Session No. 514

The Role of the Indoor Environmental Professional in Mold Remediation

Ronald D. Schaible. CIH, CSP, P.E.
Robson Forensic, Inc.
Lancaster, PA

Introduction

The nature of mold contamination and subsequent remediation (sometimes also referred to as "restoration") requires adherence to consistent techniques and protocols to successfully and effectively restore a structure for human occupancy. Until recently, the qualifications and role of the Indoor Environmental Professional (IEP) in this process were fluid. Recent guidance documents and standards now provide some structure and clarity to the IEP's contribution to successful mold remediation. Litigation has also elevated the standard of care for all parties involved with mold remediation.

This paper provides perspectives on the role of the IEP in mold remediation, with particular emphasis on the IEP's responsibility to bring clarity from complex issues due to the lack of definitive criteria for performing pre- and post-remediation activities.

What Is An Indoor Environmental Professional?

Published minimum qualifications and professional competencies have become more widespread as the issue of mold remediation and the broader spectrum of indoor air quality has gained prominence. Sound professional judgment is necessary as there is no current regulation of mold. This is due to the numerous and complex issues involved in establishing causal relationships between exposure and health response. Various states have passed, or have attempted to promulgate legislation governing the qualifications and activities of mold assessors and the companies for whom they work, as well as remediation companies. Some states have initiated studies of the health effects of mold toxicity and have established criteria under which damages may be sought with respect to mold exposure. The National Association of Mutual Insurance Companies (NAMIC) and Aerotech Laboratories Inc. (Aerotech(b)) maintain useful web sites for monitoring the progress of mold legislation at the state level, and the outcomes of selected litigation involving damages due to mold.

Organizations such as the American Industrial Hygiene Association (AIHA 2001, 2004) and more recently the Institute of Inspection Cleaning and Restoration Certification (IICRC) have published criteria that describe qualifications, competencies, and assessment methods. The International Environmental Standards Organization (IESO) also published standards for

performing mold testing. The American Society for Testing and Materials (ASTM) is in the process of developing their own standard.

The IICRC (2003) states that "The role of an IEP is to perform an assessment of the fungal ecology of property, systems and contents at the job site, create a sampling strategy, sample the indoor environment, interpret laboratory data and determine Condition 1, 2 and 3 status for the purpose of establishing a scope of work (pre-remediation assessment) and/or when necessary to verify the return to normal fungal ecology."

The AIHA (2004) identifies not only educational and experience requirements, but eight technical areas in which the IEP should possess a specified level of knowledge. There are numerous technical subjects within each of the general areas. It is not possible nor is it the intent of this paper to discuss them all. The general areas that constitute a multi-disciplinary approach to mold remediation include (AIHA, 2004):

1. Exposure Assessment
2. Indoor Environmental Quality
3. Microbial Assessment And Remediation
4. Microbiology/Mycology
5. Heating, Ventilating, And Air Conditioning (HVAC)
6. Building Science
7. Legal/Communication
8. Health Effects

The IEP As Competent Investigator

The technical subject areas mentioned above speak clearly to the need for the IEP's competency as an investigator. Ideally, in addition to possessing core knowledge of some of the competencies mentioned previously, s/he should be a member of a multi-disciplinary team, or have access to qualified individuals that can compliment the independent IEP's expertise. This capability is crucial to effectively determine damages, and the liability of potentially responsible parties (PRPs). Examples of PRPs include construction managers, project architects, mechanical engineers, subcontractors, product manufacturers, landlords and property management companies, tenants, HVAC maintenance contractors, water extraction companies, real estate brokers, owners, property inspection companies, pest control companies, employers, insurance companies ("bad faith" claims), and other consultants.

The multi-disciplinary approach is especially important for complex mold assessments and remediation projects. It is highly unusual that one individual has expert knowledge in all of the eight competencies listed above, especially when one recognizes that these competencies include skill sets such as ventilation engineering, architectural engineering (windows, doors, roofing, siding, EIFS and related building envelope issues), civil/structural engineering (soils and foundations), utilities (plumbing), microbiology laboratory services, and possibly toxicology and medical expertise. IEPs must know their area of expertise, and stay within that expertise.

A property owner or insurance claims adjuster who selects an individual(s) with these capabilities should expect to receive quality, unbiased advice. Sound technical assessment should

be able to locate and address areas of contiguous fungal growth, and provide appropriate guidance to protect the health and safety of building occupants and workers.

When Should An IEP Be Used?

The IICRC (2003) states that a third-party IEP must be considered under the following circumstances:

- Where there is microbial contamination that can adversely affect worker or occupant health;
- Where there are high risk occupants in the structure (e.g., elderly care or child care facility); or
- Where a public health issue exists.

These criteria are consistent with the New York City Department of Health, Bureau of Environmental and Occupational Disease Epidemiology *Guidelines.*

The IEP As Unbiased Advisor

The IEP must be an unbiased, independent third party advisor that does not have an ownership affiliation with any remediation contractor. This may seem an obvious pitfall to avoid but it is often overlooked by consumers of these services. Professional experience involving insurance claims and litigation indicates that the separation of a given IEP and remediation firm should not be automatically assumed. The IEP should be viewed as an advocate for those retaining his services. It is a recommended and prudent activity for a client to investigate and clarify the relationship between the IEP and the remediation contractor before retaining their services.

The IEP As Teacher And Communicator

The IEP should also be an effective teacher who is willing to educate interested parties about such issues as:

1. The IEP's working relationship with the remediation contractor
2. Prevention and control of microbial contamination during construction and building operations.
   a. Surprisingly, many building contractors still require repeated admonishments to keep new building materials dry, and what quality controls may be effective to promote good indoor air quality throughout the construction process. Guidance published by the Sheet Metal and Air Conditioning Contractors' National Association, Inc. (SMACNA, 1995), and other organizations, should be consulted.
4. The potential structural problems that chronic water damage and mold presents
5. The health issues that may be posed by microbial contamination
6. The process that the IEP may use to investigate the problem
7. The purpose, value, and content of a mold remediation plan
8. The value of conducting post remediation validation testing

Lessons Learned

Use of the scientific method in mold investigations

The ACGIH (1999) discusses the use of the scientific method within the context of mold investigation strategies. The American Board of Industrial Hygiene (2005) also includes the requirement to follow scientific principles in their Code of Ethics for the Practice of Industrial Hygiene. The first Canon of Ethical Conduct is:

"1. Practice their profession following recognized scientific principles with the realization that the lives, health and well-being of people may depend upon their professional judgment and that they are obligated to protect the health and well-being of people.

- Industrial Hygienists should base their professional opinions, judgments, interpretations of findings and recommendations upon recognized scientific principles and practices which preserve and protect the health and well-being of people.
- Industrial Hygienists shall not distort, alter or hide facts in rendering professional opinions or recommendations.
- Industrial Hygienists shall not knowingly make statements that misrepresent or omit facts."

The scientific method is difficult to apply to mold investigations because we currently lack all the scientific facts about mold. Much more is known about building science and HVAC engineering issues than the science of how mold propagates and is transported within buildings. We do not know how to differentiate mold arising from different water intrusion events over time. Health issues related to mold are ill-defined and must be addressed in light of case-specific information.

Performing testing for mold contamination requires the IEP consider the source of contamination, the potential pathways by which mold can affect building occupants, and the receivers (i.e., the building occupants). If testing is to be performed, then hypotheses should be developed for each of these pathways, and especially before performing source sampling. Hypotheses contribute to the selection of sampling protocols and the interpretation of data gleaned from those protocols.

However, mold investigations are not funded or conducted like research grants. IEPs in the "real world" are faced with constraints in their ability to investigate a particular situation as completely as possible. Limitations in one's ability to investigate a problem include the various hypotheses that may need to be tested, and the types and number of samples required over time to provide statistical validity to the data analysis. This translates to how much time and money is available to the IEP from the client. Apart from major litigation where resources may be more copious, typically the client is not interested in funding a major study; rather, they just want to be able to properly restore the building to a suitable, pre-loss condition in a timely manner.

The issue of how well the IEP used the principles of the scientific method is a favorite line of attack by adversaries (e.g., attorneys). They seek to discredit the IEP's findings by having the IEP disqualified as an expert by using a *Daubert* challenge. With respect to mold assessments, *Daubert* says that there must be some scientific basis for your investigation protocol and remediation plan.

The traditional industrial hygiene approach of anticipation, recognition, evaluation, and control has changed in the world of mold assessment and remediation. Evaluation and control has changed drastically, especially the control aspect of the IEP's participation. The IEP's role is diluted due to the intervening participation of others, such as the remediation contractor, and sometimes the client. Instead of direct involvement, the IEP is often separated from the remediation process.

Additional complications include information gaps and practical constraints that prevent full use of the classic scientific method. IEPs often must compromise between a rigorous sampling protocol and one that is more practical or feasible. The IEP should use all the tools reasonably at his disposal during mold assessments to maximize the credibility of his findings. The IICRC (2003) indicates that such tools include, but are not necessarily limited to, physical inspection, moisture testing, sample collection, and documentation, interpretation and communication of results. The use of infrared thermography with digital photography capability is an expensive but potentially useful addition to the IEP's tool box. The use of borescopes and wall cavity sampling devices is contraindicated because of their respective inherent limitations. Borescopes have a restricted field of view which makes the already difficult task of visually identifying mold that much more difficult. Wall cavity sampling is necessarily invasive and the results typically lack any correlation to conditions found in occupied spaces in the building.

Documents, documents, and more documents

When determining the origin and cause of water intrusion, it is always wise to conduct a pre-site inspection document and record review. If not provided as part of the initial consultation, then the IEP should request all available documents applicable to the loss before performing the site inspection. This provides background information that establishes a chronology of events. The IEP should be able to rely on this information, but s/he should verify critical information during the site inspection. Interviews with the owner(s) and occupants (in multi-family dwellings such as apartment buildings or condominiums) may be valuable. For large scale projects involving many occupants, using epidemiologic software can provide a cost effective means of discerning whether a particular indoor air quality phenomenon is mold related, or due to chemical constituents unrelated to mold, or to a building envelope issue. The IEP should consider obtaining additional information, such as engineering plans or sketches, as valuable input for the investigation consistent with the scope and magnitude of the loss. The importance of good photographic documentation of the site and pertinent conditions cannot be overstated.

Do no harm

The Hippocratic oath for doctors states "do no harm". IEPs and contractors would do well to heed this advice. Inspections and microbial testing should be noninvasive to the greatest extent possible.

Frequently, assignments are in response to an owner or occupant who questions the condition of their property after a "mold inspector" has completed their inspection. What is determined during the telephone conversation or upon arriving on site is that indiscriminate or unnecessary invasive techniques have been used to open wall or ceiling cavities to visibly detect mold in those cavities. The space is left in that condition by the "mold inspector".

Indiscriminate stripping of wall materials or the use of tools to create wall openings to visually detect mold should never be done. The occupants are potentially exposed to the airborne spores that have been disturbed. The HVAC system is also potentially compromised. Further, the background levels of spores in what may have been considered "noncompliant" areas during

remediation are now often questionable and may have to be considered as part of the affected remediation areas. This can greatly increase the complexity and cost of remediation. It can also confound one's ability to perform meaningful post remediation validation testing because comparisons to post remediation microbial levels are not possible.

Removal of suspect materials during the investigation phase should be performed carefully under controlled conditions when its value has been carefully weighed against the risks of removal. The removed materials should then be replaced or covered with plastic and sealed to prevent spore release. Careless removal by unqualified personnel has resulted in remediation cost increases of 50%-200% due to re-doing parts of the job and/or bio-washing/cleaning surfaces that would not have been part of the originally contaminated area requiring remediation.

What do the numbers mean?

Conducting mold sampling creates a unique set of problems. Ideally, the scientific method should be used to establish a basis for obtaining, testing and interpreting the data, despite the fact that air sampling is considered unnecessary during routine assessments or to evaluate worker exposure to mold (AIHA 2004, EPA, 2001). Yet most materially interested parties want some form of data to justify their conclusions and actions. The IEP faces a difficult and critical task of determining the methodologies needed, and evaluating the data in light of the findings of the origin and cause investigation. Some of the reasons for this difficulty lie in the fact that currently there are no uniformly accepted:

1. Regulations, standards, or guidelines for specific molds in the building environment despite the variety of worldwide entities that have established their own criteria (Brandys).
2. Criteria for what kinds of testing to perform to assess mold in the building environment. Sampling guidelines have been established for performing mold sampling using air, bulk, surface, and other media (AIHA, 1995; Aerotech, 2005; IESO (2002).
3. Criteria for correlating quantitative sampling data between sampling methods, such as comparing total spore trap sample data with data obtained using a single-stage impactor.
4. Criteria for correlating quantitative data to health effects.
    a. Rank order comparisons, the presence or absence of target fungal types, and comparing indoor to outdoor fungal levels are currently the common methods for evaluating mold sampling data.

The IEP is challenged to apply professional judgment absent peer reviewed, accepted criteria. Simply stated, the following has been the generalized framework for decision-making:

1. Were the bioaerosol levels substantially reduced to less than outdoor or similar indoor background levels?
2. Was there a similar biodiversity for predominant organisms?
3. Were any predominant toxigenic forms identified? The absence of molds typically associated with the presence of water-damaged materials reduces concerns about potentially unhealthy spore levels.

If the investigation protocol has been thoughtfully prepared and the testing performed in accordance with the protocol, then competent analysis of the samples is needed to complete the standard of care for testing. The IEP should always use the services of an AIAH-accredited microbiology laboratory that has the EMLAP designation. Mold identification requires specialized

skills. IEPs cannot afford to have their competence compromised by relying on data from a laboratory that has not demonstrated its competence as evidenced by this independent accreditation process.

Preparing the remediation (a/k/a "restoration") plan

The ACGIH (1996) defines restoration as "(a) removal of porous materials showing extensive microbial growth, (b) physical removal of surface microbial growth on nonporous materials to typical background levels, and (c) reduction of moisture to levels that do not support microbial growth." This must be achieved in a cost-effective manner while simultaneously protecting the health of building occupants and the workers performing the remediation.

Guidelines for mold remediation have existed for at least five years. The most notable are the guidelines by the New York City Department of Health (2002), *Mold Remediation in Schools and Commercial Buildings* (EPA, 2001), and those published by the ACGIH (1999). Now, documents such as the IICRC S520, the draft ASTM standard (2003), and others have appeared. Selected documents are referenced at the end of this paper. These standards provide a structure to conduct mold contamination assessment and remediation activities.

Knowing all that precedes this step in the mold remediation process, and acknowledging that information gaps exist in our current knowledge of mold and its health effects, how does one determine the scale of the remediation effort that is necessary? The contents of a mold remediation plan will vary depending on the:

1. Nature and extent of contamination (type and concentration of mold)
2. Location of contamination (visible, hidden, structural considerations)
3. Building type (single-family residence, multi-tenant building, commercial establishment, industrial facility)
4. Occupants (health care facilities, nursing homes, day care centers, etc.)

At a minimum, a remediation plan for any size project should provide general practices and procedures for (a) removal and disposal of mold contaminated materials, (b) preventing contamination of adjacent spaces that are believed to be unaffected by the contamination, and (c) protecting the remediation workers and sensitive building occupants during the remediation process.

For the purpose of this paper, a "scope of work" is more limited than a "specification." Additional information and the sequencing of work activities are crucial to successful project completion. The following topics are always addressed.

General Project Considerations:

1. The requirement that the condition(s) that contributed to the water intrusion have been properly repaired so that remediation can begin.
2. General performance requirements with references to the IICRC S520 standard (IICRC, 2003), US EPA (EPA, 2001), and Chapter 15 of the ACGIH text (ACGIH, 1999).
3. The expectation that the contractor will use reasonable field decisions about the means and methods to address unexpected conditions consistent with approved or accepted industry practice or standards.
4. Definition of the areas, systems, and/or contents in the structure that require remediation.

5. The requirement for the contractor to abide by all OSHA requirements for their workers, with particular attention to the health and safety aspects of soda bead blasting or dry ice blasting if those methods will be used.
6. Results of air and surface testing.
    a. It is my opinion and practice that a summary of the results of the initial mold investigation be included so that the nature and extent of contamination is clearly conveyed to the building owner and remediation contractor. This practice is consistent the IEP's role of defining the affected mold contaminated areas, and protecting the health of remediation workers.

Abbreviated, similarly effective methods can be used if they are consistent with sound professional judgment to achieve cost-effective solutions. (AIHA, 2004).

Sequence of Work Activities:

1. Construction of decontamination units with recommendations for ingress and egress.
2. Erection of critical isolation barriers.
3. Installation of negative air systems with particular mention of a minimum recommended number of air changes per hour, pressure differential (in inches of water gauge) in the work area, identification of potential "dead zones" in the work area where air circulation may be lacking, and the possible need for a "push-pull" ventilation arrangement.
4. Disposition of content items (clean, discard, no action).
5. Damaged materials removal, with mention of affected building materials, carpeting, flooring, thermal insulation systems, etc.
6. Recommend the use of a professional engineer to properly evaluate structurally compromised materials.
7. Instructions regarding cleaning and use of antimicrobials, and the requirement (where applicable) for cleaning the air conveyance system in accordance with the NADCA standard.
8. Mention the value of post remediation validation testing and the criteria to be used for defining a successful outcome.

Larger projects benefit from the development of more formalized remediation specifications due to their complexity and significantly more parties being involved. In addition to the subject headings found in a scope of work, specifications should include these provisions:

1. Contractor qualifications with particular experience in asbestos removal and water restoration techniques, including references regarding similar large scale projects.
2. Definitions of terminology such as acronyms, and "should" versus "shall" to provide interpretation of critical terms to avoid confusion and to clarify expectations.
3. Listing of federal, state, or local regulations and guidelines applicable to the work being performed.
4. Contractor's comprehensive safety program, including hazard communication, personal protective equipment, respiratory protection compliance, etc.
5. Temporary utilities such as power, lighting, and water.
6. On-site and off-site storage considerations.
7. Building permits and codes.
8. Project schedule and working hours.
9. Post-award submittal requirements placed on the contractor before work begins.

10. Record keeping and the requirement for daily project logs and a visitor log to help ensure site control, security, and to prevent unauthorized access. Also,
11. Records of periodic manometer pressure readings in containment areas.
12. Engineering and administrative measures to protect occupants.
13. Special considerations such as fireproofing, asbestos, authority to stop work, etc.
14. Emergency planning and procedures and fire protection.
15. Tenting procedures.
16. Signage and notifications.
17. Pack-out procedures including bagging, disposal, and decontamination.
18. Disposal and transportation of hazardous wastes, if applicable.

Additional information on developing project specifications may be found at the web sites of The American Institute of Architects (www.aia.org) and The Construction Specifications Institute (www.csinet.org). The NADCA (2004) publishes a General Specification that describes the minimum requirements necessary for commercial HVAC system cleaning.

How clean is clean?

Post remediation validation testing is the stage of the project that typically draws the most interest from all parties. Everyone involved wants some assurance that the work was properly performed. Post remediation validation testing has limitations as to its scientific and functional use due to inter- and intra-day variability. However, it is my opinion that post remediation validation testing is worthwhile as it provides some (and maybe the only) indication of satisfactory job completion. It is also my opinion that the client's interests are best served when the IEP that performed the initial investigation also performs the post remediation validation testing. By doing so, it helps ensure a continuity of project familiarity, testing protocols, and data interpretation and comparison of pre- and post-remediation conditions.

Conducting post remediation validation testing is comparable in rationale and technique to that which was performed during the initial mold assessment. The goal of testing at this stage of the project is to determine, to the greatest extent practical, that (a) bioaerosol levels were substantially reduced to less than outdoor or similar indoor background levels, (b) that they were of similar biodiversity for predominant organisms, and (c) no predominant toxigenic forms were identified.

However, this task relies first and foremost on visually confirming that the remediated area(s) appear clean with no visible signs of remaining mold growth or water-damaged materials. It is my practice that post remediation verification testing is conducted if and only if the visual inspection is satisfactory. One aspect of determining that the work is qualitatively considered "satisfactory" is by use of a "black glove' inspection on suspect surfaces to confirm the absence of dust.

Baxter, et al. (2005) has found that "A systematic visual inspection can be an accurate predictor of the level of airborne fungal concentrations. In general, the absence of visible mold growth in readily accessible areas of buildings is an accurate predictor of the absence of elevated fungal spore concentrations. Exceptions are most likely to occur in nonresidential buildings."

Any presence of dust or dirt fails the job and obviates the need for performing any quantitative tests. Piles of construction debris, no matter how carefully and aesthetically arranged in the work area, indicate the contractor's clear disregard for the standards governing remediation work and the

criteria in the written remediation plan, and his lack of appreciation of the challenge of removing microscopic particles.

Quality control versus quality assurance

The IEP's role may include conducting mold assessments, performing environmental testing and data interpretation, writing remediation plans, and/or determining if a remediation job has been satisfactorily completed, without standardized practices. This role places us in the unenviable position of acting as both judge and jury. Yet the IEP must not solely bear the responsibility for quality control or for quality assurance on a mold remediation project. No one, even an IEP, is infallible.

A standard of care is necessary even if a national standard does not exist. There exist sufficient standards and guidelines to extrapolate and follow important applicable criteria. If the IEP and contractor are both sufficiently familiar with existing standards and guidelines, then a consensus approach can be used in the development of the remediation plan.

Quality control occurs during a project. It is the daily oversight of everyday job tasks to ensure that the means and methods conformed to the work scope or project specifications. It is the responsibility of on-site personnel. Quality assurance is a retrospective evaluation of a project, or important benchmark stage(s) of a project, to ensure that quality control of the work scope or specification was proper. Quality assurance should confirm or validate quality control.

Except for large, complex mold remediation projects, it is costly and therefore rare for an IEP to be retained to provide on-site quality control. Pinto (2005) correctly asserts that it is the responsibility of the contractor (and sub-contractors, if applicable) to provide daily quality control oversight as the work progresses. It is incumbent upon remediation contractors to perform some sort of quality assurance before the IEP is involved at the post remediation validation testing phase of the project. The contractor may save time, money, and client goodwill by avoiding costly and unnecessary re-cleaning if he performs some form of qualitative and limited quantitative evaluation of the work site. This data can then be used to confirm or question the findings of the IEP.

Conclusion

In summary, the role of the IEP is to bring clarity from complexity with respect to the origin and cause of water intrusion while identifying the type and extent of mold contamination (if any) and its relationship to alleged health effects of building occupants. The IEP is also responsible for defining the means and methods for successful remediation while protecting the health of occupants and workers. Serving as judge and jury is a complex and demanding task in an environment where the science of building indoor air quality is still evolving, and regulations affecting mold remediation are lacking.

References

Aerotech Laboratories Inc. (a), State Mold Legislation. January 12, 2005. http://www.aerotechlabs.com/Infobase/legislation.aspx?CatID=0. Accessed on February 21, 2005.

Aerotech Laboratories Inc. (b). Indoor Air Quality Services Guide. January 12, 2005. http://www.aerotechlabs.com/Services/serviceguide.aspx?CatID=1. Accessed on February 21, 2005.

American Board of Industrial Hygiene. http://www.abih.org/Docs/Code-of-Ethics.htm#article1. Accessed on February 20, 2005.

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

American Industrial Hygiene Association (2004). *AIHA Guideline 3 – 2004. Assessment, Remediation and Post-Remediation Verification of Mold in Buildings.* Fairfax, VA. Approved July 20, 2004.

AIHA (May 2001). *Report of Microbial Growth Task Force.*

AIHA (1996). *Field Guide for the Determination of Biological Contaminants in Environmental Samples.*

American Society for Testing and Materials (2003). "WK 1892, Standard Guide for Readily Observable Mold and Conditions Conducive to Mold in Commercial Buildings: Baseline Survey Process." Date Initiated: July 10, 2003.

Baxter, Daniel M., Jimmy L. Perkins, Charles R. McGhee, and James M. Seltzer. (2005) "A Regional Comparison of Mold Spore Concentrations Outdoors and Inside 'Clean' and 'Mold Contaminated' Southern California Buildings." *Journal of Occupational and Environmental Hygiene,* 2:8-18.

Brandys, Robert C. and Gail M. Brandys. (April 2004). *Worldwide Exposure Standards for Mold and Bacteria: Historical and Current Perspectives, Second Edition.* OEHCS, Inc., Hinsdale, IL.

Environmental Protection Agency (March 2001). *Mold Remediation in Schools and Commercial Buildings.* Office of Air and Radiation, Indoor Environments Division. EPA 402-K-01-2001.

EPA. (2005). "Should You Have the Air Ducts in Your Home Cleaned?" www.epa.gov/iaq/pubs/airduct.html. Accessed on February 21, 20055.

Health Canada. (June 1995). *Fungal Contamination in Public Buildings: A Guide to Recognition and Management.*

Health Canada. (2004). *Fungal Contamination in Public Buildings: Health Effects and Investigation Methods.*

Indoor Environmental Standards Organization (April 2002). "Standards of Practice for the Assessment of Indoor Air Quality, Volume 1: Mold Sampling; Assessment of Mold Contamination, First Edition." Minneapolis, MN.

Institute of Inspection Cleaning and Restoration Certification (December 2003). *S520 Standard and Reference Guide for Professional Mold Remediation.* Vancouver, WA.

Listing of AIHA Environmental Microbiology (EMLAP) Accredited Laboratories http://www.aiha.org/qs/reports/anylist.aspx?type=2. Accessed on February 21, 2005.

National Air Duct Cleaners Association (2004). Assessment, Cleaning and Restoration of HVAC Systems – ACR 2005. Washington, DC. 2004.

New York City Department of Health and Mental Hygiene, Bureau of Environmental & Occupational Disease Epidemiology (January 2002). *Guidelines on Assessment and Remediation of Fungi in Indoor Environments.*

Pinto, Michael A. "Cleaning Contents from Mold-Contaminated Environments". (January 2005). *Cleaning & Restoration.*

The National Association of Mutual Insurance Companies. www.moldupdate.com. Accessed on February 21, 2005.

Sheet Metal and Air Conditioning Contractors' National Association, Inc. (1995). *IAQ Guidelines for Occupied Buildings Under Construction.* Sheet Metal and Air Conditioning Contractors' National Association, Inc., Chantilly, VA.