smells moldy, but you cannot see the source, or if you know there has been water damage and building occupants are reporting health problems. Investigating hidden mold problems may be difficult and will require caution when the investigation involves disturbing potential sites of mold growth—make sure to use personal protective equipment (PPE). For example, removal of wallpaper can lead to a massive release of spores from mold growing on the underside of the paper. If you believe that you may have a hidden mold problem, you may want to consider hiring an experienced professional. If you discover hidden mold, you should revise your remediation plan to account for the total area affected by mold growth.*"

The problem with proceeding with a remediation project that does have hidden mold is that once you "discover" it, as in the example referenced in the EPA warning, mold spores, in all likelihood, already will have been dispersed into otherwise uncontaminated areas. That being the case, who is going to pay for the additional and perhaps unnecessary cleanup? Remediation firms may find that, if they submit such cleanup costs to their insurance liability carrier, the insurance carrier may deny the claim as a result of the "pollution exclusion" in their Commercial General Liability (CGL) coverage.

The Philosophical Shift

In 2000, the Indoor Environmental Institute (IEI) approached the Institute of Inspection, Cleaning and Restoration Certification (IICRC) with a proposal to develop a mold remediation standard. Later the Indoor Air Quality Association (IAQA) also participated. These three organizations, under the auspices of IICRC, cooperated to produce the first edition of the IICRC S520 *Standard and Reference Guide for Professional Mold Remediation* (IICRC, 2003). The stated purpose of this standard is to: *". . . define criteria and methodology to be used by the remediator for inspecting and investigating abnormal moisture and mold contamination, and for establishing remediation and safety plans and procedures*."

The Foreword of the IICRC S520 states: "*Remediators and other parties to the remediation process often request specific guidance regarding quantities of mold or mold spores that trigger remediation activities or confirm remediation success. Quantifying visible levels of mold growth alone is not feasible as an action level decision criterion, because of the wide range of occupant susceptibility and the inability to precisely measure exposure, along with insufficient science to support conclusions in this area at the time of publication.*

Thus, [IICRC] S520 represents a philosophical shift away from setting numerical mold contamination action levels. Instead, it establishes mold contamination definitions, conditions (1, 2, 3) and general guidance, which, when properly applied, can assist remediators and others in determining criteria that trigger remediation activities or confirm remediation success."

The IICRC S520 defines Conditions as follows:

Condition: for the purpose of this Standard, Conditions 1, 2, and 3 are defined for indoor environments relative to mold.

Condition 1 (normal fungal ecology)**:** an indoor environment that may have settled spores, fungal fragments or traces of actual growth whose identity, location and quantity are reflective of a normal fungal ecology for a similar indoor environment.

Condition 2 (settled spores)**:** an indoor environment which is primarily contaminated with settled spores that were dispersed directly or indirectly from a Condition 3 area, and which may have traces of actual growth.

Condition 3 (actual growth): an indoor environment contaminated with the presence of actual mold growth and associated spores. Actual growth includes growth that is active or dormant, visible or hidden.

Since there is a potential mold problem on most water damage restoration projects when there is a delayed response or a pre-existing condition, investigations should be conducted. This investigation includes gathering information, conducting an inspection, and then making a preliminary determination.

This is not a new approach. It is a more appropriate scientific approach. As referenced by ACGIH (1999), an investigation should include the following four steps.

1. Gather information;
2. Formulate a hypotheses;
3. Test the hypotheses, and
4. Make recommendations.

The old adage, "An ounce of prevention is worth a pound of cure" applies to performing inspections. The IICRC recommends this thinking when evaluating water losses and mold remediation projects. The first edition of the S520 highly recommends that remediators obtain a building history, perform a building inspection (which includes any comments from the occupants about their reactions to the indoor environment) and make a preliminary determination as to whether or not there is a mold problem that is either visible or concealed. The compilation of a building's history, along with the inspection results, corresponds

to the "*gather information"* step. The preliminary determination is comparable to the "*Formulate a hypothesis"* step. If the preliminary determination is that there is suspected or actual mold growth, then an IEP is used to "*Test the Hypothesis"* and "*Make Recommendations"* for remediation. Those recommendations would include location of mold growth and presence or absence of dispersed spores (Condition 2). Performing a more thorough inspection and utilizing sampling as part of the process is an ounce of prevention.

Not accepting a numerical value based upon a visual inspection to determine the extent of contamination presents an issue similar to that of interpreting occupant exposures to indoor mold. To date, neither industry nor governments have been able to promulgate science-based threshold levels for exposure to molds, and therefore have resisted pressure to arbitrarily establish numerical values as acceptable exposure limits. This situation is no different for the professional remediator. Without establishing permissible exposure limits and a model to calculate the dispersal of mold spores and associated particles, the practice of using an arbitrary size of an affected area, to determine the appropriate remediation response based solely upon a visual inspection, is not consistently accurate or appropriate.

The Advantage

The IICRC S520 approach to determining an appropriate mold remediation response has a number of advantages over a visual inspection:

1. It helps to more accurately determine the extent of mold contamination that is either visible or concealed as a result of dispersed, settled spores;
2. It allows remediators to determine the actual scope of work and where to place appropriate containment;
3. It minimizes the need to perform additional cleaning because of an incomplete scope of work;
4. It minimizes the potential for inadvertent exposure to occupants due to incomplete remediation;
5. It minimizes the potential for contaminating areas that were otherwise not contaminated when opening interstitial areas of a building;
6. It minimizes the potential for excessive remediation due to not determining an accurate scope of work, and
7. It minimizes the potential for litigation and customer dissatisfaction.

Conclusion

As previously mentioned, initial efforts to establish a method for determining the extent of mold contamination and a subsequent remediation response was a good first step. However, those efforts were too general in scope to adequately

help professional remediators establish an accurate scope of work. In most cases, those efforts focused primarily on building maintenance staff. Professional remediators do not have the luxury of being in a building night after night performing on-going maintenance and cleanup. It was decided that a different approach, that was more comprehensive and better served professional remediators, was needed. The Institute of Inspection Cleaning and Restoration Certification (IICRC) along with Indoor Environmental Institute (IEI) and the Indoor Air Quality Association (IAQA) collaborated to produce the IICRC S520 *Standard and Reference Guide for Professional Mold Remediation* (IICRC, 2003). The result has been an industry-consensus approach to a comprehensive inspection and preliminary determination process that has helped resolved the many limitations, complexities, conflicts, and complications that have been associated with an inspection based solely upon a visual assessment.

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