ANSI/IICRC S520-2015

# STANDARD FOR PROFESSIONAL MOLD REMEDIATION

Third Edition

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ANSI

IICRC
Institute of Inspection Cleaning and Restoration Certification

# ANSI/IICRC S520
# Standard for Professional Mold Remediation

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# *Disclaimer*

The Institute of Inspection, Cleaning and Restoration Certification S520 Standard for Professional Mold Remediation (referred to as the "Standard" or the "S520") is intended to provide information about the remediation of mold contaminated structures, systems and contents and to assist individuals and entities working in the mold remediation industry in establishing and maintaining their professional competence. Users of this document should stay updated and informed about developments in the field of mold remediation, implement changes in technology and procedures as appropriate, as well as follow applicable federal, state, provincial and local laws and regulations. Since every mold remediation project is unique, in certain circumstances, common sense, experience and professional judgment may justify a deviation from this Standard. Furthermore, this Standard is not intended to be either exhaustive or inclusive of all pertinent requirements, methods or procedures that might be appropriate on a particular mold remediation project. The information upon which this Standard is based is subject to change, which may invalidate any or all of the information contained herein.

This Standard was developed through a consensus standard development process, which brought together volunteers representing varied viewpoints and interests to achieve consensus on mold remediation issues. While the Institute of Inspection, Cleaning and Restoration Certification (IICRC) administers the process and establishes policies, procedures and guidelines to promote fairness in the development of consensus, it does not independently test, evaluate or verify the accuracy of any information or the soundness of any judgments contained in this Standard.

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## ANSI/IICRC S520 Standard for Professional Mold Remediation

# *Foreword*

Awareness of mold growth in buildings has risen sharply in recent years. Several factors have contributed to this heightened awareness, including energy conservation measures, changes in building materials, the use of fast-track construction techniques, failure of occupants to manage moisture intrusion and humidity properly, and an increased reliance on mechanical Heating, Ventilating and Air Conditioning (HVAC) systems for comfort control. In addition, significant media focus and litigation have fueled increased consumer concern.

Response by public and private organizations to mold concerns led to the publication of several documents and guidelines that address mold remediation. They were written primarily for risk managers, building managers, occupational safety and health professionals, public health officials, and those making remediation decisions. The ANSI/IICRC S520 Mold Remediation Consensus Body has considered those existing documents; e.g., New York City Department of Health (NYCDOH) guidelines, Environmental Protection Agency (EPA) guidelines, and National Institute of Environmental Health Sciences (NIEHS), Recognition, Evaluation and Control of Indoor Mold (AIHA Green Book), ACGIH Bioaerosols: Assessment and Control, AIHA Field Guide for the Determination of Biological Contamination in Environmental Samples, in the development of this document.

In 1994, the Institute of Inspection, Cleaning and Restoration Certification (IICRC) first published the *Standard and Reference Guide for Professional Water Damage Restoration* (S500, revised 1999, 2006, 2015), which describes procedures for water damage restoration of structures, systems, and contents. While the S500 was a significant step forward in the water damage restoration industry and it recognized the problem of microbial growth associated with water damage, it was not intended to provide specific guidance on the subject of mold remediation. The ANSI/IICRC S520 *Standard for Professional Mold Remediation* attempts to combine essential scientific principles with practical procedures for remediators facing mold remediation challenges.

The ANSI/IICRC S520 is a procedural Standard. However, the information herein does not preclude use in performance-based scopes of work for mold remediation. It is based on reliable remediation principles, review of available scientific and industry literature and information, and practical experience. In addition, there has been extensive consultation with, and information obtained from, numerous other sources. These sources include, but are not necessarily limited to microbiologists and other scientists, government and public health professionals, industrial hygienists, international, national and regional trade associations serving the professional mold remediation industry, chemical formulators and equipment manufacturers, cleaning and remediation training schools, remediation firms, the insurance industry, allied trades persons and others with specialized experience. This document is subject to further revision as developments occur in technology and procedures.

This document is written for use by those involved in the mold remediation industry, primarily for mold remediation companies and workers, and secondarily, for others who investigate or assess mold complaints, prepare remediation specifications, protocols or procedures, and manage remediation projects, (e.g., indoor environmental professionals (IEPs), other specialized experts) and finally, for other potential materially interested parties (e.g., consumers and occupants, property owners and managers, insurance company representatives, government and regulatory bodies). The ANSI/IICRC S520 is a voluntary Standard. Although attempts have been made to ensure that this Standard is technically consistent with knowledge about mold remediation at the date of its publication, there is no representation or guarantee that every issue and topic relevant to mold remediation has been thoroughly addressed. Users of this document should stay updated and informed about the rapid developments in the field of mold remediation, implement changes in technology and procedures, as appropriate, and follow applicable federal, state, provincial, and local laws and regulations. All mold

remediation projects are unique and in certain circumstances, common sense, experience and professional judgment may justify deviation from this Standard. It is the responsibility of the remediator to verify on a case-by-case basis that application of this Standard is appropriate. When in doubt, apply caution and seek additional professional opinions. Users of this document assume all risks and liability resulting from use of and reliance upon this Standard.

The Standard summarizes most of the significant and important procedures and methodologies of a mold remediation project. The ANSI/IICRC S520 Standard and IICRC R520 Reference Guide complement one another and should be considered in tandem. The S520 does not attempt to teach mold remediation procedures, but rather provides the principles and foundation for understanding proper remediation practices. The S520 is not a substitute for remediation training and certification programs that are necessary to attain competence in the field of mold remediation and properly apply this Standard.

The ANSI/IICRC S520 is not intended to establish procedures or criteria for assessing mold contamination in an indoor environment. These issues are most appropriately addressed by professional organizations that represent IEPs. Since these professional organizations have not agreed upon threshold exposure limits or levels of visible mold growth that constitute a concern for occupant and worker safety, the IICRC S520 Mold Remediation Consensus Body Standard Committee decided not to establish action levels or procedures based upon the quantity or size of the area of visible mold growth.

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 it does not take into consideration hidden, concealed (not readily visible) mold growth, and it does not take into consideration contamination resulting from settled spores (not visible) that were dispersed from areas of actual growth.

Thus, ANSI/IICRC S520 represents a philosophical shift away from using “size” of visible mold growth to determine the remediation response. Instead, it establishes mold contamination definitions, (Conditions 1, 2, and 3) and guidance, which, when properly applied, can assist remediators and others in determining remediation response or confirm remediation success.

The terms “indoor environmental professional” and “IEP” are used in this document and in the remediation industry to generically describe individuals having advanced technical competency in a wide range of subjects related to mold in the built environment, that qualify them to perform assessments and related professional services typically provided by an IEP, as defined in this document. Because there is such a broad array of skills encompassed within the description of an IEP, it is impossible to develop a single, meaningful course of study that would adequately address the advanced levels of knowledge an IEP should possess within their area of specialization. Therefore, the terms “indoor environmental professional” and “IEP” are used in this document and in the remediation industry as a description, and not as a title, designation, certification, trademark, or service mark. Consequently, there is no single license, designation or certification that qualifies an IEP. The qualifications required for an IEP are often gained through years of formal study at the university level, specific training related to mold and the indoor environment, and years of on-the-job work experience, or a combination of these factors. Therefore, the IICRC does not offer or recognize a professional certification or designation for an IEP, and prohibits the exclusive use or co-option of the terms “indoor environmental professional” and “IEP” in association with any one individual, entity or organization, as such use would be contrary to the intent of this document. However, use of the terms “indoor environmental professional” and “IEP” as a generic description is permitted. Remediators and others who engage an indoor environmental professional are advised to consider the individual’s knowledge,

skill, education, training and experience to best judge their ability, qualifications and competence, as further explained in this document.

This Standard does not specifically address the protocols and procedures for remediation when potentially hazardous, regulated materials are present or likely to be present in mold-contaminated structures, systems, and contents. Such potentially hazardous, regulated materials include but are not limited to: asbestos, lead, arsenic, mercury, polychlorinated biphenyls (PCBs), pesticides, fuels, solvents, radiological residues, and other chemical and biological contaminants. This standard also does not address water damage restoration; please reference the latest edition of ANSI/IICRC S500 *Standard and Reference Guide for Professional Water Damage Restoration* for information directly related to water damage restoration.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. The IICRC is not responsible for identifying any or all such patent rights.

The S520 is a living document subject to change as more information regarding mold contamination and remediation becomes available and as scientific developments occur and advancements are made in remediation technology and practice. The S520 will be reviewed, evaluated, and validated through application in the field, and thereafter revised and improved. This process and further professional and public review allows the industry to develop a body of mold remediation science and achieve the overall IICRC goal of improving the environments in which people live and work.

# Acknowledgements

This publication is the result of a collaborative effort involving industry experts and trade associations, educational institutions, training schools and other organizations. The Institute of Inspection, Cleaning and Restoration Certification (IICRC) is the principle designer of the document.

The development and publication of this document was made possible through the generous contributions of a dedicated group of volunteers. The IICRC Board of Directors and the Standards Committee genuinely appreciate the time and effort contributed by these individuals. They exhibit the true volunteer spirit that has been the driving force behind the IICRC since its inception. At the time of approval of the third edition of the ANSI/IICRC S520 Standard for Professional Mold Remediation, the IICRC S520 Mold Remediation Consensus Body consisted of the members listed below. Other contributors and some past contributors to this document and their respective roles are also listed below.

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# *Important Definitions*

Throughout this document the terms “shall,” “should,” and “recommend” are used to compare and contrast the different levels of importance attached to certain practices and procedures. It is impractical to prescribe procedures intended to apply to every mold remediation situation. In certain circumstances, deviation from portions of this Standard may be appropriate. Carelessness is unacceptable and common sense and professional judgment are to be exercised in all cases.

**shall:** when the term *shall* (previously “must”) is used in this document, it means that the practice or procedure is mandatory due to natural law or regulatory requirement, including occupational, public health and other relevant laws, rules or regulations, and is therefore a component of the accepted “standard of care” to be followed.

**should:** when the term *should* (previously “highly recommended”) is used in this document, it means that the practice or procedure is a component of the accepted “standard of care” to be followed, while not mandatory by regulatory requirements.

**recommend(ed)**: when the term *recommend(ed)* is used in this document, it means that the practice or procedure is advised or suggested, but is not a component of the accepted “standard of care” to be followed.

In addition, the terms “may” and “can” are also available to describe referenced practices or procedures, and are defined as follows:

**may:** when the term *may* is used in this document, it signifies permission expressed by the document, and means that a referenced practice or procedure is permissible within the limits of this document, but is not a component of the accepted “standard of care” to be followed.

**can:** when the term *can* is used in this document, it signifies an ability or possibility open to a user of the document, and it means that a referenced practice or procedure is possible or capable of application, but is not a component of the accepted “standard of care” to be followed

For the practical purposes of this document, it was deemed appropriate to highlight and distinguish the critical remediation methods and procedures from the less critical, by characterizing the former as the perceived and recommended “standard of care.” The IICRC S520 consensus body standard committee interprets the “standard of care” to be: practices that are common to reasonably prudent members of the trade who are recognized in the industry as qualified and competent. Notwithstanding the foregoing, this Standard is not intended to be either exhaustive or inclusive of all pertinent requirements, methods or procedures that might be appropriate on a particular mold remediation project. Ultimately, it is the responsibility of the remediator to verify on a case-by-case basis that application of this Standard is appropriate.

# ANSI/IICRC S520 Standard for Professional Mold Remediation

## 1 Scope, Purpose and Application

### 1.1 Scope

This Standard describes the procedures to be followed and the precautions to be taken when performing mold remediation in residential, commercial, and institutional buildings, and the systems and personal property contents of those structures.

The Standard explains mold remediation techniques, the principles of which may apply to other microbial remediation projects or services. This Standard assumes that determining and correcting the underlying cause of mold contamination is the responsibility of a property owner, landlord, or their agent(s), and not the remediator, although a property owner may contract with a remediator or other professional to perform these services.

### 1.2 Purpose

It is the purpose of this Standard to define criteria and methodology to be used by remediators for inspecting mold contamination and establishing remediation procedures and safety plans.

Because of the unique circumstances encountered in mold remediation projects, it is impractical to prescribe procedures that apply to every situation. In certain circumstances, deviation from portions of this Standard may be appropriate. Carelessness is unacceptable and common sense and professional judgment are to be exercised in all cases.

Among other things, S520 does not address *Histoplasma capsulatum*, *Cryptococcus neoformans,* hanta virus, animal-derived pathogens or other highly infectious agents, including those from bird and bat droppings. Refer to the Centers for Disease Control (CDC) or the National Institute for Occupational Safety and Health (NIOSH) for appropriate decontamination procedures for these contaminants. See, for example, *Histoplasmosis, Protecting Workers at Risk,* NIOSH and NCID, U.S. Department of Health and Human Services, 2004.

In addition, this Standard does not specifically address the protocols and procedures for restoration, remediation, or abatement when potentially hazardous, regulated materials are present or likely to be present in water-damaged or contaminated structures, systems, and contents. Such potentially hazardous, regulated materials include but are not limited to: asbestos, lead, arsenic, mercury, polychlorinated biphenyls (PCBs), pesticides, fuels, solvents, radiological residues, and other chemical and biological contaminants.

### 1.3 Application

This Standard was written for use by those involved in the mold remediation industry, primarily for mold remediation companies and workers, and secondarily, for others who inspect or assess mold complaints, prepare remediation specifications, protocols, or procedures, and manage remediation projects (e.g., indoor environmental professionals or IEPs). Finally, this document is for other materially interested parties (e.g., consumers and occupants, property owners and managers, insurance company representatives, government and regulatory bodies).

## 2 References

Portions of the following documents are referenced herein and thereby constitute provisions of this Standard. At the time of publication, the references as cited were current. All cited references are subject to revision, and those using this Standard are directed to investigate the necessity of applying the most recent editions or amendments of the references indicated below:

*29 CFR 1910, Occupational Safety and Health Standards for General Industry*, U.S. Department of Labor

*29 CFR 1926, Occupational Safety and Health Standards for the Construction Industry*, U.S. Department of Labor

*40 CFR 61, National Emission Standards for Hazardous Air Pollutants* (NESHAP), U.S. Environmental Protection Agency

*ACR*, *Assessment, Cleaning and Restoration of HVAC Systems*, 2013 or Latest Edition, National Air Duct Cleaners Association

*ASHRAE Standards 62.1 or 62.2*

*ASTM D-1653, Standard Test Methods for Water Vapor Transmission of Organic Coating Films*

*Bioaerosols: Assessment and Control,* 1999 or Latest Edition, American Conference of Governmental Industrial Hygienists

*Field Guide for Determination of Biological Contaminants in Environmental Samples*, 2005 or Latest Edition, American Industrial Hygiene Association

*A Guide for Mold Remediation in Schools and Commercial Buildings, 2008 or Latest Edition,* US Environmental Protection Agency

*Protecting the Built Environment: Cleaning for Health,* Michael A. Berry Ph.D., 1993

*IICRC S100 Standard and Reference Guide for Professional Carpet Cleaning,* Latest Edition, Institute of Inspection, Cleaning and Restoration Certification, (S100)

*IICRC S300 Standard and Reference Guide for Professional Upholstery Cleaning, First Edition,* Institute of Inspection, Cleaning and Restoration Certification, (S300)

*ANSI/IICRC S500 Standard and Reference Guide for Professional Water Damage Restoration, Latest Edition,* Institute of Inspection, Cleaning and Restoration Certification, (S500)

*Safety Requirements for Confined Spaces, American National Standard Institute, ANSI Z117.1-2009,*

*Occupational, Safety and Health Administration, (OSHA) General Duty Clause, 29 USC 654, §5*

*OSHA Technical Manual TED 1-0.15A, Section III, Chapter 4*

*Damp Indoor Spaces and Health, the Institute of Medicine (IOM) of the National Academies of Science, (IOM, 2004)*

*World Health Organization (WHO) Guidelines for Indoor Air Quality: Dampness and Mould* released in 2009] available online at:
http://www.euro.who.int/__data/assets/pdf_file/0017/43325/E92645.pdf

Other reference materials used in the S520 are listed in the Source Acknowledgments of this document or listed as appropriate in the References at the end of the chapters of the IICRC R520 Reference Guide.

# 3 Definitions

**actual growth:** molds that have colonized a substrate, formed fungal mycelia, growth structures, and spores; are active or dormant, visible or hidden.

**administrative controls:** measures aimed at reducing risks, such as the setting of time tables and scheduling of workers to minimize exposures.

**air cleaning (washing):** a technique used to dislodge particulate from surfaces into the air so it may be captured with an air filtration device, or exhausted to the outdoors.

**air filtration device (AFD):** depending on the mode of use, an AFD that filters (usually HEPA) and recirculates air is referred to as an air scrubber. One that filters air and creates negative pressure is referred to as a negative air machine.

**assessment:** a process performed by an indoor environmental professional (IEP) that includes the evaluation of data obtained from a building history and inspection to formulate an initial hypothesis about the origin, description,

location and extent of Condition 2 or 3. If necessary, a sampling plan is developed, and samples are collected and sent to a qualified mycology or microbiology laboratory (e.g., EMLAP, A2LA, NELAP, or equivalent program) or individual (e.g., National Registry of Microbiologists, Public Works Canada Accredited Mycologist, or equivalent program) for analysis. The subsequent data is interpreted by the IEP. Then, the IEP or other qualified individual may develop a remediation plan.

**biofilm:** densely packed communities of microbial cells that grow on living or inert surfaces and surround themselves with secreted polymers, often associated with inorganic or organic contamination. Second option from http://www.biofilm.montana.edu/node/2390: biofilm forms when bacteria adhere to surfaces in moist environments by excreting a slimy, glue-like substance.

**can:** when the term *can* is used in this document, it signifies an ability or possibility open to a user of the document, and it means that a referenced practice or procedure is possible or capable of application, but is not a component of the accepted “standard of care” to be followed.

**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 or fungal fragments)**:** an indoor environment which is primarily contaminated with settled spores or fungal fragments 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, associated spores, and fungal fragments. Actual growth includes growth that is active or dormant, visible or hidden.

**containment:** engineering controls used to minimize cross-contamination from affected to unaffected areas by airborne contaminants, foot traffic, or material handling. Containment systems normally consist of 6-mil polyethylene sheeting, often in combination with air pressure differentials, to prevent cross-contamination.

**contaminated (contamination):** for the purposes of this Standard, the presence of indoor mold growth or 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 or adversely affect the operation or function of building systems.

**cross-contamination:** the spread of contaminants from an affected area to an unaffected area.

**engineering controls:** primary control methods using equipment and containment in such a manner that they limit the exposure of remediation workers and occupants to contaminants and prevent the introduction of contaminants to surrounding uncontaminated areas and contents.

**fungus (plural "fungi"):** organisms belonging to the Kingdom Fungi, one of the major groups into which living things are categorized, and include a variety of types such as molds, mildews, yeasts, decay fungi, and mushrooms. Fungi have distinct nuclei, filamentous or unicellular growth form, and typically reproduce by spores

**HEPA:** an acronym for “High Efficiency Particulate Air,” which describes an air filter that removes 99.97% of particles at 0.3 microns in diameter.

**HEPA vacuum:** a vacuum cleaner which has been designed with a High Efficiency Particulate Air (HEPA) filter as the last filtration stage. A HEPA filter is a filter that is capable of capturing particulates of 0.3 microns with 99.97% efficiency. The vacuum cleaner must be designed so that all the air drawn into the machine is expelled through the HEPA filter with none of the air leaking past it. HEPA vacuums must be operated and maintained in accordance with the manufacturer's instructions.

**HVAC:** an acronym for “heating, ventilating and air-conditioning.”

**indoor environmental professional (IEP):** an individual who is qualified by knowledge, skill, education, training, certification, and experience to perform an assessment of the fungal ecology of structures, systems, and contents at a job site, create a sampling strategy, sample the indoor environment and submit to an appropriate laboratory, interpret laboratory data and determine Condition 1, 2 or 3 for the purpose of establishing a scope of work and verifying the return of the job site to Condition 1.

**inspection**: the gathering of information regarding the mold and moisture status of the building, system, contents, or area in question.

**materially interested parties:** an individual or entity substantially and directly affected by a mold remediation project.

**may:** when the term *may* is used in this document, it signifies permission expressed by the document, and means that a referenced practice or procedure is permissible within the limits of this document, but is not a component of the accepted “standard of care” to be followed.

**mold:** a group of microscopic organisms that are a part of the Fungi Kingdom. They generally reproduce by means of spores and are ubiquitous. Often, the terms mold and fungus are used interchangeably.

**normal fungal ecology (Condition 1):** 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.

**personal protective equipment (PPE):** safety items designed to prevent exposure to potential hazards. Examples include: respirators, gloves, goggles, protective clothing, and boots.

**post-remediation:** following remediation; after removing contaminants and contaminated materials.

**post-remediation evaluation:** a quality assurance inspection performed by a remediator after a remediation project, which can include visual inspection, odor detection, analytical testing or environmental sampling methodologies to confirm that the structure, system, or contents have been returned to Condition 1.

**post-remediation verification:** an inspection and assessment performed by an independent third-party IEP after a remediation project, which can include visual inspection, odor detection, analytical testing, or environmental sampling methodologies to verify that the structure, system, or contents have been returned to Condition 1.

**preliminary determination:** a conclusion drawn from the collection, analysis, and summary of information obtained during an initial inspection to identify areas of moisture intrusion and actual or potential mold growth and the need for assistance from other specialized experts.

**qualified laboratory:** EMLAP, A2LA, NELAP, or equivalent program or individual (e.g., National Registry of Microbiologists, Public Works Canada Accredited Mycologist, or equivalent program).

**quality control:** activities performed by a remediator that are designed to assure the effectiveness of the remediation process.

**recommended:** when the term *recommended* is used in this document, it means that the practice or procedure is advised or suggested.

**remediation:** the process of removing contamination consistent with this Standard.

**remediation contractor**: the remediation company or firm that is responsible for the remediation project.

**remediator**: when the term "remediator" is used in the S520, it refers to either the remediation contractor or the remediation worker.

**shall:** when the term *shall* (previously "must") is used in this document, it means that the practice or procedure is mandatory due to natural law or regulatory requirements, including occupational, public health, and other relevant laws, rules, or regulations, and is therefore a component of the accepted "standard of care" to be followed.

**should:** when the term *should* (previously "highly recommended") is used in this document, it means that the practice or procedure is a component of the accepted "standard of care" to be followed, while not mandatory by regulatory requirement.

**standard of care:** practices that are common to reasonably prudent members of the trade who are recognized in the industry as qualified and competent.

**structural remediation:** structural remediation is defined as that portion of a remediation project that deals specifically with a building's structure and typically does not address a building's contents or HVAC components.

# 4 Principles of Mold Remediation

There are five general principles used in the remediation of mold-contaminated structures and materials. Applying these principles may require a multi-disciplinary approach involving professionals from several fields of expertise.

## 4.1 Provide for the Safety and Health of Workers and Occupants

When it has been determined that an indoor environment is contaminated with mold, remediation workers shall be protected from exposure. Engineering controls, administrative controls, and work practices are the primary means for preventing exposure. Appropriate respiratory protection or other personal protective equipment (PPE) shall be used in conjunction with engineering controls to protect workers when engineering controls are insufficient, as indicated in 29 CFR 1910.134(a)(1). Reasonable efforts should be made to inform occupants of and protect them from similar exposure as a result of investigation and remediation activities. Employers shall identify safety and health issues prior to commencing work.

## 4.2 Document the Conditions and Work Processes

Environmental conditions and work processes associated with mold remediation should be documented.

### 4.2.1 Assessment

When a preliminary determination indicates that mold contamination exists or is likely to exist, an assessment should be performed prior to starting remediation. An independent IEP who has no business affiliation with the remediator should be used for this purpose. In circumstances where an entire building or system is fully involved as a result of Condition 3 mold contamination or when the scope of work can be determined without sampling or independent IEP inspection and assessment, engagement of an IEP for assessment may not be necessary. Furthermore, some mitigation services may be initiated before or during assessment of conditions or performance of remediation processes. Notwithstanding the foregoing, if health issues are discovered or apparent that seem to be related to the actual or suspected mold contamination, an IEP or other appropriate professional should be engaged by the property owner and the extent and Condition (1, 2 or 3) to which areas of the structure, systems and contents are potentially mold-contaminated should be assessed, documented, and reported to the client.

### 4.2.2 Documentation During Remediation

The conditions and work processes should be documented on an on-going basis during remediation work.

### 4.2.3 Post-Remediation Documentation

The return of the remediated portion of the structure and salvable contents to Condition 1 should be documented before the structure is rebuilt or the contents reused.

## 4.3 Contamination Control

The spread of mold contamination should be controlled as close as practical to its source. Methods of controlling the spread of contamination are further defined herein.

Initial moisture mitigation services may be performed to control amplification, while ensuring that mold contamination does not spread from more-contaminated to less or non-contaminated areas.

## 4.4 Contamination Removal

Physically removing mold contamination is the primary means of remediation. Mold contamination should be physically removed from the structure, systems and contents to return them to Condition 1. Attempts to kill, encapsulate or inhibit mold instead of proper source removal generally are not adequate.

Remediated structures, systems, and contents can be considered clean (post-remediation evaluation) when contamination, unrestorable contaminated materials, and debris have been removed, and surfaces are visibly free of dust. The term “visibly” can include direct and indirect observation (e.g., using a white or black towel to wipe a surface to observe for cleanliness). Also, remediated areas should be free of malodors associated with microorganisms. At that point, it is probable that the structure, systems, and contents have been returned to Condition 1.

After a post-remediation evaluation, the remediated structures, systems, and contents are ready for post-remediation verification. When verification that the structure, systems, and contents have been returned to Condition 1 and when it is requested or required, a post-remediation verification should be performed by an independent IEP. If the IEP conducting any activity such as assessment or post-remediation verification is not independent from the remediator, they should disclose in writing to the client that they are deviating from the Standard.

### 4.5 Contamination Prevention

To prevent recontamination or future contamination, the moisture problem that contributed to the mold growth shall be identified and corrected or controlled as soon as practical. Affected salvable materials should be dried to acceptable moisture content/water activity (Aw) following the latest version of ANSI/IICRC S500 *Standard and Reference Guide for Professional Water Damage Restoration* (S500).

## 5 Equipment, Tools and Materials

Before mold remediation work can begin, remediators should be familiar with and have access to certain equipment, tools, and materials required to accomplish their work.

Since this document is not designed to be a training manual, remediators should have specialized training in using and operating equipment, tools, and materials during mold remediation work.

Remediators shall follow manufacturer instructions and label directions for the safe and proper use of equipment, tools, and materials.

### 5.1 Inspection/Monitoring Tools

When using tools for inspecting and monitoring remediation projects, the same tool should be used in the same general location to allow consistent data collection and to promote more accurate project monitoring and post-remediation evaluations. When using measurement tools for inspecting and monitoring remediation projects, quality control procedures should be established and used to generate data with known accuracy and precision.

### 5.2 Thermo-hygrometer

Temperature and relative humidity readings taken during a project should be recorded to document environmental conditions within the remediated space before and during the project. Readings can be taken inside and outside the contained area. If readings indicate conditions that are likely to promote microbial growth, remediators should take steps to control the environment. Because differences in calibration can occur from one piece of equipment to the next, the same thermo-hygrometer should be used to monitor conditions throughout a project.

### 5.3 Moisture Sensors

A moisture sensor (probe) typically has penetrating pins and produces an audible or visible signal. Generally, it is used to indicate elevated moisture in various materials. Because moisture sensor pins penetrate materials, remediators should consider and mitigate where possible, potential collateral damage before use. Contaminants in materials (e.g., animal urine) or materials that are naturally conductive can give false indications of moisture.

### 5.4 Moisture Meters

Remediators should use properly calibrated moisture meters, in accordance with manufacturer specifications, to determine the presence of moisture, which can indicate the potential for mold growth and amplification on structural materials. Readings should be taken on materials that are considered to be at acceptable moisture content or have a known moisture content. These readings can be used as target drying goals or dry standards against which all other readings can be compared.

## 5.5 Infrared (IR) Thermometers and Thermal Imaging Devices

Infrared (IR) cameras and infrared thermometers are used to detect surface temperature differences and do not detect moisture or measure moisture through materials. Suspect areas identified with an IR camera should be verified by other means, such as using a moisture meter. Remediators using infrared thermography equipment in surveying buildings for moisture damage should receive proper training on its use.

## 5.6 Structural Cavity Drying Systems

Structural cavity drying systems carry many of the same risks as air movers and axial fans in that they can spread contamination. When drawing moist air out of potentially contaminated cavities using negative pressure, an in-line HEPA filter should be used to remove contamination before exhausting the air into the structure. A potentially contaminated cavity should not be positively pressurized. Air exhausted from a contaminated cavity shall be vented to the exterior of the building if not HEPA filtered prior to discharge.

The possibility of cross-contamination due to a breach should be considered when routing exhaust in any ducting material through a non-contaminated area.

## 5.7 Supplemental Mechanical Systems

Supplemental mechanical systems may be required during mold remediation projects when combustion-type mechanical systems (e.g., natural gas, fuel oil) or other services are disconnected or removed from service. Supplemental systems can include heating and air conditioning equipment, power generators and domestic water heaters. Supplemental equipment can introduce new hazards to the workspace. Supplemental equipment and licensed installers shall meet applicable federal, state, provincial, and local laws, regulations and codes.

## 5.8 Post-Remediation Materials, Considerations and Alternative Methodologies

Physically removing mold contamination is the primary means of remediation. Mold contamination should be physically removed from the structure, systems, and contents to return them to Condition 1. Before implementation or adoption of new, innovative or alternative mold remediation methodologies, whether specified or requested, remediators should evaluate whether or not such methodologies are consistent with the *Principles of Mold Remediation*, the goals of a specific remediation project, and carefully consider the potential benefits and consequences from use. In addition, use of a particular product or technique in the industry does not necessarily equate to remediation efficacy.

### 5.8.1 Chemicals (Antimicrobials and Biocides)

There are a variety of chemical products available for professional mold remediation, and remediators should be familiar with the advantages and disadvantages of using these products along with customer concerns and preferences.

Source removal of mold contamination should always be the primary means of remediation. Indiscriminate use of antimicrobials, coatings, sealants, and cleaning chemicals is not recommended.

#### 5.8.1.1 Limitations of Use

Antimicrobials should not be used as an alternative to cleaning procedures and physical removal of mold contamination. Some antimicrobials are specifically labeled for both cleaning and disinfecting. However, it is preferable to physically remove both bioburden and soil prior to

disinfection. Antimicrobials should only be used in conjunction with proper cleaning, and should not be used indiscriminately. For thoroughly cleaned non-porous building materials, antimicrobials are generally not needed. Antimicrobials should not be relied upon to eliminate the contaminants or contaminated material's allergenic or toxigenic properties.

#### 5.8.1.2 Antimicrobial Application Considerations

Antimicrobial pesticides can harm humans, pets, and wildlife if used improperly. When using antimicrobials in a post-remediation application, for efficacy, safety, and legal liability reasons, remediators shall follow label directions carefully and explicitly. In order to minimize potential liability, remediators shall:

- only apply chemicals to treat microorganisms for which the product has been registered by appropriate governmental agencies;
- only apply chemicals on those types of surfaces for which the product has been registered by appropriate governmental agencies (for additional guidance, the terms porous, semi-porous, non-porous surfaces are described in Chapter 11 of the IICRC R520 Reference Guide);
- only apply chemicals in those types of structures for which the product has been registered by appropriate governmental agencies (i.e., schools, hospitals, residential);
- only apply chemicals for the purpose for which the product has been registered by appropriate governmental agencies;
- comply with applicable training, safety, use, and licensing requirements in their respective jurisdictions;
- ensure that proper personal protective equipment (PPE) is available and worn by remediators who are engaged in antimicrobial (biocide) use and application;
- not use such products in any heating, ventilating, air-conditioning, or refrigerating systems unless the product is specifically approved for that application by the appropriate governmental agencies;
- apply products strictly in accordance with label directions, including allowing for sufficient contact time, and
- dispose of antimicrobials (biocides) according to label directions and regulatory requirements.

In addition, remediators should:

- discuss potential risks and benefits with the customer, make available product information including the SDS, and obtain a written informed consent with the customer's signature before applying any antimicrobial (biocide). Inquire about any pre-existing health conditions that might require special precautions. Advise customers to remove occupants and animals from the product application site, particularly children and those with compromised health;
- document relevant biocide application details;
- refrain from making statements or representations to the customer beyond those stated on the product label or in the efficacy claims made by the product and approved by the applicable government agency, and
- clean treated surfaces of antimicrobial (biocide) residues, if required by the product label.

### 5.8.2 Fungicidal Coatings and Mold Resistant Coatings

Fungicidal coatings and mold-resistant coatings should not be used in place of proper source removal of mold contamination, moisture control, and regular cleaning and maintenance, but can protect some materials from microbial growth.

Fungicidal coatings and mold-resistant coatings should not create a vapor barrier that could lead to a buildup of moisture, and possibly contribute to a future microbial or structural problem. Products should demonstrate reasonable permeability as tested under ASTM D-1653 (minimum 1.0 perms). Fungicidal coatings and mold-resistant coating products should be water-based, low odor, and contain low volatile organic compounds (VOCs).

#### 5.8.2.1 Limitations of Use

Fungicidal coatings and mold-resistant coatings should be applied to surfaces that have been properly cleaned, and disinfected/sanitized when appropriate.

Mold-resistant coatings should not be used as 'sealants' or 'encapsulants' to contain or cover active, viable mold growth. Failure to properly dry the substrate can permit continued mold growth beneath the coating, as the active ingredients in these products inhibit growth only on or in the coating film. Fungicidal coatings should not be used as 'sealants' or 'encapsulants' to contain or cover active, viable mold growth. Fungicidal coatings are only effective as an antimicrobial after visible growth has been removed and the surface has been cleaned and the substrate dried.

Where concern exists that an opaque coating or sealant may be used to cover up mold contamination without proper cleaning, a clear or translucent product may be used to allow visual post-inspection of the treated surfaces.

Coatings and sealants should only be applied after post-remediation evaluation and verification has verified the return to Condition 1. If antimicrobials, fungicidal coatings, mold-resistant coatings, or sealants are used, and concerns exist that there could be future recurrence, the use of non-pigmented (clear) coatings could permit future visual inspection of treated surfaces.

### 5.8.3 Extremes of Temperature

Temperature extremes, either hot or cold, should not be used as an alternative to cleaning procedures and physical removal of mold contamination. Temperature extremes should not be relied upon to eliminate the contaminants or their allergenic or toxigenic properties.

## 6 Building and Material Science

Remediators should understand building systems and related physical laws in order to remediate a contaminated building and return it to its intended function. Building and material science addresses the materials and interrelated systems that create structures in our built environment. It also addresses how buildings respond to different climatic environments. Climatic and regional variables include rainfall, temperature, and relative humidity. Such variations can necessitate that remediators use different equipment and techniques when remediating similar structures.

A properly constructed building envelope acts as a physical separator between the interior of the built environment and the effects of outside climatic conditions. However, the actions of remediators can force outside conditions to come into the built environment. The result can be either positive or negative with respect to the goals of a mold remediation project. Remediators should have a basic understanding of how a building envelope works and the interaction of building assemblies and coatings, in order to properly remediate damaged components. Alterations to the structure and its systems shall follow all applicable building codes.

It is complex and expensive for buildings to be constructed to function optimally in a single climatic zone during all seasonal conditions within a calendar year. Due to the variations within a single year or season, the building construction may be more or less appropriate with respect to prevailing ambient conditions. It follows that drying and remediation techniques will not be the same at all times of the year in all of these regions. Due to these varying climatic conditions, it is necessary for remediators to combine science and abilities with professional judgment to successfully remediate mold-contaminated structures.

Building components are interrelated so that even a small change in one component can have a dramatic and potentially unexpected effect on the entire building. The interaction of these components affects the safety and health of occupants and the function and durability of a building.

## 6.1 Wall, Floor and Ceiling Assemblies

It is important for remediators to understand the construction of wall, floor, and ceiling assemblies and the effect of moisture on materials to facilitate making educated decisions about drying and remediation. Knowledge of construction materials and their applications for strength, function, sound transmission, and fire ratings all affect decisions as to how a building or structure can be properly dried and remediated. Since all components of a building are interrelated, it is recommended that remediators attempt to discern the intent of the design and construction of a building during a remediation project, and address those aspects individually and collectively.

## 6.2 Elements of Airflow

It is important for remediators to understand the elements of airflow because it is a key transport mechanism for moisture, mold spores, and fragments. In order for a given volume of air to enter a building, an equal volume of air must leave. The type of building design and construction will influence where air will enter or exit, and how moisture and contaminants can be controlled or removed. The better a remediator understands the mechanisms of air ingress, egress, and passage through a structure, the more efficiently and effectively the remediation process can be planned and executed.

All structures have planned openings (e.g., doors, windows, vents) and unplanned openings (e.g., cracks, crevices, gaps, material shrinkage, and utility penetrations). Planned openings can be designed to either add or remove air from a building. If designed properly, these openings do not compete for air. In order for air to move into or out of an enclosed space, such as a building or portion of a building, there must be an opening and a driving or pulling force. At times, these forces may be unexpected and potentially dangerous.

Caution should be used when blocking, sealing, or restricting airflow, or reversing the direction of airflow through a planned opening. Serious safety and health problems can result. If large amounts of air are drawn out of a building, the probability of combustion appliances backdrafting or experiencing flame rollout is increased.

There are always unplanned openings in a building. If accompanied by a driving force, an unplanned opening can allow airflow into a building from garages, crawlspaces, attics, or other air spaces. Driving forces, such as wind, heat/stack pressure, fans, and duct systems, can affect the indoor environment and a building system.

## 6.3 Mechanisms of Moisture Flow

Understanding the four mechanisms of moisture flow is helpful in determining where and how moisture gets into a building, and is necessary when devising an effective remediation plan. The

four mechanisms of moisture flow are liquid flow (bulk water), air transport, vapor diffusion, and capillary action.

### 6.4 The Effects of Moisture on Materials

Remediators should be aware of the effects of moisture on building materials and the potential contamination from mold growth. Understanding how materials react to moisture allows remediators to more adequately devise a remediation plan. How materials react to moisture depends upon many factors (e.g., porosity, permeability, absorption, moisture holding capacity, evaporation rates, and susceptibility to damage and microbiological growth).

## 7 Remediator Qualifications

### 7.1 Licensing Requirements

Licensing requirements for mold remediation work vary by country, state, province, and municipality. Remediators shall possess the necessary licenses to satisfy federal, state, provincial and local laws and regulations.

#### 7.1.1 Business License

Local business licenses are frequently required for doing business. Remediators shall comply with state, provincial, and local business licensing requirements.

#### 7.1.2 Contractor's License

Companies that perform intrusive and destructive work might be required to obtain a General Contractor's License or a specialty license. These requirements vary widely, and are usually administered by a state contractors licensing board. Remediators shall comply with state, provincial and local contractors licensing requirements.

#### 7.1.3 Specialty Contractor's License

Companies or individuals that are engaged in the cleaning of HVAC systems and the attached duct work might be required to hold a specialty license (e.g., mechanical, electrical). Such licenses are often issued on a state or provincial level. Remediators shall comply with state, provincial and local contractors licensing requirements.

### 7.2 Training and Certification

#### 7.2.1 Training

Remediators are expected to be qualified by education, training, and experience. Remediation workers should be trained in the principles of mold remediation as defined in this document, appropriate to their work responsibilities, including but not limited to: safety and health, engineering controls, containment methods, and appropriate work practices.

Depending on the project, additional training could be required by federal, state, provincial, or local laws and regulations. Employers shall be familiar with these requirements and provide training for remediation workers in the recognition and avoidance of hazards they encounter. Employers shall also provide training regarding hazards in accordance with the company's written injury and illness prevention program, if applicable, under federal, state, provincial, and local laws and regulations. Training can include, but is not necessarily limited to:

- physical hazards;
- chemical hazards;
- microbial hazards;
- PPE; and
- building-related regulated substance (e.g., asbestos, lead) awareness.

### 7.2.2 Certification

Training alone does not imply qualification or competency in the field of mold remediation. Certification requirements should include some combination of field experience, course work (including classroom attendance) and successful completion of a written examination. It is recommended that the certifying body be a recognized and established non-profit organization with experience in the remediation or restoration industry.

Various governmental bodies require certification as a requirement for performing mold remediation services, and remediators shall be aware of and comply with applicable laws and regulations. In the absence of specific legal requirements, certification is recommended for those engaged in mold remediation.

# 8 Safety and Health

Protecting the safety and health of remediators and building occupants is of paramount importance in mold remediation projects. In the United States and in other countries there are laws that require employers to comply with applicable safety and health regulations. This section addresses safety and health issues that employers shall comply with in the United States. Laws governing worker safety can be found in the Occupational Safety and Health Act (OSHA) and in regulations implementing the Act found in Title 29 of the Code of Federal Regulations (CFR). While these laws and regulations do not apply to remediators in other countries outside the United States, the principles referenced in these laws would apply to most, if not all, remediation projects regardless of geography.

## 8.1 Applicable Regulations

Applicable sections of the Federal safety and health regulations that can impact the employees of a remediation business include but are not limited to the following OSHA Standards found in Title 29 of the Code of Federal Regulations (CFR) parts 1910 and 1926:

- 29 CFR 1910 – General Industry Standards
- 29 CFR 1926 – Construction Industry Standards

The OSHA Standards for the Construction Industry (29 CFR 1926) require that no employee “shall work in surroundings or under working conditions which are unsanitary, hazardous, or dangerous to his or her health or safety” (29 CFR 1926.10). Each state is required to use Federal OSHA as a minimum statutory requirement. Individual state and local governments may have additional safety and health requirements that are more restrictive than the Federal Occupational Safety and Health Act. Employers shall comply with these safety and health regulatory requirements. Safety and health plans shall be established as required by applicable laws, rules and regulations promulgated by federal, state, provincial, and local governmental authorities.

### 8.1.1 General Regulations

Specific provisions addressed by these regulations include but are not limited to the following:

- emergency action and fire prevention plans;
- personal protective equipment;
- respiratory protection;
- asbestos abatement;
- lead-based paint abatement;
- heat disorders and health effects;
- bloodborne pathogens;
- confined work spaces;
- hazard communication;
- electrical safety;
- control of hazardous energy (lockout/tagout);
- fall protection;
- scaffolds and ladders; and
- noise exposure.

### 8.1.2 OSHA General and Specific Duty Clause

The OSHA "General Duty Clause" states that "Each employer shall:

- furnish to each of his employees employment and a place of employment which are free from recognized hazards that are causing or are likely to cause death or serious physical harm to his employees.
- comply with occupational safety and health standards promulgated under this Act." (See 29 USC 654, §5)

In the absence of a specific OSHA standard for mold remediation, it is important to recognize general principles of exposure prevention as they are covered in the "General and Specific Duty Clause," as well as to understand the current information available about health effects from occupational exposure in mold contaminated structures, systems, and contents.

## 8.2 Emergency Action and Fire Prevention Plans

Emergency action and fire prevention plans (OSHA 29 CFR 1926.20 and 1910.38-39) are required for all work places, including mold remediation job sites. Requirements include but are not limited to:

- communication and alarm systems;
- the location of the nearest hospital and fire station;
- emergency phone numbers (posted);
- shut down, evacuation, and rescue procedures (posted);
- escape routes and signage (posted);
- use of less-flammable materials;
- use and placement of fire extinguishers; and
- a written program if the employer has 20 or more employees.

## 8.3 Personal Protective Equipment (PPE)

According to 29 CFR 1910.132 employers shall provide their employees with the necessary PPE to reduce the risk of exposure to chemical, physical, or biological hazards.

### 8.3.1 Routes of Exposure:

- inhalation (respiratory);
- contact with mucous membranes (eyes, nose, mouth);
- ingestion; and
- dermal (contact with skin).

### 8.3.2 Selecting PPE

Employers shall provide dermal and respiratory protection for employees entering a containment area where microbial contamination is present and remediation is being performed. The selection of PPE depends on the anticipated exposure, types of microbial contamination, activities to be completed, and potential hazards of chemicals that may be used in the remediation process. Remediators should consult an IEP or other specialized expert if there is a question regarding PPE selection. Employers should review accident and illness logs periodically to determine if the selection of PPE is appropriate or needs to be upgraded. PPE can consist of the following:

- respirator;
- eye protection;
- disposable coveralls including hood and booties;
- foot protection;
- hand protection;
- head protection; and
- hearing protection.

#### 8.3.2.1 Respirator Use and Written Respiratory Protection Plan

Employees shall wear respirators whenever engineering and work practice controls are not adequate to prevent atmospheric contamination at the job site. Untrained visitors to work sites should be warned of hazards and encouraged to not enter the worksite. If visitors insist or must enter a worksite, they should be encouraged to wear respiratory protection and other appropriate PPE if they are able.

Respiratory protection regulations are found at 29 CFR 1910.134. Respiratory protection program outlines written program requirements, and shall include, but not be limited to:

- selection and use of NIOSH-approved respirators;
- medical evaluation;
- respirator fit testing;
- user instruction and training in the use and limitations of the respirator prior to wearing it;
- designated program administrator; and
- cleaning and maintenance program.

#### 8.3.2.1.1 Respirators

Respirators range from NIOSH-approved N-95 filtering face-piece respirators, to full-face air-purifying respirators (APR) or powered air-purifying respirators (PAPR) equipped with HEPA (N100, R100, or P100) filter cartridges and air-supplied respirators, such as self-contained breathing apparatus (SCBA). HEPA filter cartridges should be used to protect against fungal spores and fragments, bacterial spores, dust, and particles. Organic vapor cartridges protect against microbial volatile organic compounds (MVOCs), and some chemicals used in other microbiological remediation projects. Cartridge selection should be based upon the chemicals that are present.

Air-purifying respirators (APR) or powered air-purifying respirators (PAPR) shall not be used in oxygen-deficient atmospheres or in other atmospheres that are immediately dangerous to life or health (IDLH).

## 8.4 Warning Signs

Where applicable, warning signs shall be posted to Identify:

- egress means and exits (29 CFR 1910.37[q]);
- specific hazards (29 CFR 1910 and 1926);
- caution (29 CFR 1910.145[c][2], [d][4]); and
- dangers (29 CFR 1910.145[c][1], [d][2], [f][5]).

Warning signs posted to identify hazards that might exist on the job site should list the following emergency-contact information: the remediation company name, remediation company address, 24-hour emergency contact number and the name of project supervisor.

When warning signs are posted on confined-space projects, they shall be printed with the date they were posted and the approximate date they are expected to be taken down or reassigned. Typical signs specifically related to remediation work can include but are not limited to:

- Do Not Enter – Mold Remediation in Progress;
- Caution: Slip, Trip and Fall Hazards;
- Caution: Hard Hat Area; and
- No Unauthorized Entry.

## 8.5 Asbestos

Asbestos safety regulations are found in OSHA Construction Standards 29 CFR 1926.1101 and General Industry Standard 1910.1001. These regulations shall be followed whenever a detectable amount of asbestos is encountered or presumed in the course of a remediation project.

Remediators are responsible for identifying and controlling asbestos exposure during demolition and removal of materials. If remediators encounter materials containing asbestos or presumed to contain asbestos that has been or potentially will be disturbed during the course of work activities, they shall stop activities that can cause the material to become friable or aerosolized. Qualified asbestos abatement contractors shall be engaged to perform the asbestos abatement. Many states and local governments require that asbestos inspections be performed by licensed or AHERA accredited asbestos building inspectors.

Both 29 CFR 1926.1101 and 1910.1001, state the regulations apply any time there is asbestos present. A clarification letter issued by OSHA states that this means "any detectable amount of asbestos" whether the amount present is greater than 1% asbestos-containing material (ACM) or not. Both regulations also contain requirements for dealing with asbestos content determined to be less than 1%. (Standard Interpretations 11/24/2003 - Compliance requirements for renovation work involving material containing less than 1% asbestos).

## 8.6 Lead

Construction work that involves lead is a regulated process in many jurisdictions. This includes work that involves lead-based paint or other structural materials containing lead. Lead-related activities may include emergency cleanup, demolition, repair, or other work that could disturb the lead. Remediators shall be responsible for identifying and controlling lead exposure during demolition and removal of materials. If remediators encounter lead-based paint during the course of their activities, they should stop activities that may disturb lead-based paint and lead hazards, and proceed using appropriate and applicable assessment and control methods in accordance with federal, state, provincial, and local laws and regulations.

In the United States, restorers shall be in compliance with USEPA's Renovation, Repair and Painting (RRP) program for lead-based paint and surface coatings, as well as any other applicable federal, state, and local laws and regulations.

## 8.7 Heat Disorders

Work activities involving high air temperatures, radiant heat sources, high humidity, direct physical contact with hot objects, or strenuous physical activities may result in an increased potential for inducing heat stress. Employees are at risk for heat-induced stress particularly when engaged in activities in areas such as attics and crawlspaces, or when wearing PPE.

Remediators shall address prevention through safe work practices and on-site response to heat disorders through administrative controls.

## 8.8 Confined Space Entry

OSHA regulations addressing confined spaces are found in 29 CFR 1910.146 and 29 CFR 1926.21. Further guidance can be obtained from American National Standards Institute ANSI Z117.1-1989, *Safety Requirements for Confined Spaces.* A "confined" or "enclosed space" means any space that:

- is configured so that an employee can enter it;
- has limited means of ingress or egress; and
- is not designed for continuous occupancy.

- If it is determined that the workplace is a confined space, then the confined space entry program shall include:
- determining if the space meets the definition of a Permit-Required Confined Space;
- identifying the confined spaces and hazards in the workplace;
- monitoring of atmospheric conditions in the space;
- instructing workers on the proper use of the safety equipment;
- defining the duties of the confined space entry team; and
- developing training requirements for employees who enter the confined space.

Permit-required confined space (permitted space) means a confined space that has one or more of the following characteristics:

1. it contains or has a potential to contain a hazardous atmosphere;
2. it contains a material that has the potential for engulfing an entrant;
3. it has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor that slopes downward and tapers to a smaller cross-section; or
4. it contains any other recognized serious safety or health hazard.

If it is determined that the confined space is a Permit-Required Confined Space, then the confined space shall have a posted permit and remediators shall comply with OSHA entry requirements.

## 8.9 Hazard Communication

Employers shall provide information concerning chemical hazards (physical or health hazards) and communicate this information to employees. This is accomplished by means of hazard communication programs (HCP), which include a written program, container labeling and other forms of warning, maintenance of safety data sheets (SDS), and annual chemical-specific employee training prior to working with hazardous chemicals. Employee training shall include: how the HCP is implemented in the workplace; how to read and interpret information on labels and SDS; hazards associated with the chemicals used in the workplace and the measures that employees shall take to protect themselves; and specific emergency procedures that are to be instituted.

Remediators working on multi-employer work sites shall:

- inform other employers of hazardous substances;
- inform other employers of means to protect their employees;
- provide access to SDSs; and
- inform other employers of the labeling systems used.

### 8.9.1 Hazard Communication in the U.S.

U.S. employers shall comply with OSHA Hazard Communication Standard (29 CFR 1910.1200) and any Global Harmonization System (GHS) requirements.

## 8.10 Lockout/Tagout (Control of Hazardous Energy)

The OSHA Standard on the Control of Hazardous Energy (Lockout/Tagout), found in 29 CFR 1910.147, delineates steps employers shall take to prevent accidents associated with hazardous energy. This standard addresses practices and procedures necessary to disable machinery and prevent the release of potentially hazardous energy while maintenance or servicing activities are performed.

## 8.11 Safe Work Practices in Contaminated Buildings

Remediators should incorporate the following items into remediation work procedures:

- no eating, drinking, or smoking in any potentially contaminated or designated work area;

- remove protective gear and wash hands before eating, drinking, smoking, rest periods, using the bathroom, and at the end of the work day;
- dispose of contaminated protective clothing with other refuse before exiting the containment;
- do not move used protective clothing from one area to another unless properly contained;
- wear latex or nitrile chemical-resistant or vinyl gloves while inside containment areas, designated work areas, or while handling bagged contaminated materials;
- wear a second pair of gloves (rubber, textile, or leather work gloves) to protect against personal injury;
- use the buddy system when working in high heat, remote, or isolated work spaces;
- address cuts, abrasions, and first-aid blood-borne pathogen issues promptly, especially when sewage-damaged materials are present;
- discard gloves that are damaged, wash hands with soap and water, and inspect hands for injury; and
- dispose of used disposable gloves as contaminated material, along with contaminated debris.

Remediators shall incorporate the following items into their remediation work procedures where appropriate:

- tailgate meetings to discuss the daily work activities, including a review of safety issues;
- electrical safety practices (e.g., using ground fault circuit interrupters and lock-out tag-out);
- wear PPE appropriate to the hazards identified in the work area;
- inspect PPE prior to use;
- use protective disposable coveralls with attached or separate shoe covers;
- don protective clothing before entering containment or other designated areas;
- repair or replace damaged personal protective equipment;
- workers are to be instructed as to job specific emergency plans including emergency exits;
- when an injury occurs, the injured worker and co-workers are to take the steps delineated in the company safety program;
- workers are to be informed about the location of emergency shower and eye-wash stations; and
- report injuries to a supervisor as soon as practical.

## 8.12 Immunizations and Health Effects Awareness

Remediators should consider reducing the risk of infectious disease to workers by referring them to their primary health care physician for information on available immunizations. Workers who are at an increased risk for opportunistic infections including but not limited to those who are immunocompromised due to HIV infection, neoplasms, chemotherapy, transplantation, steroid therapy, or underlying lung disease, should be advised of the increased risk of disease due to their condition. Such workers are usually precluded from participating in remediation activities in mold-contaminated buildings. Employees who have medical conditions that are of concern (e.g.,

AIDS, HIV seropositivity, pregnancy) should be evaluated by a qualified physician for a recommendation regarding whether performing assigned remediation activities presents an unacceptable health risk.

# 9 Administrative Procedures, Documentation and Risk Management

Remediation project administration typically includes but is not necessarily limited to:

- use of written contracts;
- good verbal and written communication;
- thorough project documentation and recordkeeping;
- appropriate methods to manage risk;
- responsiveness;
- an ability to understand and coordinate multiple tasks and disciplines, and
- a professional and ethical attitude.

It is recommended that remediators establish and consistently follow methods and procedures for project administration, including but not limited to business and quality control systems, and operational plans and protocols.

## 9.1 Contracts

Remediators should enter into an adequate written contract before starting a remediation project. Remediators should seek legal counsel for the development of a contract that includes appropriate terms and conditions, or when circumstances or situations dictate, the need for contract modifications, addendums or project-specific legal advice. Remediators should verify that contracts contain the elements necessary to form an enforceable contract under the laws of the applicable jurisdiction.

### 9.1.1 Recommended Contract Specifications

Although projects vary in size and scope and may have unique issues and complications, it is recommended that contracts specify the following, at a minimum:

- the identity and contact information of the client and materially interested parties;
- a description of work to be performed, which may include references to attached project specifications or other documents that specify the details of the work;
- description of and responsibility for repair of collateral or consequential damage;
- known limitations, complexities, or potential complications of the project;
- permits required for the project;
- the respective duties and responsibilities of parties;
- the project start date and time and estimated time for completion of the work;
- the price or professional fees charged for the work or method for calculating them;
- the party responsible for payment and the terms of payment;
- provisions dealing with contract default and termination;
- whether or not an insurance company or surety is involved, and how claims will be handled;
- warranty and disclaimer provisions, if any;

- criteria for determining the effectiveness of remediation, and
- provisions relating to changes or additions to the work, including change orders.

It is recommended that contract documents be accurate and complete, free of ambiguity, and contain adequate disclaimers, reservations, or recommendations when project uncertainties, limitations, complexities, or complications exist, or are anticipated. In addition, the contract should be dated and signed by all parties to the contract and each party should be given a copy of the contract as soon as reasonably practical. If a written contract is executed, it is recommended that each page of the contract be initialed by all parties to the contract.

Specific information, including the source and extent of the contamination is necessary to adequately define the scope of work and develop a work plan for a mold remediation project. Remediators should determine if the moisture problem at issue has been identified, controlled, or repaired, and if not, to identify the process and party responsible for doing so. This determination may be delegated to a specialized expert as necessary (e.g., moisture intrusion expert, drying contractor, building envelope expert or other qualified tradesperson).

### 9.1.2 Changes to Contracts

Substantive or material changes from the original, agreed-upon contract or scope of work should be documented in a written and detailed change order, which includes a description of the changes to the work, time for performance, price or fees, and method of payment. Further, it is recommended that the client, or the client's designated agent, and the remediator's representative accept the change order in writing.

## 9.2 Communication

Communication between all materially interested parties is important on remediation projects. Many times the source of a dispute between parties is the failure of the parties to communicate clearly and adequately. It is recommended that materially interested parties agree on the purpose and subjects of project communication, the frequency and mode of communication, and with whom communications will be distributed. It is recommended that any significant items that could affect the job be discussed verbally and then reduced to writing and distributed to appropriate materially interested parties.

Remediation project communication may often involve professional advice, education, and warnings. When providing such information, remediators should inform customers and occupants that any information provided is not to be construed as medical advice, directive, or diagnosis. Customers and occupants who express health concerns or ask medical questions should be instructed to seek advice from qualified medical professionals or public health authorities. Remediators should not give advice, education, or warnings on subjects outside their areas of professional expertise.

## 9.3 Project Documentation and Recordkeeping

Documentation and recordkeeping are important in developing a remediation plan, executing the plan, and completing a successful remediation project, especially if there is a need to review or reconstruct the remediation process or project at some future time. Thorough documentation and recordkeeping should be performed and maintained throughout the remediation project. To properly document the remediation project, it is recommended that remediators attempt to obtain all pertinent project information developed before, during, and after a remediator's involvement in the project. It is also recommended that remediators document important communications, to reduce the possibility of misinterpretation.

Before the remediation project begins, remediators should attempt to obtain available environmental reports, remediation plans or protocols, and other pertinent project documentation.

Remediators should establish and maintain a document retention program.

### 9.3.1 Required Documentation

Documents and records obtained and maintained by remediators shall include documents required by applicable laws, rules and regulations promulgated by federal, state, provincial and local governmental authorities.

### 9.3.2 Documentation that Remediators Should Create and Maintain

To the extent the documents exist, a remediator's documentation (which may include photographs) and recordkeeping should include, at a minimum, the following:

- the written remediation contract;
- the scope of work and remediation plan or protocol;
- materials related to project limitations on Standard compliance or deviations from Standard compliance (e.g., notices, agreements, disclosures, releases, waivers);
- environmental reports made available to remediators;
- written remediation recommendations or technical specifications from IEPs, industrial hygienists, inspectors, and others acting in the capacity of consultants or advisors, if made available to remediators;
- contents and personal property inventories, both salvable and non-salvable, signed and dated by remediators and customer with both parties receiving copies of the documents as soon as reasonably practical;
- detailed work or activity logs, including a description of who did what, when, where, how, and for what duration, including entry and exit logs, where applicable;
- equipment logs or similar documents that include a description of equipment and supplies used on the project (including biocides and antimicrobials), the quantity and length of time used (where applicable) and other relevant information;
- documents reflecting customer approval for the use of chemical compounds, including Material Safety Data Sheets for cleaners, antimicrobials, and biocides;
- documentation of project safety and health elements (e.g., safety and health plan, occupant communication and worker "Right-to-Know" information; safety meetings; hazard signs; PPE; a general description of the nature and location of containment, negative air machines, air filtration devices, and the like, used on the project);
- records of pressure readings in and out of containment (if negative pressure is being used);
- change orders, if any; and
- estimates, invoices, and bills.

### 9.3.3 Recommended Documentation

It is recommended that a remediator's documentation and recordkeeping include the following:

- administrative information (e.g., customers' and materially interested parties' contact information and call report records; copies of notices, disclosures, documents and information provided; notes or synopses of meetings that summarize the substance of the meetings and the decisions made, and which generally document the progress

of the project; communication logs; important written communications [correspondence, e-mail messages and the like]; decisions to transfer project investigation to an IEP, or to involve an IEP in a mold remediation project; background and qualification information for subcontractors or trades engaged by a remediator on a project, if any);

- subcontractor contracts, work specifications, insurance requirements and change orders for subcontractors engaged by remediators on a project;
- insurance and financial information (e.g., identifying the party responsible for payment, and determining responsibility for collateral and consequential damage resulting from remediation);
- permits and permit applications (if available);
- building and contents information, including: property type (e.g., residential, commercial, industrial, institutional); the relationship of the customer to the property (e.g., owner, lessor, purchaser, property manager); building history (i.e., relevant known characteristics of the building or its history that materially affect the remediation process, including information about remodeling, renovation, and maintenance issues); pertinent known information about the subject property (e.g., the cause and date of the moisture problem, a description of when and how the problem was discovered, leak detection reports, and description of previous remediation efforts);
- observations upon inspection (e.g., diagrams; moisture "mapping"; photography or videography of pre-existing conditions, water stains or damage, and areas of visible or suspected mold, or efflorescence);
- other relevant project or customer observations or perceptions (e.g., odors; condensation; relative humidity readings; temperature, moisture content or moisture levels of structural materials; and health complaints);
- contact information for employees, known visitors or occupants, IEPs, industrial hygienists, inspectors, adjusters, claims representatives and other materially interested parties who enter contained areas or who participate in the remediation process or its administration;
- lien notices and lien releases (if applicable); and
- certificate(s) of completion.

### 9.3.4 Documentation of Limitations and Deviations

A client or customer may request or refuse some services that prevent a remediator from complying with remediation plans or protocols, or the requirements and recommendations of this Standard and the R520 Reference Guide (see Chapter 9, *Limitations, Complexities, Complications and Conflicts* and Chapter 11, *Structural Remediation*). When proceeding under such circumstances, there is a heightened risk of future conflict with a client or customer, which can create potential liability for a remediator. If a remediator decides to proceed with the project despite limitations on compliance with this Standard, they should adequately document the situation and circumstances, which may include advising the client or customer of the potential consequences of such noncompliance in writing and attempting to obtain a written waiver and release of liability for those potential consequences.

It is recognized that remediation projects are unique, and that in certain circumstances, common sense, experience, and professional judgment may justify deviation from this Standard. It is the responsibility of remediators to determine and verify on a case-by-case basis that application of this Standard is appropriate. When material deviation from this Standard is warranted, it is recommended that remediators adequately document the situation and circumstances, which

when appropriate may include notices and disclosures to the client or customer, or obtaining consent, approval, waiver, or release of liability from the client or customer.

## 9.4 Recordkeeping and Record Retention

Remediators shall maintain remediation project documentation for the time required by record retention laws and regulations of applicable jurisdictions, if any. It is also recommended that remediation project documentation be maintained for the longest applicable statute of limitations in the relevant jurisdiction, at a minimum. In some circumstances, it may be appropriate to maintain remediation project documentation indefinitely. It is recommended that remediators obtain advice from qualified counsel regarding timeframes for document retention. The method of recordkeeping and record retention is beyond the scope of this document.

## 9.5 Emergencies

In some circumstances, remediation projects are conducted on an emergency basis. Emergency situations may impede project communications or limit the opportunity to document the project as described in this section. However, once an emergency situation is resolved, to the extent practical, remediators should attempt to complete the appropriate documentation and correct communication deficiencies caused by the emergency.

## 9.6 Insurance

### 9.6.1 Customer/Client Insurance

The interpretation of an insurance policy is outside the scope of a remediator's responsibility and expertise. It is recommended that mold remediation companies refrain from analyzing and interpreting insurance policies. It is recommended that such matters be referred to a qualified insurance professional or attorney.

### 9.6.2 Risk Management

Prudent business management in the remediation field includes an awareness of risk and potential exposure to liability, and the application of various management tools. It is recommended remediators develop a written Risk Management Program.

Remediators shall carry adequate amounts of General Liability, Automobile Liability, and Workers Compensation insurance coverage when required by statute. Remediators should carry adequate amounts of Contractors Environmental Liability insurance coverage. If the remediator is rendering opinions or issuing reports, Professional Liability insurance coverage is recommended. In some jurisdictions, remediators are required by law to obtain and maintain specific types of insurance in certain minimum amounts. It is recommended that remediators consult with credentialed environmental insurance specialists in addition to their local insurance agent, to ensure that appropriate insurance coverage is placed for their business operations. Because insurance related to the remediation industries is rapidly evolving, it is incumbent upon remediators to stay abreast of insurance industry developments impacting their businesses.

# 10 Inspection and Preliminary Determination

An inspection is primarily the gathering of information regarding the mold and moisture status of the building, system, contents, or area in question. After the initial inspection is completed, remediators develop a "preliminary determination," which is a conclusion that identifies actual or potential mold growth, known or suspected areas of moisture intrusion, and the need for

assistance from other specialized experts such as an IEP to conduct assessments or to perform necessary services beyond the expertise of the remediator. The preliminary determination performed by the remediator, and assessments performed by an IEP (if any), provide the basis for developing work plans, protocols, and specifications.

## 10.1 Qualifications

Remediators are expected to be qualified by education, training, and experience to appropriately execute the skills and expertise required to safely remove mold contamination from structures, systems, and contents, and to restore Condition 2 or 3 structures, systems, and contents to Condition 1. Remediators should be qualified by education, training, and experience in water damage restoration and inspection. It is recommended that remediators have a basic knowledge of building science as it applies to moisture intrusion.

Remediators should perform only those services that they are qualified to perform. If situations arise where there is a need to perform services beyond their expertise, remediators should engage specialized experts or other support services, or recommend to customers or clients that appropriate specialized experts be retained in a timely manner.

## 10.2 Initial Contact

Inspections for moisture problems that may have resulted in mold growth can begin in many ways and be initiated by any number of parties for a variety of reasons. When mold contamination is discovered, a building moisture inspection should be conducted promptly.

### 10.2.1 Health Complaints

If occupants express health concerns or have medical questions during the inspection process, remediators should instruct them to seek advice from qualified health care professionals, public health authorities, or IEPs. Remediators should not give advice, education, or warnings on subjects outside their areas of expertise.

## 10.3 Inspection Process

The inspection process includes but is not necessarily limited to gathering information for moisture problems and potential mold contamination. The inspection process can require a multi-disciplined approach involving specialized experts from various fields. The inspection process is not intended to be an exposure assessment, and as such is not intended to address occupant health complaints or risks.

### 10.3.1 Information Gathering

Remediators should make a reasonable attempt to obtain available background information on the affected premises, including a building history. This information can help establish a building inspection strategy.

Occupant health concerns or conditions can be an important part of the information gathering process and can serve several purposes including: determining the need for additional occupant protection; the need to involve an IEP or other specialized expert; or the need for occupant referral to a qualified health care professional or public health authority. Remediators should not give advice, education or warnings on subjects outside their area of expertise.

## 10.4 Building Inspection

A physical site inspection or a walk-through of affected premises should be performed in order to gather information about the condition of a property that can lead to a preliminary determination about the presence of moisture and mold. The building inspection can include but is not limited to looking for: water intrusion or condensation, water stains, structural damage, HVAC operation, odors, construction type, previous repairs or remodeling, and structure defects.

Contamination can be active or dormant, visible or hidden, in the form of settled spores, fragments, or other fungal components, or a combination thereof. Regardless of the quantity of visible mold growth and extent of water damage, remediators should attempt to obtain enough information to locate or predict the approximate extent of associated concealed or non-visible mold contamination. Obtaining a building history and performing an inspection assists in locating concealed mold contamination. In order to locate potentially concealed mold, remediators should identify, to the extent practical, the pathway(s) of the water intrusion in the affected premises.

It is recommended that remediators have a basic knowledge of building science as it applies to moisture intrusion and air pathways. A building moisture inspection should be performed and documented in accordance with the latest version of ANSI/IICRC S500, *Standard and Reference Guide for Professional Water Damage Restoration*.

In some cases during the inspection process, remediators may need to conduct intrusive activities. Remediators shall check with local regulatory agencies to determine whether or not permits or licenses are required for such activities. Where visible or suspected mold growth is present or potentially disturbed, immediate containment, other engineering controls and personal protective equipment (PPE) should be considered during the inspection process. Such decisions should be based upon the remediator's professional judgment and shall be consistent with applicable laws and regulations and the guidance set forth elsewhere in this document.

During the inspection process, the presence of hazardous or regulated materials that might be disturbed during the remediation process shall be determined and documented. Remediators shall comply with federal, state, provincial and local laws and regulations regarding the handling of hazardous or regulated materials, such as asbestos or lead-based paints. In some states and countries, individuals who perform these types of investigations or remediation services shall have appropriate training and licensing.

## 10.5 Developing a Preliminary Determination

After the initial inspection is completed, the next step involves developing a preliminary determination. A preliminary determination is a conclusion that identifies actual or potential mold growth, known or suspected areas of moisture intrusion, the need for the assistance of an IEP to conduct a formal assessment of Conditions 1, 2, or 3, or whether other specialized experts are needed to perform necessary services beyond the expertise of a remediator. Generally, the preliminary determination is made by a remediator, and is based upon the analysis of information obtained during the initial inspection, and the exercise of professional judgment by a remediator.

A remediator should engage or recommend to customers that they engage an IEP when Condition 1, 2, or 3 cannot be determined by the remediator. Remediators should also recommend to customers that they engage an IEP and other appropriate specialized experts (e.g., qualified health care professional) when health issues are discovered or apparent that seem to be related to the mold contamination. Furthermore, in all situations, remediators should exercise professional judgment in making appropriate recommendations.

### 10.5.1 Summary of Possible Preliminary Determinations

- Enough information is currently available to determine that Condition 1 exists throughout the structure, systems, or area, including contents, and therefore, no remediation activity is required.

- Enough information is currently available to determine that Condition 2 or 3 exists throughout the affected structure, systems, or area, including contents, and therefore, work plans, protocols, and specifications can be developed.

- There is not enough information available to determine that Condition 2 or 3 exists throughout the affected structure, systems, or area, including contents, and therefore, the remediator should engage or recommend to the customers that they engage an IEP to assess the affected structure, systems, or area, including contents.

## 10.6 Developing Work Plans, Protocols and Specifications

The inspection information, preliminary determination, and assessments performed by an IEP provide the basis for developing work plans, protocols, and specifications, the development of which can necessitate the further assistance of an IEP or other specialized expert.

When preparing work plans, protocols, and specifications for a mold remediation project, remediators should use the information contained in this document to determine the need for specific services and procedures. When developing work plans, protocols, and specifications, at a minimum, consideration should also be given to the following:

- containment;
- pressure differentials;
- hazardous or regulated materials;
- safety and health provisions;
- contents;
- contaminated material removal and handling;
- detail cleaning;
- disposal;
- post-remediation evaluation;
- post-remediation verification; and
- containment removal.

# 11 Limitations, Complexities, Complications and Conflicts

Remediators can be faced with conditions that present challenges to the work process, producing limitations, complications, complexities, or conflicts. Remediators should have a thorough understanding of these issues and communicate them to appropriate parties.

## 11.1 Limitations

A “limitation” is a restriction placed by others upon a remediator that results in a limit on the scope of work, the remediation activities, or the outcomes that are expected. Before beginning non-emergency work, known or anticipated limitations and their consequences should be understood, discussed, and approved in writing by remediators and the owner or owner’s agent.

Remediators should refuse to allow anyone other than the owner, or the owner's agent, to impose limitations on the performance of a remediation project. If an attempt to impose a limitation is initiated by any other materially interested party, the owner or owner's agent should be advised and provide approval before the limitation takes effect. Limitations should be defined in writing.

## 11.2 Complexities

A "complexity" is a condition that causes a project to be more difficult or detailed, but does not prevent remediators from performing work adequately. Before beginning non-emergency work, known complexities and their consequences should be understood, discussed, and approved in writing by remediators and the owner or owner's agent.

## 11.3 Complications

A "complication" is a condition that arises after the start of work and causes or necessitates a change in the scope of activities because the project becomes more complex, intricate, or perplexing. The owner or owner's agent should be notified in writing as soon as practical regarding complications that develop. The presence of project complications can necessitate a written change order.

## 11.4 Conflicts

"Conflicts" are limitations, complexities, or complications that result in a disagreement between the parties involved about how the remediation project is to be performed. Mutual agreements to resolve conflicts should be documented in writing, and releases, waivers, and disclaimers should be reviewed by a qualified attorney.

## 11.5 Hazardous or Regulated Materials

The presence of a hazardous or regulated material on a project can present a limitation, complexity, or complication. The presence or potential presence of a hazardous or regulated material on a project shall be carefully evaluated to determine if remediators and remediation employees are qualified to work in that environment. Some hazardous or regulated materials require HAZMAT training, while others require more specific training and licensing, or they may necessitate engaging a qualified specialized expert. Remediators shall avoid situations that result in an activity that is illegal, or which is likely to result in injury or adverse health consequences for workers or occupants.

## 11.6 Change Orders

Disputes can develop when contract additions or modifications are made while performing work, but are not adequately documented in writing. In order to protect all parties to a remediation contract, substantive changes in the scope of work, time frame, price or method of payment, or other material provision of a contract should be documented in a written change order that details the changes. Further, it is recommended that the owner or the owner's designated agent and the remediator's representative accept the change order in writing.

## 11.7 Insurance

Remediators should be aware that the terms and conditions of their insurance coverage can create project limitations and complications. If applicable insurance does not cover the work anticipated at commencement of the project, a limitation can result if insurance is required. If a complication develops or is discovered after commencing project work, it is possible that resultant changes in the scope of work might not be covered by the remediator's insurance policy.

Remediators should determine whether or not specialized insurance coverage is required for their operations.

### 11.8 Work Stoppage

In some situations, limitations, complexities, complications or conflicts can necessitate work stoppage. In the event an illegal or dangerous limitation, complexity or complication exists, occurs, or is discovered on a mold remediation project, the condition shall be resolved immediately or the work stopped.

Remediators shall avoid situations that result in activities that are illegal or are likely to result in injury or adverse safety or health consequences for workers. Remediators should avoid situations that result in activities that are likely to result in injury or adverse safety or health consequences for occupants.

The reason for the work stoppage and the significant events leading to a work stoppage decision should be documented in writing. It is recommended that a work stoppage be reviewed by a qualified attorney.

## 12 Structural Remediation

Structural remediation is defined as that portion of a remediation project that deals specifically with a building's structure and typically does not address a building's contents or HVAC components. Mold remediation procedures in a contaminated building are based on generally accepted industrial hygiene practices, and safety and health principles. These procedures describe safeguards and controls that assist in achieving remediation project goals.

Regulated materials, such as lead or asbestos, require specific mitigation or remediation protocols. The presence of these and other regulated materials take precedence over mold remediation, and they shall be addressed according to federal, state, provincial, and local laws and regulations.

The remediation of different building materials (remediation methods) depends upon the ability of materials to absorb or adsorb moisture (i.e., whether or not they are porous, semi-porous or nonporous), the ability of the material to support fungal growth, a materials' ability to trap and hold mold spores, and the structural integrity of the material. In addition, remediation methods can depend on exposed substrates or material layers with different porosities (composite materials). Thus, contaminated materials should be carefully evaluated before attempting mold remediation. If structural components have been compromised and require removal, a qualified structural engineer should be involved in decisions to remove such components.

### 12.1 Engineering Controls

Remediators should prevent cross-contamination and shall use engineering controls to help ensure worker safety and health during structural mold remediation projects. When performed in accordance with generally accepted industrial hygiene principles and standards, engineering controls eliminate or reduce the hazard.

#### 12.1.1 Isolation

Isolation can be achieved by covering a moldy surface with self-adhering plastic or by erecting physical barriers that separate affected from unaffected areas. Isolation barriers are commonly referred to as "containment barriers" or "critical barriers." Isolation barriers are usually constructed of polyethylene (poly) sheeting. HVAC diffusers, and building openings and fixtures

in the mold remediation area should be sealed off to prevent cross-contamination. Fire retardant polyethylene with a minimum flame-spread rating of 25 should be used to reduce fire hazards and shall be used when required by applicable federal, state, provincial, or local laws and regulations.

#### 12.1.1.1 Containments

During mold remediation projects, containments generally are separated into three basic types: source containment; local ("mini") containment; and full-scale containment. Expanding containments may be necessary when additional mold contamination is discovered.

#### 12.1.1.2 Source Containment

Source containment may be used:

- to address relatively small or limited areas of mold growth, or it can be used in combination with other engineering controls to reduce the amount of spore release and dust generation;
- alone when mold growth is limited to small visible controllable areas where hidden mold growth is not anticipated; and
- within areas of more extensive mold growth in conjunction with other forms of containment.

When there are small or limited areas of mold growth, and hidden mold growth is suspected, a more extensive containment should be used.

#### 12.1.1.3 Local Containment

Local or "mini" containments may be used when moderate levels of fungal growth are visible or suspected. A structural enclosure can be built to contain a work area and separate it from the unaffected section of the room or structure. In a local containment HEPA-filtered air filtration devices (AFDs), when used as negative air machines (NAMs), are installed to create negative pressure differentials in relation to surrounding areas. In local containments, a HEPA vacuum cleaner can be substituted if it is able to create the necessary pressure differential. However, this works only if the vacuum canister is adequately sized and located outside the containment area.

#### 12.1.1.4 Full-Scale Containment

Full-scale containments normally are used when significant or extensive mold growth is present or suspected, and where source and local containments cannot effectively control or eliminate cross-contamination. Critical barriers are established to separate unaffected from affected areas.

#### 12.1.1.5 Decontamination Chamber

A decontamination chamber, sometimes referred to as a "decon unit" or "decon," is engineered to provide a transition space between the containment ("contaminated area") and surrounding clean areas, and are used for:

- entry to and exit from a work area; and
- decontaminating exterior surfaces of plastic bags or sheeting used to contain contaminated materials, remediation tools, and the exterior clothing of personnel when exiting the work area.

Decontamination chambers are intended to prevent cross-contamination to unaffected areas and to provide controls to maintain pressure differentials.

#### 12.1.1.6 Containment Maintenance

Remediators should:

- not disturb contaminated materials until containment is erected, a negative air system is installed, and the containment's performance is checked;
- not remove containment until demolition, remediation, clean-up, and post-remediation evaluation by the remediator and post-remediation verification by an IEP when required, have been completed;
- maintain integrity of the containment throughout the remediation process, including post-remediation evaluation;
- monitor and document containment performance at appropriate intervals;
- construct containment barriers so that if pressure differentials are lost, containment flaps will close to prevent losing control; and
- stop work any time there is a breach in containment or loss of pressurization, and not resume work until the containment has been repaired and pressure differentials have been re-established.

It is recommended that any breach in the containment's integrity be reported immediately to a supervisor.

### 12.1.2 Pressure Differentials

Pressure differentials are used to manage airflow into and out of the containment area. Professional judgment determines how airflow is managed and pressure differentials are applied. Contaminated areas should be negatively pressurized relative to unaffected or clean areas of the building to prevent cross-contamination. Generally, when pressure differentials are used, they should be created using HEPA-filtered air filtration devices (AFDs) used as a negative air machines (NAMs). Pressure differentials can be monitored by analog or digital manometers, smoke tube or pencils, or visual inspection.

In sensitive environments, such as daycare or healthcare facilities, alarmed or alert pressure differential monitoring systems with data logging capability should be used; multiple AFDs should be used when appropriate and operated on separate electric circuits where available.

### 12.1.3 Air Flow and Exchange Rates

Air exchanges are used to dilute airborne fungal concentrations in work or containment areas. This helps reduce worker exposure and facilitates the clean-up effort. Airflow direction should be from clean to contaminated areas. Industrial hygiene practices recommend a minimum of four air changes per hour for contaminant ventilation and dilution.

Pressure differentials in buildings can create hazards associated with fireplaces, laboratory hoods, and sewer lines, and can cause unintended airflow, such as drawing air from wall and ceiling voids or chases. Negative-pressure differentials in warm, humid climates or seasons can cause moisture and consequent dampness to enter indoor spaces. In cold climates, negative pressure can draw cold or freezing air into the indoor environment, potentially creating unwanted condensation or freezing. The remediator should exercise care to avoid such unintended consequences when managing airflow on remediation projects.

Remediators should use carbon monoxide detectors in and adjacent to containments whenever the work area is negatively pressurized in order to identify dangerous levels of carbon monoxide in the event of back drafting of exhaust from gas-fired appliances.

### 12.1.4 Air Filtration Devices

Air moving devices with filters are referred to as air filtration devices (AFDs). AFDs can be installed to create negative or positive pressure differentials. When used to create negative pressure, they are referred to as negative air machines (NAMs). AFDs also may be used as air scrubbers. When using an AFD as an air scrubber, care should be taken to prevent positive pressurization of the contaminated area, thereby causing a release of contaminants into unaffected parts of the building.

Remediators should:

- clean and inspect AFDs for proper performance prior to use at a job site;
- vent exhaust air from HEPA AFDs outdoors. (If circumstances prevent exhausting the AFD outside, then a deviation from the standard may be necessary (e.g., using redundant HEPA AFDs in series) and it is recommended that particle monitoring be performed when discharging into occupied portions of a building);
- inspect and re-secure, as necessary, all units and containment barriers if unexpected pressure drops occur;
- cease all work if pressure has been lost until the appropriate pressure differential is re-established;
- select and install AFD filters according to equipment manufacturer specifications. The filter change frequency is determined by the work activity; amount of dust created and captured, and filter capacity. When the AFD is inside a contained work area, the pre- and secondary filter changes should be performed with the unit operating. This prevents releasing contaminants from filters into the workspace. HEPA filters should be changed with the unit turned off in a negatively pressurized contained area, or by removing the AFD from the jobsite to an area that would not be adversely impacted by a release of contaminants;
- seal the air intake side of an AFD used in a contaminated area before turning it off to avoid releasing contaminants. The intake side of an AFD that contains accumulated mold spores and fragments should remain sealed when not in operation and while being transported or stored; and
- clean and dry the exterior of the AFD after use and prior to removal from the project site, and subsequently store the AFD in a dry environment.

### 12.1.5 HEPA Vacuums

Remediation workers should use HEPA vacuums when performing remediation. HEPA vacuum units are designed for, and equipped with filtration media that removes 99.97% of particles at 0.3 microns. Only well-constructed professional HEPA vacuums should be used in mold remediation projects. Regular shop-type or standard consumer vacuums should not be used for remediation because they are not designed to prevent mold spores and fragments from passing through the equipment and re-entering the air.

Remediators should:

- clean and check HEPA units for proper performance before being placed at the job site;
- check hoses, filter bags, and assemblies any time a drop in suction occurs or when the bag is changed;
- service HEPA vacuum cleaners within the capture zone of an AFD, or outdoors using appropriate precautionary measures; and

- before removing HEPA vacuums from containment areas, thoroughly clean the unit's exterior to remove dust/spores. This cleaning includes the exterior of the hose. Openings, such as filter and vacuum hose inlets, should be sealed with tape, or plastic and tape to prevent particles from escaping.

### 12.1.6 Other vacuum systems

There are a variety of other vacuum cleaners and systems that do not fully meet the definition of HEPA filtration. Some of these may have valid uses in the remediation process, but typically they should not be substituted for a HEPA vacuum during remediation. Other types of vacuums should not be used for most mold remediation work.

### 12.1.7 Misting

Misting is a method of atomizing water or other aqueous solutions into the air for the purpose of controlling airborne and surface particulates during remediation. Remediators may consider misting for dust suppression and clean-up purposes. Remediators should not mist or fog disinfectants or sanitizers in an attempt to kill mold in lieu of source removal. Remediators should employ adequate engineering controls to limit the release or spread of mold or spores within the work environment.

### 12.1.8 Dehumidification

Dehumidification may be needed during the remediation process to dry the structure or maintain conditions that will not support additional mold growth. Equipment operated in Condition 2 or 3 portions of a building requires cleaning after use. It may be possible to precondition make-up air in Condition 1 areas of the building to provide dehumidification of the make-up air for the work zone.

## 12.2 Remediation Work Procedures

### 12.2.1 Technical Specifications and Report Review

Remediators should:

- when available, attempt to obtain environmental reports describing the nature and extent of existing mold contamination;
- review available documents related to the project, and understand the project objectives, goals, methods, timeline, material requirements, and other circumstances before work is performed;
- in cases where enough information is currently available to determine that Condition 2 or 3 exists throughout the affected structure, systems, or area, including contents, develop work plans, protocols, and specifications following this standard;
- in cases where there is not enough information available to determine that Condition 2 or 3 exists throughout the affected structure, systems, or area, including contents, use an environmental report provided by an IEP, based on a pre-remediation assessment, to develop the work plan. The extent and details provided by the IEP can vary greatly. Some protocols may or may not be detailed, and contain technical specifications, site monitoring, or independent oversight. If incomplete or inadequate technical specifications for mold remediation are provided by an IEP, then remediators should seek clarification and, thereafter as necessary, design and implement their own protocols and work plans, and provide them to appropriate materially interested parties for review and approval when needed;

- conduct their own post-remediation evaluation for quality assurance regardless of whether a post-remediation verification is conducted; and
- provide that when post-remediation verification is necessary, it is performed by an independent IEP to avoid any conflict of interest. If the IEP conducting any activity such as assessment or post-remediation verification is not independent from the remediator, they should disclose this "complexity" in writing to the client that they are deviating from the Standard.

In addition, remediators shall comply with applicable federal, state, provincial, and local laws and regulations relating to the services that they perform.

### 12.2.2 Preliminary Steps

In order to implement remediation work plans, protocols or technical specifications, remediators should:

- ascertain site conditions;
- perform hazard assessment;
- establish project scheduling. (It is recommended that the building owner, manager or a building representative be present during the project walk through);
- determine contents salvability and how contents should be handled, and avoid trapping residual moisture when wrapping salvageable contents;
- be aware of other potential sources of mold growth and amplification, such as over-watered plants and un-emptied trashcans;
- protect unaffected contents if they cannot be removed from the remediation area; and
- evaluate the HVAC and air conveyance system to determine the presence of contamination and pre-existing conditions. The remediator may consider temporary heating or cooling depending on climatic conditions.

It is not necessarily the responsibility of remediators to identify and verify that water or moisture sources have been determined or eliminated. However, water intrusion sources should be identified and eliminated by the appropriate moisture expert, drying contractor, building envelope expert, plumbing contractor, or other qualified tradesperson. Also, on each job there should be a clear determination of whose responsibility it is to identify and eliminate water or moisture sources.

### 12.2.3 Containment Set-up

Remediators should:

- determine the necessity for, extent, and location of required containment;
- determine the necessity for appropriate personal protective equipment before and during the installation of containment and other engineering controls;
- use containment barriers to separate Condition 1 areas from Condition 2 or 3 areas, (i.e., source, local, or full-scale containment methods);
- verify that the structure's ventilating system is sealed off or isolated from mold-contaminated work areas to minimize the risk of cross-contamination;
- erect containment in a manner that mitigates the potential for cross-contamination and exposing workers and occupants to contamination;

- consider whether floors, walls, and ceilings require a polyethylene barrier erected over them; or if they can be left uncovered for later cleaning;
- be aware that containment barriers on surfaces can cause condensation, change pressure differentials, or trap moisture or Condition 2 contamination on surfaces;
- consider and mitigate, where practical, the potential for collateral or consequential damage at the point where the containment barrier is joined to a structure's finish materials. (It is recommended that a description of and responsibility for repair of such collateral damage be established prior to starting a project);
- make the containment area large enough to allow sufficient room for workers to remove affected building materials;
- when a decontamination chamber is used, establish an appropriate entry and exit, which is attached to the containment as a transitional space between work areas and unaffected areas of the building. Tack mats can be placed immediately outside the entrance of the decontamination chamber to limit contaminants from being tracked into unaffected areas after removing disposable protective clothing (booties);
- install containment flaps to provide a neutral pressure zone or to control make up air passing through the decontamination chamber; and
- establish and maintain negative pressure differentials with one or more AFDs set up in a negative-air mode. Depending on circumstances, airflow controls can be established before or after containment is installed. HEPA vacuum cleaners can also be used in small local containments to create a pressure differential.

Regulated materials, such as lead or asbestos, require specific mitigation and remediation protocols. The presence of these and other regulated materials take precedence over mold remediation, and they shall be addressed according to applicable federal, state, provincial, and local laws and regulations.

**Caution:** negative pressure differentials can create unintended air flow resulting in risk of carbon monoxide exposure, and a risk of fire due to back-drafting or flame roll-out from gas appliances, such as furnaces, ovens and water heaters. When gas appliances are in areas where negative pressure differentials are created, they should be rendered temporarily inoperable and the use of supplemental mechanical systems may be necessary.

### 12.2.4 Signage

Remediators should:

- post warning signs stating that mold remediation is in progress;
- restrict access to the work or containment areas; and
- place signs conspicuously at entrances to work areas and in areas of potential entry.

### 12.2.5 Suit Up and Entry

Remediators shall:

- wear appropriate PPE when working in areas where there is mold contamination and other potential hazards, for worker safety;
- check the respiratory PPE prior to entering a containment area to ensure that it is functioning properly; and
- be aware that entry into confined spaces can require additional measures to meet regulations and safety requirements.

### 12.2.6 Demolition and Surface Cleaning

Remediating building materials that are Condition 3 depends upon the materials' porosity and susceptibility. Porous building materials (e.g., drywall, insulation, and ceiling tiles) that are Condition 3 should be removed and discarded. Other materials that are semi-porous (e.g., wood studs) can be HEPA-vacuumed and cleaned. Small isolated areas of mold growth on a surface layer of condensation on non-porous surfaces where there is no concurrent mold growth in adjacent concealed areas, usually can be removed by HEPA-vacuuming and damp wiping.

Remediators should:

- use appropriate cleaning procedures for the surface material being remediated;
- minimize dust generation and aerosolization. During demolition, mold spores can be easily dislodged and aerosolized, especially from dry materials;
- take care to limit the release of airborne spores and fungal fragments, thereby reducing worker exposure and clean-up efforts;
- avoid crushing materials and other actions that could cause dust generation and dispersal of fungal spores and fragments;
- use techniques and controls that limit dust aerosolization and remove dust immediately. Work areas should be maintained as free from dust as practical by using a HEPA vacuum cleaner and by bagging debris immediately. Contaminated materials can be removed carefully with a razor knife or utility knives by cutting rather than tearing them into pieces to avoid generating dust or bioaerosols. Demolishing contaminated materials with a hammer or crow bar, or using electric saws without dust collecting devices, is not recommended;
- remove contaminated building materials carefully in as large a section as practical and bag or wrap, preferably in 6-mil heavy-gauge polyethylene disposal bags or sheeting;
- set the cutting depth of saw blades so that they do not penetrate all the way through gypsum board backing paper or other wall materials;
- remove insulation carefully and bag immediately, preferably in 6-mil disposable polyethylene bags;
- remove remaining drywall screws, nails and small debris, and discard;
- remove mold growth on wood framing members by HEPA-vacuuming followed by damp wiping, wire brushing, sanding, or other appropriate method, while using HEPA-vacuuming or performing removal within the capture zone of an AFD, along with other appropriate controls;
- seal bagged materials inside a second bag before moving them outside a containment area (double bagging), if they are going to pass through Condition 1 areas of the building, to prevent potential cross-contamination. Sharp items capable of puncturing polyethylene material should be packaged in such a way as to prevent them from penetrating the material before being bagged or wrapped. Mold-contaminated materials such as building framing, casements, cabinets, tubs, showers, doors, and appliances may not require bagging or wrapping if removal can be accomplished by direct access to an outside secure disposal location, and handling such materials does not pose a cross-contamination source during removal;
- clean remaining building interior surfaces and containment materials using HEPA-vacuuming and damp wiping;
- minimize the amount of water used during damp wiping to avoid wetting building materials, which may result in water damage or new mold growth;

- dry construction and finish materials that are wetted or dampened from misting to prevent mold growth; and
- not install new construction materials until post-remediation evaluation; or post-remediation verification as necessary, indicates that installation is appropriate. However, if new construction materials must be installed for structural integrity prior to completion of the remediation, those materials should also be cleaned along with the rest of the affected area.

Remediators shall:

- wear appropriate personal protective equipment (PPE), and
- when mold remediation occurs concurrently with asbestos abatement or other types of demolition where misting water is required, perform mold remediation with adequate engineering controls in place to limit the release or spread of mold or spores within the work environment, or in other parts of the building.

### 12.2.7 Deviation from Removal Processes

The Principles of Mold Remediation state that mold contamination should be controlled as close to its source as practical. Further, mold should be physically removed during remediation. Attempts to kill, encapsulate, or inhibit mold instead of proper source removal generally are not adequate.

It is recognized that remediation projects are unique, and that in certain circumstances, common sense, experience, and professional judgment may justify deviation from this Standard. It is the responsibility of remediators to determine and verify on a case-by-case basis that application of this Standard is appropriate. When Condition 3 situations exist that cannot be physically removed using reasonable measures, or when ongoing moisture intrusion cannot be resolved, it may be necessary to manage a Condition 3 area for extended periods by using long-term engineering controls, encapsulants, sealants, or other methods. Allowing mold or moisture conditions to remain is strongly discouraged, since it can compromise the health of occupants, further damage building materials, and expose remediators to liability and other consequences. However, when deviations from this Standard are considered, it is recommended that remediators advise customers in writing that controlling mold or moisture condition in place can:

- have limited effectiveness;
- result in a release of contaminants;
- result in additional structural deterioration;
- require long-term management; or
- result in additional remediation work being necessary.

It is recommended that remediators advise customers that follow-up assessment of the affected area by an IEP or other qualified professionals may be appropriate when:

- affected area(s) become visibly damaged;
- a change in the condition of the material or its surroundings occurs;
- there are health complaints; or
- engineering solutions fail.

Since deviation from the source removal principle occurred, periodic assessments may be advisable. It is recommended that remediators consult with appropriate technical professionals or attorneys for specific language to use in written communications with customers.

### 12.2.8 Disposal of Contaminated Materials

Mold-contaminated gypsum board and other structural materials that are not regulated (i.e., those that do not contain asbestos, lead or other regulated waste) usually can be disposed in normal landfills as compost or construction waste. Generally, no special disposal provisions are recommended for mold-contaminated materials; however, federal, state, provincial, and local disposal laws and regulations apply and shall be followed.

Remediators should:

- handle bagged or wrapped materials carefully, and not drop, throw, or handle them roughly while moving them to the disposal container or site;
- place bagged or wrapped materials in a reasonably secure location or transport vehicle after removing them from the building; and
- when bagged or wrapped disposal materials rupture outside the containment, but inside the building, secure the area from public access, initiate clean-up (HEPA-vacuuming), and contain the debris.

Remediators shall:

- don appropriate PPE, if bagged or wrapped disposal materials rupture outside the containment, but inside the building.

It is recommended that:

- descriptive warning labels be placed on bags and wrapped materials which describe the contents to discourage individuals from opening or removing them from the disposal site;
- label language be factual, not overstated or unnecessarily alarming; and
- dumpsters with contaminated debris be kept reasonably secure.

### 12.2.9 Clean-up

To achieve Condition 1 in the work area after demolition has been completed, it is important to clean it adequately by thoroughly removing dust and debris. Thorough cleaning consists of combining HEPA-vacuuming with damp wiping so that minimum moisture remains on surfaces. During this process, cleaning procedures inside containment should start from clean areas and work towards dirty areas in the following manner:

- clean from top to bottom; and
- clean from the source of make-up air toward the AFD.

Remediators should also:

- HEPA-vacuum and damp wipe entry and exit chamber ceilings, walls, flaps and floor of remediation areas;
- select cleaning methods and procedures based on the specifics of the project;
- repeat the cleaning process and procedures as necessary to achieve Condition 1;
- conduct a final inspection of the containment area as part of the post-remediation evaluation, prior to post-remediation verification is accomplished by an IEP, to ensure that visible dust and all debris have been removed;
- remove dust that may have settled outside the containment area by HEPA-vacuuming and damp wiping;

Physically removing mold growth and spores is the guiding principle for mold remediation. Indiscriminate antimicrobial or biocide application is discouraged. Biocide application is not considered effective as a substitute for proper source removal, however, there may be specific instances where professional judgment dictates that biocides be applied (e.g., bacterial contamination as addressed in ANSI/IICRC S500). Killing microorganisms with biocides does not typically destroy their antigenic or toxigenic properties. Remediators shall follow federal, state, provincial, and local laws and regulations, as well as product label directions. Misapplication of biocides is a federal violation under the U.S. Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). Specifications that are not consistent with biocide regulations and labeling instructions can be in violation of the law, and they can create liability for the remediator.

Using antimicrobials, fungicidal coatings, mold-resistant coatings, or sealants (products applied into or onto a material to "suppress or retard future growth") during mold remediation as a substitute for proper source removal is discouraged. However, there may be specific instances where professional judgment dictates that antimicrobials be applied. Soil, bio-films or organic residues from inadequate cleaning, accumulate on surfaces treated with fungicidal coatings and sealants generally render them less effective. Products of these types can interfere with post-remediation verification.

If antimicrobials, fungicidal coatings, mold-resistant coatings, or sealants are used, they shall be applied according to regulations and label directions.

If antimicrobials, fungicidal coatings, mold-resistant coatings, or sealants are used, remediators should:

- apply them after completion of remediation, and after completion of post-remediation verification, when necessary;
- consider that applying these products can change the permeability of materials, can cause condensation problems and trap moisture, and their application can result in future deterioration and potential liability; and
- consider that products of this type can change the flammability of the materials to which they are applied.

### 12.2.10 Containment Exit Protocol

After bagging or wrapping, demolition debris is moved to an exit chamber.

Remediators should:

- HEPA-vacuum or damp wipe the outside of bags or wrapped materials, and thereafter place them into a second bag or wrapping, sealing before they are moved from the exit chamber;
- wipe off tools and equipment being removed from the containment area and place in clean sealed bags for detailed cleaning off-site using appropriate precautions;
- vacuum and damp wipe tools, HEPA vacuum cleaners, and AFDs before they are removed from the containment area; and
- seal the intake (contaminated) side of AFDs before turning the equipment off to prevent back flushing of filtered contaminants.

If two sets of disposable coveralls are worn, the first coverall is removed in the first chamber as described in the preceding paragraph. The second set is removed in the second containment chamber and hung up for reuse as the outer coverall when re-entering the workspace. If the inner disposable coverall has been damaged, it shall not be reused, but rather disposed in the second chamber.

### 12.2.11 Post-Remediation Evaluation

Post-remediation evaluation should be conducted by remediators to determine whether or not remediation has been completed. This evaluation involves implementing internal quality control procedures. It can include visual inspection, olfactory evaluation, and tools and equipment such as laser particle counters, ATP meters, and moisture-sensing devices.

Remediated structures and systems can be considered clean when contamination, unrestorable contaminated materials, and debris have been removed, and surfaces are visibly free of dust. The term “visibly” can include direct and indirect observation (e.g., using a white or black towel to wipe a surface to observe for cleanliness). Also, remediated areas should be free of malodors associated with microorganisms. At that point, it is probable that structural components and systems have been returned to Condition 1. The evaluation can also include moisture measurements and the use of a laser particle counter. If visible mold, dust, or debris have not been removed, malodors are present or initial cleaning is questionable, repeating the cleaning process may be warranted.

### 12.2.12 Post-Remediation Verification

Following post-remediation evaluation by the remediator, it may be requested or required to verify the return of a structure, systems or contents to Condition 1. In such situations, post-remediation verification should be performed by an independent IEP. It is recommended that:

- the criteria and process used in the post-remediation verification be documented;
- the remediator and IEP clarify the minimum performance requirements of post-remediation verification prior to commencement of work; and
- if the IEP conducting any activity such as assessment or post-remediation verification is not independent from the remediator, they should disclose in writing to the client that they are deviating from the Standard.

### 12.2.13 Breakdown of Containment

Remediators should:

- HEPA vacuum and damp wipe containment materials before containment is dismantled;
- conduct a thorough post-remediation evaluation of the cleaned containment area after cleaning the containment; and
- when post-remediation verification is requested or required, verify the containment passes the verification process before being dismantled.

## 13 HVAC Remediation

The design, installation, operation, and maintenance of HVAC systems are important factors in controlling microorganism germination, growth, amplification, and dissemination. In addition, mold growth from other causes can be carried to the interior of HVAC system components where it can accumulate and degrade system operation. When system operation is affected, this can result in poor environmental control that allows widespread condensation to form. This can lead to the spread of contamination by the system and increase the scope of the mold problem by dispersing contaminants throughout a building.

Ductwork with a non-porous internal surface (e.g., galvanized sheet metal) responds well to remediation. However, sections of internally lined ductwork, duct board or flexible ductwork that

are Condition 3 cannot be successfully cleaned, and therefore such ducting with Condition 3 should be removed and replaced.

## 13.1 HVAC Operational, Maintenance and Modification Issues

When a building is being remediated, special attention should be given to remediating the HVAC system that supports the indoor environment where remediation is taking place. Also, the HVAC system should be inspected in the manner described within this section and returned to Condition 1 as part of the overall mold remediation project. It is recommended that HVAC deficiencies be identified for correction by the customer's HVAC service contractor. Otherwise, the remediation can fail and growth can return, adversely affecting environmental conditions within the building.

In situations with visible surface mold growth or suspected hidden growth, the cause should be identified and moisture sources controlled or corrected before remediating either the building components or the HVAC system. Remediating the HVAC system alone might not be sufficient to prevent future mold growth. The services of a qualified mechanical or professional engineer may be needed to recommend repairs or modifications that mitigate the likelihood of reoccurring mold contamination. Implementing such recommendations is not necessarily the responsibility or within the expertise of the remediator. At a minimum, however, customers should be advised by the remediator of known HVAC conditions that put the integrity of the building at risk.

## 13.2 HVAC Engineering Considerations

HVAC systems should be inspected for cleanliness and returned to Condition 1 as part of a building remediation. The National Air Duct Cleaners Association (NADCA) standard, *Assessment, Cleaning and Restoration of HVAC Systems* (*ACR* 2013 or current version) includes specifications for acceptable levels of cleanliness for HVAC systems and appropriate inspection techniques. It is recommended that HVAC system remediation be scheduled after other building remediation is completed in order to avoid cross-migration of particulate into the mechanical system. When this is not practical and the environment is Condition 2 or 3, HVAC system components should be isolated from the environment as part of the overall building remediation strategy. Remediated HVAC system components that can potentially be exposed to recontamination during ongoing building remediation activities should be re-assessed after building component demolition procedures and reconstruction activities are complete. Reassessment should be conducted before removing containments or other engineering controls.

When providing temporary heating, cooling, and other environmental controls within areas undergoing remediation, equipment should be decontaminated and bagged or wrapped prior to being removed from the workspace. When air-handling systems are operational, remediators should consider where to locate containment so that contaminants are not drawn into the fresh-air intake and that the negative pressure created by the fresh-air intake does not adversely affect the pressurization differential of the contained area.

In addition to a cleanliness inspection, a complete engineering assessment of the design and working condition of the entire HVAC system should be considered, depending on the Conditions (1, 2 or 3) that exist in the project. This is especially important if temperature or relative humidity cannot be maintained within the affected area in compliance with the requirements of American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) Standard 55; temperatures, relative humidity, or airflow varies between different areas of the building, or mechanical components are not in good working condition or repair. Modification to an HVAC system shall conform to applicable building codes.

Filtration upgrades should be considered in buildings that have experienced Condition 3 as part of a strategy to prevent future problems. In many cases, existing filter housings or tracks can accommodate upgraded filtration. In others, modifications should be made to the HVAC system layout to accommodate upgraded filtration. Whenever modifications are made to an HVAC

system to accommodate upgraded filtration, airflow restrictions below design levels should not occur.

## 13.3 HVAC System Cleaning and NADCA ACR

If enough information is currently available to determine that Condition 2 or 3 exists throughout affected systems, remediation work plans, protocols, and specifications can be developed. In situations where there is visible mold growth and it cannot be determined that Condition 2 or 3 exists throughout the affected system, remediators should engage or recommend that customers or clients engage an IEP to assess the affected system.

Once the HVAC system's condition has been assessed for cleanliness and mechanical corrections or enhancements have been completed, cleaning should be carried out in accordance with procedures described in *NADCA ACR, 2013* or current version, or equivalent industry standards.

### 13.3.1 Use of a Mechanical System as a Dehumidification Device

Use of an HVAC system is often considered during the initial evaluation of a moisture-related problem to assist in the dehumidification process. Using mechanical systems during remediation often results in the need to decontaminate the system after remediation and prior to post-remediation verification. In order to determine if the HVAC system needs remediation, it should be inspected and cleaned using the procedures outlined in the *NADCA ACR 2013,* or current version.

HVAC systems are not recommended for dehumidification or drying of a structure during a mold remediation project. When considering usage of an HVAC system for dehumidification, it is recommended that the following be considered:

- operational building pressurization during HVAC usage;
- airflow volume across the evaporative coil;
- fresh air intake status;
- air distribution network and potential for particle migration;
- protection of the mechanical system for the duration of the project;
- reheat coil operation and sequencing;
- decontamination of the HVAC system after usage;
- the original engineering design for the HVAC system;
- impact on the overall building strategy; and
- migration of particulate to unintended areas.

### 13.3.2 Fungal Contamination Considerations

Determining the extent of fungal contamination present in an HVAC system can be challenging. Cleanliness criteria are set forth in *NADCA ACR 2013* or current version. Multiple cleanings might be required to achieve a satisfactory level of cleanliness. On occasions, more rigorous criteria can be specified, including surface testing procedures normally used on surfaces outside of an HVAC system; however, interpretation of test results may be more difficult than with exterior environmental surfaces and air samples. Individuals procuring and interpreting such samples should be IEPs with specific training in identifying mold issues within HVAC systems.

The interior of evaporators or cooling coils can be especially difficult to clean through all layers of the coil. If a satisfactory level of cleanliness cannot be achieved, replacing coils is recommended.

Attention should be given to inspecting fan blades and blower wheels. In cases where fan and blower surfaces cannot be returned to a smooth surface condition, the component should be replaced.

HVAC components should be isolated from portions of the building where remediation is taking place. It is recommended that HVAC systems be remediated after other remediation activities have been completed. Normally it is not necessary to build containment for HVAC system cleaning. Under unusual circumstances or in sensitive locations such as active health care facilities, containment should be constructed. In addition, if an air handler is located in an equipment room that is also part of the conditioned space, containment should be constructed. Air handlers located outdoors or on rooftops require only limited containment procedures during cleaning. Remediators should use appropriate personal protective equipment while cleaning HVAC systems and isolate the portion of the system being cleaned from uncontaminated areas by blocking air ducts or supply vents. Prior to blocking these, a competent person should evaluate the impact on system operations. Sufficient ventilation is needed to dilute emissions from any cleaners used. Residue from cleaning products should be completely rinsed from surfaces before the equipment is placed back into operation.

Using an antimicrobial product may be considered to inhibit future mold growth in an HVAC system, but only after mechanical surface cleaning has been performed and the need for such treatment has been deemed necessary. Antimicrobial use should never be substituted for complete removal of mold contamination. In addition, any product used shall be specifically registered by the EPA or other applicable regulatory agency for use in HVAC systems; have undergone a risk assessment for such use; and contain specific and detailed label directions. Care should be taken to use antimicrobial products in compliance with applicable regulations. Such products shall be used in accordance with safety regulations. If label directions cannot be followed completely, antimicrobial use shall be avoided.

Remediators should understand the uses and limitations of resurfacing coatings, and communicate product use and information to the owner/client prior to application. If the project involves post remediation verification (PRV) by an IEP, the PRV should be conducted prior to application of any coating: including resurfacing coatings, repair coatings, or HVAC sealants.

Coatings and sealants used in HVAC systems which claim antimicrobial performance, shall be registered by the EPA or other applicable regulatory agency specifically for use in HVAC systems; have undergone a risk assessment for such use; and contain specific and detailed label directions. If label directions cannot be followed completely, including the use of personal protective equipment, such use shall be avoided. When coatings are used, users shall comply with EPA, state, and local regulations. Building codes and/or engineering specifications require that coatings have been tested to certain ASTM test methods as required by the performance protocols of the National Fire Protection Association (NFPA) 90A/90B. Before using any resurfacing coating, copies of this testing should be obtained from the product manufacturer.

## 14 Contents Remediation

Effective remediation of contents from a mold-contaminated environment includes the following tasks:

- categorize contents items by their likely restorability, which includes:
  - considering the extent of mold contamination and water damage to the structure and its impact on the probable condition of the contents located in different areas;

- visually inspecting for evidence of mold contamination, and possibly correlating the inspection with the results of a pre-remediation assessment performed by an IEP to determine the content's Condition (1, 2 or 3),
- determining the basic composition of content materials. Contents' composition and condition determine their ability to be cleaned. General categories of content material composition are defined for purposes of this section as follows:
  - **Porous:** Materials that easily absorb or adsorb moisture and, if organic, can easily support fungal growth (e.g., clothing and other textiles, padded or upholstered items, leather, taxidermy, paper goods, many types of fine art);
  - **Semi-porous**: Materials that absorb or adsorb moisture slowly and, if organic, can support fungal growth; and
  - **Non-porous:** Materials that do not absorb or adsorb moisture or those that have been surface treated and do not easily support fungal growth (e.g., finished wood, glass, metal, plastic);

- providing options as to the relative cost of cleaning versus the cost of replacement;
- determining cleaning requirements in order to decide whether to clean contents on-site or in-plant;
- determining those contents requiring remediation by specialty cleaning professionals (e.g., fine art, electronics, rare books, priceless keepsakes); and
- communicating with an IEP, if involved in the project, regarding issues of sampling, analysis, and verification testing.

## 14.1 Inspection and Evaluation for Restorability

- The restorability of contents is dependent upon the following factors:
  - condition of the contents;
  - basic material composition of the contents;
  - cost of remediation;
  - financial value or cost of replacement; and
  - other types of value (e.g., sentimental, legal, artistic, cultural, historical).
- The type of service required for each content item may be categorized in one of three ways:
  - restore – Items that will be cleaned to Condition 1 and returned to the customer;
  - dispose – Items that will not be cleaned because either the customer does not want them or the remediation cost exceeds the item's value. (See "Disposal" section below); and
  - preserve – Items that are irreplaceable but cannot be returned to Condition 1. This category only applies to irreplaceable porous or irreplaceable semi-porous items with Condition 3 contamination. When preservation is required, the remediator should follow the additional precautions set forth in Section 14.4 "Unrestorable Contents."

- The condition of the contents can be determined when the inspection provides:
  - enough information to determine that Condition 1 exists throughout the structure, systems, or area, and therefore no remediation of contents is required; or
  - enough information to determine that Condition 2 or 3 exists throughout the affected structure, systems, or area, and therefore an assumption can be made that all of the contents are either Condition 2 or 3; or
- There is not enough information available to determine that Condition 2 or 3 exists throughout the affected structure, systems, or area, and therefore the remediator should engage or recommend to the customer or clients that they engage an IEP to assess the contents to make the determination. When sampling is requested or required, it is recommended that a cross-section of content types be included and that an independent IEP should conduct such activities.

Materially interested parties should participate in the decision about whether to restore or dispose of contents.

## 14.2 Removing Contents from Affected Areas

Before removing potentially contaminated contents from a contaminated area to a cleaner area or to another location, the remediator or other qualified professional should:

- inspect all contents prior to inventory;
- document the condition of the contents, including actual or perceived value of one or more of the “other types of value” mentioned above;
- photo-document the placement and condition of contents;
- separate affected from unaffected contents where practical; and
- ensure that clients agree and authorize disposal of contaminated contents in writing before disposal.

Contaminated or potentially contaminated contents should be appropriately packaged or decontaminated, when moved into or through uncontaminated areas (Condition 1) to prevent the spread of contaminants into unaffected areas and the exposure of workers or occupants to contaminants. The exterior of the packaging on its way through a decontamination chamber system should be decontaminated by cleaning or wrapping a fresh layer of packaging material around the item just before it exits the decontamination chamber system. Care should be taken when packaging items not to trap moisture inside the packaging, especially if contents are to be moved into a storage area where environmental conditions may be different.

### 14.2.1 Inventory, Packing, Transport and Storage

Before contents are packed out, a detailed inventory should be prepared containing at least the following information:

- description of each item;
- quantity of each item;
- Condition (1, 2, or 3) of each item;
- location of each item within the structure; and
- an individually assigned inventory number for each item, box, or group of items.

The customer should sign a form accepting the inventory as representative of the existence and actual physical condition of the contents before the remediator assumes responsibility for

contents transport and processing. Contents should be packed, transported and stored using appropriate measures to minimize breakage/damage, loss, exposure to employees, occupants or the public, and, contamination or cross-contamination of unaffected areas of the building. Vehicles, equipment, storage vaults, or facilities that become contaminated in the course of remediation should be decontaminated.

Storage conditions should be controlled while contents are in the remediator's custody to minimize conditions favorable to mold growth. Contaminated contents should be cleaned as soon as practical rather than being stored for long periods while contaminated, and cleaned contents should be stored in a clean area that is separate from the area where contaminated contents are stored. They should not be returned to contaminated areas of the structure until both have attained Condition 1.

## 14.3 Cleaning Contents – General Discussion

The goal of contents remediation is to clean items to Condition 1 by physically removing fungal contamination and odors. When additional damage or contamination to contents is discovered, it should be documented, and materially interested parties informed within a reasonable period of time. It is recommended that appropriate appearance enhancement processes be applied to the items after their return to Condition 1 has been completed. Contents can be cleaned either on-site or in-plant. Whether contents are cleaned onsite or in-plant, appropriate precautions should be taken to prevent spreading contaminants from work or storage areas into unaffected areas.

### 14.3.1 Outdoors versus Multi-stage Cleaning Chamber

Condition 2 or 3 contents should be cleaned either outdoors or in a multi-stage cleaning chamber.

#### 14.3.1.1 Outdoors

When cleaning contents outdoors:

- work performed without containment should be performed at a distance from a structure, air intakes, or unprotected people that allows adequate dispersal of released contaminants;
- remediation workers handling or working near contaminated contents shall wear appropriate PPE; and
- remediators should take other relevant factors into consideration before deciding to perform contents cleaning outdoors (e.g., weather, security, possible public alarm at the sight of people attired in PPE).

#### 14.3.1.2 Multi-stage Cleaning Chamber

A multi-stage cleaning chamber maximizes removal of contaminants by allowing two or more "rounds" of cleaning to be performed on each item. For the system to be effective, appropriate airflow and air pressure relationships should be maintained.

### 14.3.2 Cleaning Methods

When selecting a cleaning method, remediators should choose the most appropriate one for the situation. Knowing the material composition, the condition, and the location where contents are to be cleaned, is instrumental in selecting a method. Also, a combination of methods may be necessary to facilitate remediating contents.

#### 14.3.2.1 Air-based Methods

- HEPA vacuuming – This method uses a vacuum with a filter that is 99.97% efficient in removing particles at 0.3 micrometers. It is recommended that this method be applied at least three times in a cross pattern to each affected item.
- Air washing – This method should only be used outdoors or in laminar airflow, high-volume cleaning chamber or in other situations where engineering controls are adequate to prevent excessive buildup of contaminants.

#### 14.3.2.2 Liquid-based Methods

The liquid-based cleaning method relies on water combined with physical or mechanical cleaning processes to dislodge contamination. High-pressure washing techniques should be limited to situations in which aerosolization is not a critical factor (e.g., outdoors).

#### 14.3.2.3 Abrasive Methods

Abrasive methods of cleaning rely on the use of a medium or material to dislodge contamination. These techniques should be used with caution, especially those involving abrasive blasting. By definition, abrasive blasting methods have a strong tendency to aerosolize the particles they remove from the surface. This can lead to extremely high levels of contaminants in the air, potentially creating unacceptable exposure for workers or occupants or allowing spread of contaminants into previously unaffected areas. Some media can also create a difficult cleanup problem (e.g., sand, soda, sponge corn husks, and rice hulls) or lead to the development of unacceptable worker exposure (e.g., dry ice blasting in an enclosed space creating excessive levels of $CO_2$ in the work area). The use of organic media is not recommended due to the potential for hypersensitivity reactions, or the creation of combustible dust, and providing a potential growth medium.

Abrasive blasting techniques should be limited to situations in which aerosolization is not a critical factor (e.g., outdoors), or can be adequately controlled (e.g., high-volume, laminar airflow cleaning chambers).

### 14.3.3 Appearance Enhancement

Although removing contaminants is the primary focus of mold remediation, it is recommended that customer expectations be addressed and that contents be “appearance enhanced” to the extent practical before being returned to the customer. The presence of visible stains is not an indication that an item is contaminated. The removal of mold stains can be included in appearance enhancement.

### 14.3.4 Cleaning Porous, Semi-Porous and Non-Porous Contents

Condition 3 porous contents are generally not restorable. It is recommended that special care be taken with porous Condition 1 contents to prevent potential contamination, which can occur while contents are stored in an off-site facility. HEPA-vacuuming and brushing with a soft bristle or tampico brush while on a downdraft cleaning table are the most commonly used methods for cleaning Condition 2 porous contents. Air washing, in the proper situation, can also be effective on many porous items. However, air washing should be performed in a controlled work area where the massive aerosolization associated with this method will not pose a health risk to workers or occupants during the process.

Most cleaning processes should start and end with HEPA-vacuuming. Rapid drying after wet cleaning and appearance enhancement, as necessary, follows most cleaning methods. It is recommended that appearance-enhancement processes take place after Condition 1 has been obtained.

#### 14.3.4.1 Cleaning Porous Contents

Porous materials are items that easily absorb or adsorb moisture and, if organic, can easily support fungal growth (e.g., clothing and other textiles, padded or upholstered items, leather, taxidermy, paper goods, many types of fine art). After carefully examining items for unrestorable water damage, the proper cleaning method should be selected based on material composition and manufacturer's instructions. It is recommended that contaminated clothing and other textiles be HEPA vacuumed prior to disturbing them at their location within the structure. The following specific guidance supplements the general guidance provided above.

- **Porous Textiles:** Clothing, fabric, and other textile items.
  - **Condition 2 –** Porous contents with Condition 2 contamination may or may not be restorable using appropriate cleaning methods based on material composition. Use of a detergent in the laundering process facilitates the removal of contaminants. The laundering process can also be enhanced by increasing the water temperature. Care should be taken not to exceed the manufacturer's water temperature recommendations.
  - **Condition 3 –** Porous contents with Condition 3 contamination are usually unrestorable based on material composition.
- **Porous Furnishings:** Area rugs, loose carpet, upholstery, mattresses, wicker, and similar items.
  - **Condition 2 –** Porous contents with Condition 2 contamination are usually restorable using appropriate cleaning methods based on material composition. Area rugs and carpet may be cleanable in a controlled, in-plant facility. Determining the severity of contamination may necessitate an assessment. The spreading of spores during the cleaning process is a potential problem. Submersion methods that clean rugs or carpet under water are less likely to aerosolize spores.

    If items such as pillows, sofa cushions, mattresses, or leather products have been used while contaminated, attempts to return the item to Condition 1 usually are unsuccessful. Disposal is recommended.
  - **Condition 3 –** Porous contents with Condition 3 contamination are usually unrestorable based on material composition.
- **Paper Goods:** Books, documents, manuscripts, family records, scrapbooks, photographs, and similar items.
  - **Condition 2 –** Porous contents with Condition 2 contamination are usually restorable using appropriate cleaning methods based on material composition. Air washing can be effective. However, air washing should be performed only in a properly controlled work area, or using controlled techniques where massive aerosolization will not pose a health risk to workers or occupants.

    Valuable or irreplaceable documents that cannot be cleaned or decontaminated may be encased, laminated, or otherwise sealed.
  - **Condition 3 –** Porous contents with Condition 3 contamination are usually unrestorable, based on material composition. Cleaning may require a specialized conservation process and might not be successful. Valuable or irreplaceable documents that cannot be cleaned or decontaminated may be encased, laminated, or otherwise isolated.
- **Fine Art:** Paintings, sculpture, works of art, and similar items.
  - **Condition 2 –** Porous contents with Condition 2 contamination are usually restorable using appropriate cleaning methods based on material composition. Remediation of

mold-contaminated fine art at Condition 2 should be performed only by qualified, experienced specialists, primarily due to the high value of the items involved.

- **Condition 3 –** Porous contents with Condition 3 contamination are usually unrestorable based on material composition. Remediation of mold-contaminated fine art at Condition 3 might not be completely successful and can be quite expensive. These services should be performed by qualified, experienced specialists.

#### 14.3.4.2 Cleaning Semi-porous Items

Semi-porous materials are those that absorb or adsorb moisture slowly and, if organic, can support fungal growth (e.g., unfinished wood, masonry). The following specific guidance supplements the general guidance provided above.

- **Condition 2 –** Semi-porous contents with Condition 2 contamination are usually restorable using appropriate cleaning methods. Air washing or abrasive blast cleaning with an appropriate media may also be effective.
- **Condition 3 –** Semi-porous items are often unrestorable due to staining, discoloration, and decay caused by mold enzymes unless growth is in a biofilm rather than in the wood. If growth has penetrated wood, aggressive cleaning methods such as HEPA-assisted hand sanding, abrasive blast cleaning with an appropriate media, and wire or other aggressive brushing (preferably on a downdraft cleaning table) may be required.

End results of such aggressive cleaning methods may result in an appearance that is unacceptable to the customer. Attempts should be made to determine if results will be acceptable before extensive cleaning is performed.

#### 14.3.4.3 Cleaning Non-porous Items

Non-porous materials are those that do not absorb moisture or have treated surfaces and do not easily support fungal growth (e.g., finished wood, glass, metal, plastic). The following specific guidance supplements the general guidance provided above.

- **Condition 2 –** Non-porous contents with Condition 2 contamination are restorable and cleaned using appropriate methods based on material composition.
- **Condition 3 –** Non-porous contents with Condition 3 contamination are usually restorable and can be cleaned using appropriate methods based on material composition. Cleaning can usually be accomplished by using one or a combination of the following: detergent washing and rinsing; ultrasonic cleaning; HEPA-vacuuming plus damp wiping with a suitable cleaning agent; or other process suitable for the particular item; followed by removal of cleaning residue.

### 14.4 High-value and Irreplaceable Contents

High-value or irreplaceable contents are those with high financial value or replacement cost. Irreplaceable contents are those with high historical, sentimental, cultural, artistic, legal, or other types of value. Extraordinary cleaning procedures may be appropriate for these contents. Such procedures can be as simple as repeated cleanings using standard practice(s) as described above, or they may require highly specialized expert services. For many categories of high-value and irreplaceable contents, specialty remediation services are available. Some remediators may provide these services in-house, while others outsource them.

These specialty remediation services include but are not limited to:

- art restoration or conservation for paintings, valuable books, works of art on paper, documents, objects, frames, tapestries, and other textiles;

- doll restoration;
- freeze drying for valuable books and documents (does not remove mold, but might prevent or arrest mold growth if wet books are dried quickly);
- area rug cleaning and repair;
- electronics and machinery restoration;
- data recovery; and
- musical instrument restoration.

Such additional or specialty remediation procedures may not return these items to Condition 1. Depending on the item restored and the level of contamination, an IEP may be necessary to determine whether or not an item has been restored to Condition 1. If items are not restored to Condition 1, then the materially interested parties should be consulted to determine an acceptable course of action with respect to the disposition of the items.

## 14.5 Unrestorable Contents

Unrestorable contents are those on which remediation is not attempted due to a lack of cost-effectiveness, severity of damage, or other factors, as well as those items for which remediation procedures have not been effective. After being categorized as unrestorable, they should be inventoried, photo-documented, and removed or disposed of in compliance with the removal and disposal recommendations in this document.

Unrestorable contents should not be disposed of without the express written permission of the customer, the adjuster (if applicable), and other materially interested parties. These parties authorize disposal by signing an appropriate form listing the items. It is recommended that unrestorable items be removed from the work area before remediation services begin.

When returning contents that have not been restored to Condition 1 to customers, or when performing preservation services on irreplaceable items, remediators should inform customers of the circumstances involved (i.e., why the contents were not restored to Condition 1), advise customers in writing of the potential consequences of accepting contaminated contents, and attempt to obtain a written waiver and release of liability from customers for those potential consequences.

## 14.6 Disposal and Waste Material Handling

Waste materials should be moved from the work area to the waste container in a manner that minimizes the possibility of cross-contamination or occupant or worker exposure. Mold-contaminated, unrestorable contents should be handled and removed carefully, preferably packaged in heavy-gauge polyethylene such as 6-mil disposal bags, or securely wrapped in 6-mil polyethylene sheeting, unless contents are disposed directly through a waste-out tunnel or transfer system. Sharp items capable of puncturing polyethylene material should be packaged in such a way as to prevent them from penetrating the material before being bagged or wrapped. Polyethylene surfaces should be HEPA-vacuumed, damp wiped with an appropriate cleaning agent, double-bagged or wrapped in a fresh layer of polyethylene just prior to being removed from the contaminated area or decontamination chamber. Respirators are not required outside while transporting double-bagged materials. Bags should not be dropped, thrown, or handled roughly. If bagged or wrapped disposal materials rupture outside the containment, transporting workers shall don appropriate PPE immediately, secure the area from public access, initiate clean-up (HEPA-vacuuming), and contain the debris.

If timely disposal of contaminated contents is not practical, it is recommended that staged debris be stored in a reasonably secure location. Generally, no special disposal provisions are

recommended for mold-contaminated materials; however, federal, state, provincial, and local disposal laws and regulations apply and shall be followed. Placing descriptive warning labels on bags and wrapped materials is recommended to discourage individuals from opening or removing them from the disposal site. It is recommended that label language be factual, not overstated or unnecessarily alarming.

### 14.7 Post-Remediation Evaluation

Post-remediation evaluation should be conducted by remediators to evaluate whether or not remediation has been completed. This evaluation involves implementing internal quality control procedures. The evaluation begins with subjective criteria that includes but is not limited to visual inspection focusing on acceptable removal of visible mold, and olfactory inspection focusing on removal of malodor.

Remediated contents can be considered clean when contamination, unrestorable contaminated items, and debris have been removed, and surfaces are visibly free of dust. The term “visibly” can include direct and indirect observation (e.g., using a white or black towel to wipe a surface to observe for cleanliness). Also, remediated contents should be free of malodors associated with microorganisms. At that point, it is probable that the contents have been returned to Condition 1. The evaluation can also include moisture measurements. If the visible mold, dust or debris has not been removed, malodors are present or initial cleaning is questionable, either repeat processing may be warranted or items may be categorized as not restorable.

### 14.8 Contents Post-Remediation Verification

Following post-remediation evaluation by the remediator, it may be requested or required to verify the return of the contents to Condition 1. When post-remediation verification is not performed on contents, remediators should inform customers of the circumstances involved, advise customers in writing of potential consequences of accepting contaminated contents, and attempt to obtain a written waiver and release of liability from customers for those potential consequences.

When sampling is requested or required, it is recommended that a cross-section of content types be included and that an independent IEP should conduct such activities.

## 15 Post-Remediation Verification

Following post-remediation evaluation by the remediator, it may be requested or required to verify the return of the structure, systems, or contents to Condition 1. In such situations, post-remediation verification should be performed by an independent IEP. If the IEP conducting any activity such as assessment or post-remediation verification is not independent from the remediator, they should disclose in writing to the client that they are deviating from the Standard. It is recommended that the criteria and process used in the post-remediation verification be documented.

The post-remediation verification can include subjective or objective criteria. Subjective criteria can include but are not limited to visual inspection and odor detection and characterization. Objective criteria can include but are not limited to analytical testing (e.g., moisture monitoring, temperature and relative humidity) and environmental sampling.

Post-remediation verification provides a measure of assurance within sampling, testing, and analysis limitations that the structure, systems, or contents have been remediated to Condition 1.

# 16 Indoor Environmental Professional

The IICRC S520 defines an indoor environmental professional (IEP) as an individual who is qualified by knowledge, skill, education, training, certification or experience to perform an "assessment" of the fungal ecology of structures, systems, and contents at the job site, create a sampling strategy, sample the indoor environment, submit to an appropriate laboratory or individual, interpret laboratory data, determine Condition 1, 2, and 3, and verify the return of the fungal ecology to Condition 1.

Using the IICRC S520 as guidance, a qualified remediator can use the preliminary determination to develop a scope of work (work plans, protocols, or specifications) for a mold remediation project. However, when a pre-remediation assessment or post-remediation verification is requested or required, it should be performed by an IEP. The assessment information can assist the remediator in developing additional technical specifications, detailed protocols and post-remediation verification parameters.

It is preferable that the IEP be an unbiased resource. An IEP engaged to perform pre-remediation assessment or post-remediation verification should be independent of the remediator. If the IEP conducting any activity such as assessment or post-remediation verification is not independent from the remediator, they should disclose in writing to the client that they are deviating from the Standard. In some jurisdictions, the law may require that the inspection and assessment function be performed by an individual or entity independent of the remediator. If there are complexities, complications, or conflicts, a remediator may need to request additional input or guidance from the IEP.

# 17 Final Documentation

After post-remediation evaluation and verification, it is recommended that the remediator take appropriate action to close the job, complete closing paperwork, and project documentation. Final documentation can include a certificate of completion, which involves entering into an agreement with the customer acknowledging the completion of the project; documenting the post-remediation evaluation and verification; obtaining final project payment and releasing liens; or filing lien notices as necessary. In addition, there can be notices or other requirements specific to the laws and regulations of the jurisdiction in which a mold remediation project is located.

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