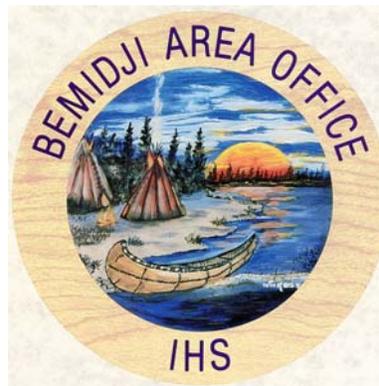


**Bemidji Area Indian Health Service
Office of Environmental Health and Engineering
Environmental Health Services Section**



**Guidelines on Assessment and Remediation
of Fungi in Indoor Environments**

This document was developed using the best practice recommendations of Federal, State, City, University, and private organizations. It is designed to provide a condensed document that provides guidance that can assist Bemidji Area Programs, Tribal Programs, or other Programs in determining the best methods and practices to effectively and with financial responsibility, respond to complaints about indoor fungi issues and problems.

**Indian Health Service
Bemidji Area Office of Environmental Health and Engineering
Environmental Health Services Section
Guidelines on Assessment and Remediation of Fungi in Indoor
Environments**

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Executive Summary

The Bemidji Area Indian Health Service increasingly must respond to the complexities of addressing indoor mold and moisture problems. A variety of concerns have been raised when such problems occur or are suspected. The goal of this document is to assist the Indian Health Service Environmental Health Officers, Tribal Environmental Health Staff, and other Tribal Program staff in dealing with indoor mold and moisture issues. This document will provide this assistance during initial efforts to investigate the causes and severity of such problems and help with finding appropriate cost-effective solutions.

Two of the key messages of this document are that the most effective way to prevent mold growth in the indoor environment is the control of moisture within that environment and that from a health perspective any home or facility should rarely, if ever, need to have mold testing performed in their initial investigation of a mold problem. Briefly, the main reasons for these positions are that:

- No home or building is mold free; however, excessive mold growth should not be tolerated in any environment -- when such growth is evident, the critical cause (excess moisture) should be corrected and the mold removed quickly and be done in a safe and effective manner;
- There are other practical and cost-effective methods for identifying many of the conditions which need intervention; and
- The key to solving a facility or home mold problem will always be to correct the source of excess moisture and remove mold contamination – very often; these can be achieved reasonably well without costly mold testing.

The Bemidji Area Indian Health Service Environmental Health Services Section (BAIHS EHSS) developed this guidance to assist staff of BAIHS EHSS in responding to problems related to indoor mold. Its focus is on practical, cost-effective methods to identify indoor mold and moisture problems and assess the causes. The main objective of any mold investigation should be to locate sites of indoor mold growth, in order to determine how to best control the underlying moisture problem and remove the contamination.

This document is not a legal mandate and should be used as a guideline. Currently there are no Federal regulations or standards for evaluating potential health effects of fungal contamination or for remediating the contaminated areas. These guidelines are subject to change as more information regarding fungal contaminants becomes available.

Introduction

The Bemidji Area Indian Health Service Environmental Health Services Section (BAIHS EHSS) developed this guidance to assist staff of BAIHS EHSS in responding to problems related to indoor mold. Its focus is on practical, cost-effective methods to identify indoor mold problems and assess the causes. The main objective of any mold investigation should be to locate sites of indoor mold growth, in order to determine how to best control the underlying moisture problem and remove the contamination.

Mold contamination in the indoor environment is a complex and evolving issue that currently involves a great deal of uncertainty. This guidance is intended to represent “best practices” advice of a general nature for the types of situations many facilities and homes have been struggling with recently. When extensive hidden mold growth is present or when problematic contamination has spread beyond the initially identified areas, these guidelines alone may not be sufficient. This document does not provide comprehensive guidance on remediation of severe mold contamination. These situations may require the BAIHS EHSS or the Tribal Program to seek the assistance of a professional mold assessment and remediation expert.

There may be instances when mold testing is performed – hopefully for sound reasons; in addition, “investigative” techniques not described in this document may be used to assist remediation efforts. **However, it is important for anyone using this guidance document to understand that it is usually not necessary to test for mold, unless both sampling and interpretation of the data can be done in a way that meets the investigation objectives with an acceptable degree of certainty.**

This document contains the following five sections:

1. Background and Potential Health Issues
2. Testing
3. Environmental Assessment
4. Remediation
5. Risk/Hazard Communication.

This document is not a legal mandate and should be used only as a guideline. Currently, there are no Federal regulations or standards for evaluating potential health effects of fungal contamination or for remediating the contaminated areas. These guidelines are subject to change as more information regarding fungal contaminants becomes available.

1. Health Issues

1.1 Health Effects

Mold is a commonly used term used to refer to a number of various organisms within the Kingdom Fungi. The Kingdom Fungi consists of eukaryotic, heterotrophic organisms such as molds, slime molds, mildew, yeasts, rusts, lichens, and mushrooms (Alexopoulos et al., 1996). Fungi are ubiquitous in the environment. Most fungi are saprophytic and play a vital role in the decomposition and recycling of organic material within the environment.

Mold refers to filamentous fungi that grow on most any type of organic substrate. Structurally, mold consists of intertwined microscopic multinucleated filaments referred to as hyphae. The total mass of hyphae that makes up a mold colony is referred to as the mycelium. The vegetative mycelium anchors the mold and absorbs nutrients from the substrate. The aerial mycelium produces asexual reproductive spores (Alexopoulos et al., 1996).

Mold and the so-called toxic molds have become a growing concern as an indoor air pollutant and possibly a public health concern. While many species of fungi live as commensal organisms in or on the surface of the human body, some fungi have been identified as adversely affecting human health through one of three processes: 1) allergy; 2) toxicity; and 3) infection (Harden, Kelman and Saxon 2002).

1.1.1 Allergy and other Hypersensitivity Effects

The most common form of hypersensitivity to mold is an allergy to fungal proteins. This reactivity is triggered by the inhalation of mold spores or hyphal fragments that can lead to allergic asthma or allergic rhinitis. Approximately 10% of the population has allergic antibodies to fungal agents (Horner, 1995). The most common symptoms associated with allergic reactions to mold are runny nose, eye irritation, cough, congestion, and aggravation of asthma.

Another form of hypersensitivity that may arise from mold is hypersensitivity pneumonitis (HP). HP is an exaggerated and intense local immune reaction to inhaled fungal or other protein. Unlike immediate hypersensitivity such as allergic rhinitis or allergic asthma, HP is not associated with normal or modestly elevated levels of mold spores. Rather, in most cases HP arises from occupational exposures (Harden, Kelman and Saxon, 2002).

Rare forms of hypersensitivity include allergic bronchopulmonary aspergillosis (ABPA) and allergic fungal sinusitis (AFS). These conditions arise from allergic reactions arising from fungal growth within a person's airway. ABPA typically occurs in allergic individuals who have airway damage from previous illnesses leading to bronchial irregularities that impair normal drainage (Greenberger, 1986). Irregularities and airway damage predispose and contribute to the fungal colonization of these areas while adjacent tissue remains un-impacted (Zhaoming, 1996). AFS is similar to ABPA in that fungal colonization occurs due to poor drainage (Katzenstein, Sale & Greenberger, 1983).

However, AFS is characterized by fungal colonization within the sinus cavity. AFS can also occur due to an underlying allergic disease.

While there is a growing body of literature that has associated a variety of diagnosable respiratory illnesses, particularly in children, with residence in damp or water damaged homes, recent studies have indicated that mold spores are not the sole cause for these illnesses. Mold generally thrives in conditions where indoor relative humidity exceeds 60%. Relative humidity at this level or greater is also an ideal environment for dust mites and bacteria. Bacterial and dust mite activity increases dramatically when indoor relative humidity is 60% or higher.

Recent studies have documented increased inflammatory mediators in the nasal fluids of persons in damp buildings. However, these studies found that mold spores were not responsible for this change; rather, dust mite infestation and bacterial growth were found to be the culprit of this change (Roponen, 2002). The relative contribution of each allergen (dust mites, bacteria and mold) to hypersensitivity reactions is unknown at this time. However, mold, bacteria and dust mites likely all play a role in hypersensitivity reactions, all of which can be minimized by addressing moisture and water intrusion issues in damp or water damaged buildings.

1.1.2 Toxicological Effects

Toxigenic fungi are those fungi able to produce toxins (referred to as mycotoxins). When produced, mycotoxins are found in all parts of the mold including hyphae, spores, mycelia and the substrate on which the mold is growing. The amount, if any, and type of mycotoxins produced by a mold colony depends on the species of mold and a complex interaction of factors such as nutrition, growth substrate, moisture, temperature, maturity of the fungal colony and competition with other organisms. The interaction of these factors that contributes to the production of mycotoxins is currently poorly understood. However, it should not be presumed that the mere presence of a toxigenic species of mold indicates mycotoxins are also present given that under the same growth conditions, the production, quality and profile of mycotoxins produced by a given species of toxigenic fungi can vary widely from mold colony to mold colony (Hardin, Kelman & Saxon, 2002).

Toxicity studies for mycotoxins are scant in the literature. In single-dose studies, *Stachybotrys chartarum* (a.k.a. *Stachybotrys atra*) spores were administered intranasally to mice (Nikulin, et al., 1996) or intratracheally to rats (Rao, Burge & Brain, 2000). High doses (30×10^6 spores/kg and higher) were found to produce pulmonary inflammation and hemorrhage in both studies.

One of these studies explored dose-related responses by administering a range of doses to rats intratracheally. This study demonstrated a graded dose response with 3×10^6 spores/kg being a clear no-effect dose. This no-effect dose in rats corresponds to continuous 24-hour exposure to 2.1×10^6 spores/m³ for infants, 6.6×10^6 spores/m³ for a school age child or 15.3×10^6 spores/m³ for an adult. (This calculation assumes all inhaled spores are retained and uses standard default values for the subpopulations mentioned.)

It is important to note that this calculation likely overestimates the toxicity risk since it assumes a bolus intratracheal dose would induce similar acute toxic effects as gradual inhalation exposure over 24 hours. In reality, a cumulative dose over hours, days and weeks would likely be less acutely toxic than a bolus dose since a bolus dose would likely overwhelm detoxification systems and lung clearance mechanisms (Hardin, Kelman & Saxon, 2002).

In repeat-dose studies, mice were given intranasal treatments with toxic *S. chartarum* spores twice weekly for three weeks. Two dose levels were used in the study: either 4.6×10^6 or 4.6×10^4 spores/kg per treatment for a cumulative dose of 2.8×10^7 or 2.8×10^5 spore/kg over three weeks. Mice given the higher doses of toxic spores experienced severe inflammation with hemorrhage. Mice given lower doses experienced less severe inflammation and no hemorrhage was seen. The lower no hemorrhage, less severe inflammation dose would correspond to continuous 24-hour exposure to 9.4×10^3 spores/m³ for infants, 29.3×10^3 spores/m³ for school-aged children and 68.0×10^3 spores/m³ for adults (Hardin, Kelman & Saxon, 2002).

Human exposure to mycotoxins can occur through inhalation or ingestion. Inhalation exposure occurs when the substrate, fungal fragments or spores are aerosolized. Direct exposure through inhalation of mycotoxins is not likely since mycotoxins are relatively large molecules that are not significantly volatile (Schiefer, 1990). Non-volatile substances do not readily evaporate or 'off-gas' into the environment.

Most documented cases of human and animal poisonings due to mycotoxins involves eating moldy foods. Acute poisoning attributed to inhalation exposure has been documented primarily by agricultural workers exposed to silage or spoiled grain which contained high concentrations of fungi, bacteria and organic debris associated with endotoxins, glucans and mycotoxins (Emanuel, Wenzel & Lawton, 1975), (Di Paolo et al., 1994). Total microorganism counts in these exposures ranged from 10^5 to 10^9 per cubic meter of air or even 10^9 to 10^{10} spores per cubic meter. These exposures were described as a 'fog of particulates' or a 'thick airborne dust' and represent extreme condition not ordinarily encountered in homes, schools or offices (Lacey and Crook, 1988), (Malmberg, Rask-Anderson & Rosenhall, 1993).

In Cleveland, Ohio, a series of cases of pulmonary hemorrhage among infants led to an investigation in 1993-1994 where investigators initially proposed that the cause of the pulmonary hemorrhage in these infants was due to exposures in the home to *Stachybotrys chartarum*. Investigators suggested that very young infants might be unusually vulnerable. Subsequent re-evaluation of the original data by CDC lead a panel of experts to conclude the pulmonary hemorrhage in infants observed in Cleveland could not be causally linked to *S. chartarum* exposure (Hardin, Kelman & Saxon, 2002).

It is important to note that molds do produce microbial volatile organic compounds (MVOCs) in addition to mycotoxins. MVOCs are low molecular weight alcohols, aldehydes and ketones that are responsible for the musty, disagreeable odor typically associated with mold and mildew. They are also responsible for the objectionable taste of

spoiled foods. MVOCs may contribute to many of the health affects experienced by individuals exposed to moldy environments (Hardin, Kelman & Saxon, 2002).

1.1.3 Infectious Disease

Some fungi collectively referred to as dermatophytes, can cause superficial infections on the skin or mucosal surfaces. These superficial infections are very common in normal subjects. Superficial fungal infections include infections of the feet (*tinea pedis*), groin (*tinea cruris*), dry body skin (*tinea corporis*) or nails (*tinea onychomycosis*). Some of the fungal species involved in superficial infections includes *Trichophyton rubrum* (sometimes found growing as an indoor mold) *Microsporum canis* and *T. metagrophytes* (usually found on indoor pets such as dogs, cats, rabbits and guinea pigs). Commensal fungal species typically found on mucosal surfaces also can cause superficial infections. *C. albicans* is one of a number of species associated with infections of mucosal tissues such as thrush and vulvovaginal candidiasis (Hardin, Kelman & Saxon, 2002).

There are a limited number of opportunistic pathogenic fungi known to cause serious illness in healthy individuals. Fungi such as *Blastomyces*, *Coccidioides*, *Cryptococcus* and *Histoplasma*, can infect non-immuno-compromised individuals and may cause a fatal illness if allowed to progress untreated.

Severely immuno-compromised individuals (such as individuals receiving chemotherapy, or recipients of organ/tissue transplants) are at significant risk for severe fungal infections. Fungi known to cause superficial infections or serious systemic infection, such as *C. albicans* or *Histoplasma*, can cause serious illness and even death in the seriously immuno-compromised patient.

1.2 Medical Evaluation

Individuals with persistent health problems/conditions (HIV/AIDS, Cancer patients, Late Stage Diabetes, Surgical Recovery Patients, and similar illnesses/diseases) or health problems that they believe are related to fungi or other bioaerosol exposure should see their physicians or a practitioner who is trained in occupational/environmental medicine or related specialties and are knowledgeable about these types of exposures. The IHS or Tribal Environmental Health Officers should never make any medical conclusions or evaluations of occupants. These individuals are not trained to make such conclusions or evaluations and if pressed to do so should refer these questions or issues to a physician or other medical specialist that has training regarding these types of exposures.

1.3 Medical Relocation

Infants (less than 12 months old), persons recovering from recent surgery, or people with immune suppression, asthma, hypersensitivity pneumonitis, severe allergies, sinusitis, or other chronic inflammatory lung diseases are generally believed to be at greater risk for developing health problems associated with certain fungi. Such persons should be instructed to consult with their physician concerning possible relocation from an affected area during its remediation (see Section 4, Remediation).

In general, a building wide evacuation during the remediation of a mold-impacted area is not necessary. Individuals who are concerned about adverse effects associated with mold exposures during a remediation project should consult with their physician and follow their recommendations concerning medical removal from premises. It should be noted that a building wide evacuation is appropriate in extreme cases of widespread fungal contamination (greater than 100 contiguous square feet in area).

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2. Testing

Consistent with CDC and USEPA BAIHS EHSS does not recommend testing as the first response to an indoor air quality concern. Instead, careful detailed visual inspection and recognition of moldy odors should be used to find problems needing correction. Efforts should focus on areas where there are signs of moisture or high humidity or where moisture problems are suspected. The investigation goals should be to locate indoor mold growth to determine how to correct the moisture problem and remove contamination safely and effectively.

BAIHS EHSS has added this section to explain why it usually does not recommend mold testing as the first response to indoor air quality concerns and to help people better understand what testing can and cannot be expected to do. Mold testing is often not an appropriate or effective way to answer many of the questions that lead people to ask for it. In a great deal of the cases that come to BAIHS EHSS's attention, people seeking mold testing really need a thorough investigation into moisture problems and the damage it can cause. Often times this is something they can do on their own. Appendix A provides a more detailed rationale for these recommendations.

2.1 Limitations of Testing

There are many testing methods that can detect molds. They can be used to find mold particles suspended in air, in settled dust, or growing on surfaces of building materials and furnishings. Some methods can identify a portion of the types of live (viable) molds in a sampled environment, but these may also miss or undercount those that are not live or won't grow or compete well on the laboratory media used to incubate the sample. Other methods provide better quantitative results from a sample, but not very well for identifying molds beyond large spore groups. Even tests that are done well only give a partial estimate of the amount and types of molds actually collected in a sample or in the sampled environment.

It is vital to appreciate that a test result only gives a snap-shot estimate for a single point in time and a single location. How well it represents other locations and times is uncertain since the amounts and types of mold in the environment are always changing. This variability can be especially large for airborne molds, with significant changes occurring over the course of hours or less. Caution must also be used in interpreting surface testing results, since mold growth or deposition may not be uniform over an area and may increase or decrease as time passes. Unless many samples are taken over a period of time and the investigator has been mindful of building operations and activities during the testing, the results might not be very representative of typical conditions; in addition, tests reflecting typical conditions may also miss evidence of problems that only occur infrequently (water leaks during rain storms).

Despite these limitations, there are situations where mold testing by skilled investigators may be valuable, for example, to justify remediation expenses or to document that cleanup has met expectations. In some cases, tests can also provide clues that may help

find hidden mold, but the growth still has to be found by looking for it so that it can be removed. Experienced investigators should evaluate whether testing is warranted and if they are ethical, they should advise against testing whenever the problem can be corrected without it. Testing may be useful as part of an investigation, but it is never a substitute for a thorough visual inspection.

Doing mold testing well is often expensive. Programs should recognize that if testing is not needed or it is done poorly, the money spent for testing will not be available to them to make the repairs necessary to remediate the area or solve the moisture infiltration problems. It is up to the individual program or facility owner to protect their own interests when they hire a company or individual to perform mold testing. BAIHS EHSS advises Tribes or programs to attempt to investigate potential mold problems on their own first. The basic goals of any mold investigation are always twofold: 1) find the locations of mold growth, and 2) determine the sources of the moisture. If these can be answered by simpler or more cost-effective methods mold testing is probably not a wise use of resources.

2.2 What Testing Cannot Do

As described earlier, the commonly used testing methods are limited in what they can detect and measure. Skilled investigators are aware of these limitations and don't rely on testing when it is not appropriate. However, many people have unrealistic expectations of what mold testing can do and they can be taken advantage of by those who perform testing poorly or for inappropriate reasons.

Below are some impractical reasons commonly given for requesting mold testing:

Poor reason for testing #1: To find out if there is mold.

A complex mixture of mold particles normally exists in all occupied indoor environments. If appropriate testing is done, it is expected that molds will be found. There is, however, an important distinction between the normal presence of mold particles, versus mold growth and accumulation indoors. Unfortunately, even when it is done well, testing may not be able to distinguish between normal and problem conditions and it may even give misleading results.

When mold is allowed to grow and multiply indoors, it poses a potential health risk and damages what it grows on. When mold growth is visible or mold odors can be smelled, it is common sense that there is a problem that should be addressed.

Poor reason for testing #2: To identify what type of mold is present.

Some testing can be used to identify a portion of the live mold in a sample by growing it in the lab. This gives only a partial description of the total amount of molds, because those not present at the sampled time and location or those that didn't grow in the sample

are not seen by the analysis. Most importantly, nonliving molds will not be identifiable, but they can still contribute significantly to health complaints.

From a practical, health-protective perspective, knowing the types of molds is usually not very important because any indoor mold growth represents a problem. The problem should be corrected regardless of the types of molds that can be identified.

Poor reason for testing #3: To learn if the mold is the toxic kind.

Many, if not all, molds may produce one or more substances broadly called mycotoxins. Molds known to produce mycotoxins are referred to as toxigenic. Mycotoxins may harm living tissue if enough of the agent enters the body, but science does not yet know how much of the many mycotoxins that could be present are necessary to harm a person, especially by breathing it. In some inhalation lab tests completed on rats the required number of airborne spores inhaled to create an adverse health effect (pulmonary inflammation and hemorrhage) was over 3 million, translated to a normal human adult it is estimated that 22 billion airborne spores would need to be inhaled for an adverse health effect to occur, a child would need to inhale 9.5 billion and an infant 3 billion. It is simply safest to assume at this time that any molds may produce mycotoxins or other harmful substances in some circumstances and they ought to be removed.

Testing for mold is not the same as testing for mycotoxins. Since toxigenic molds may or may not be producing mycotoxins depending on the environmental conditions, their presence does not necessarily indicate that known mycotoxins are also present or that occupants will be harmed. Likewise, failing to detect molds that are currently recognized to potentially produce mycotoxins does not mean that mycotoxins or other harmful substances are absent. BAIHS EHSS advises that any mold growth indoors should be safely removed regardless of whether toxigenic species have been found.

Poor reason for testing #4: To find the cause of health complaints.

It can be very difficult to conclude if and how occupants may be impacted by a specific mold problem. For one thing, the full range of health effects caused by molds is poorly understood at this time. Whether health effects will occur depends, for each person, on how much mold gets into their body, the amount and potency of various substances that the mold mixture can contain and the unique susceptibility of each person to the effects of these substances. Unfortunately, mold tests alone will not determine if a specific problem environment is causing a person's complaints.

Even when mold contamination is found in an area where health problems are occurring, it is often difficult to conclude that the mold is the actual cause of an individual's specific complaints since other contaminants commonly present in damp or water-damaged settings can also cause or contribute to the complaints associated with moldy environments. Indeed, focusing too heavily on mold alone can be a poor strategy if other potential causes of complaints are not also addressed. Nevertheless, such an association

of complaints to evidence of mold contamination is reason enough to remove the mold and correct the underlying causes of excess moisture.

One of the biggest problems related to mold testing happens when people misinterpret equivocal or negative findings. It is a common, yet serious error to conclude that a mold problem does not exist simply because tests failed to find evidence of it. Most mold testing simply cannot prove the absence of a problem, and it should never be used as the basis for dismissing complaints or to defend inadequate efforts to investigate or solve potential problems.

Poor reason for testing #5: To determine if the environment is safe.

At this time, it is unknown what level of mold is considered safe or how much is necessary to cause health problems. Mold tests cannot measure all the molds in an environment or how much occupants are exposed to. Such testing can also miss evidence of problems and results may mislead or be misused. BAIHS EHSS recommends assuming that any visible amount of mold may potentially cause illness and advises that the best approach is to remove this potential threat as soon as it can be done safely. BAIHS EHSS also suggests that it is reasonable to conclude that an area should be relatively safe with regard to mold, if all visible growth was removed, the surrounding areas thoroughly cleaned, and it remains dry and free of mold odors.

Poor reason for testing #6: To decide how to correct a mold problem.

Knowing the specific type of mold does not change what ought to be done to clean up the mold or fix the moisture problem. All mold problems should be handled in the same general way, with safety precautions based mainly on the extent of the contamination and how likely the mold will be disturbed by removal activities. All visible mold growth should be captured and physically removed to the greatest extent practical. In all cases, fixing the moisture problem is critical.

Poor reason for testing #7: To make a party respond to the problem.

There is no legal requirement to correct a mold problem in most residential or occupational settings. Collecting mold test results does not change this fact. While common sense supports the importance of correcting indoor mold problems quickly and effectively, there is rarely any rule or law that requires a property owner to do so.

Private homeowners are responsible for deciding how they will respond to real or suspected mold problems. This includes owner-occupied condominiums and townhouses, although issues of preventive maintenance and liability may be more confusing when an association is involved. Their insurance company may or may not cover any related costs depending on the details of their policy and other factors. In occupational settings, mold and any related health concerns are solely the responsibility of the employer and/or the property manager. In leased space, terms of the lease agreement may or may not address responsibility for mold and air quality complaints.

In rental housing, tenants should promptly alert the property owner or manager to evidence of mold or moisture problems if they cannot fix the problem on their own. Tenants concerned about mold in rental properties may also ask their housing officials for help. If and how local authorities address mold complaints in rental situations depends on the status of local codes or ordinances and what authority the local program has to deal with this issue.

3. Environmental Assessment

The presence of mold, water damage, or musty odors should be addressed immediately. In all instances, any source(s) of water must be stopped and the extent of water damaged determined. Water damaged materials should be dried and repaired unless the damage or moisture content is so great proper drying and repairs cannot be made; these items should be disposed of using the programs normal waste stream. There are no special disposal requirements for items that are contaminated with mold. Mold damaged materials should be remediated in accordance with this document (see Section 4, Remediation).

3.1 History

It is critical in the early stages of a mold investigation that the staff remains objective, resisting the temptation to attribute problems and complaints to the most obvious or most easily found explanations. The first important step is to determine the background of the problem. This should include:

- A. As reported, what is the nature of the problem? Is it visible mold, odors, symptoms, or other?
- B. Who reported the problem?
- C. Where and when has the problem occurred? Include dates and weather conditions.
- D. What has been observed by the person(s) reporting the problem?
- E. Who else has observed the problem?
- F. What symptoms, if any, are reported and by whom? Include timing, location, frequency, severity, and duration.

Use the information gathered to form an initial assessment of the situation and begin developing hypotheses. Evaluate what is known, and decide what other information may still be needed to understand and resolve the problem. Make certain that the “needs” identified are logical and realistic. **If mold growth is visible and its extent is confidently understood, go to the remediation section.** Visible mold also indicates the likely presence of other moisture-related biological pollutants such as bacteria and dust mites.

3.2 Visual Inspection

The extent of any water damage and mold growth should be visually assessed. This visual assessment is the most important initial step in determining the extent of contamination and developing remedial strategies. Ventilation systems should also be visually checked, particularly for damp filters but also for damp conditions elsewhere in the system and overall cleanliness. Ceiling tiles, gypsum wallboard (sheetrock), cardboard, paper, and other cellulosic surfaces should be given careful attention during a visual inspection. In Appendix B, a detailed survey form is available to assist the staff in recording the information noted during the inspection. This form was developed to also serve as a guide for the staff completing an inspection and includes other areas and items that should be checked. Appendix C contains recommendations and advice regarding the need for personal protective equipment and contaminant control. BAIHS EHSS strongly advises that staff consider these issues before proceeding with any investigation activities, especially those that may physically disturb mold growth or other contaminants such as lead and asbestos. If applicable to investigation activities, safety requirements for confined space entry should also be anticipated and must be followed.

At a minimum a visual check should include:

- A. A visual check for mold growth. The appearance of mold may include many textures or colors. Growth may appear as a solid patch or discrete colonies.
- B. A visual check for signs of excess moisture or water damage such as leaks, warping, standing water, staining, condensation, efflorescence, corrosion if metal, and dampness to the touch.
- C. The use of your sense of smell to locate sources of odors. “Mold odors” are typically described as “earthy” or “musty”. Not all mold growth produces noticeable odors and dormant or dead mold will not be odorous. However, when such odors are detected they are a reasonable indicator of mold, bacteria and wetness.
- D. Examine or survey suspected areas with a moisture meter to determine locations of elevated moisture within materials or at surfaces in problem areas. Pay attention to colder surfaces, slab floors, hidden spaces, and areas of poor air circulation. Note that a measurement of relative humidity in room air can fail to identify excess moisture because it is not an indicator of the amount of humidity or condensation available to mold growing on a cool surface.

Staff should be able to carry out the early phases of an investigation, but the skills of an indoor air or moisture expert may also be needed in some cases.

Visual inspection and physical assessment should routinely include all areas where moisture sources may be present such as crawl spaces, basements, utility areas, bathrooms, kitchens, laundry rooms, or in floor ductwork. In doing so identify and follow safety requirements related to confined spaces. Other areas that should be evaluated include areas with potential water/weather intrusion such as roof, attics, windows, doors, skylights; moisture accumulation on cool condensing surfaces; plumbing; steam pipes, and mechanical air handling and cooling systems.

Moldy environments do not always have visible growth on easy-to-see surfaces. Mold commonly grows hidden within enclosed spaces or other areas that are difficult to view. Consequently, visual inspection and odor assessment may also require destructive or intrusive efforts to inspect areas such as the following:

- A. Behind, under, and within cabinets, shelving units, storage lockers, and other furniture or furnishings.
- B. Under carpet and pad, especially when covering, or installed over, an on-grade or sub-grade slab.
- C. Above ceiling tiles.
- D. Behind wall coverings such as wallpaper and paneling.
- E. Within duct work, chases, risers, tunnels, plenums.
- F. Within wall cavities.
- G. Inside appliances and mechanical systems.

BAIHS EHSS recommends that any intrusive work that is needed, be done by individuals who have the proper training to ensure the minimum disturbance and exposure to any mold or mold colonies that could be growing within the hidden or enclosed space. Currently there are no standards or set requirements for individuals or contractors to ensure proper mold assessment and remediation are completed. In Appendix E there are some recommendations and expectations for contractors that can be used to ensure a proper contractor is selected. In addition, these individuals will have the proper equipment to complete these types of inspections and the equipment to ensure that any risk of exposure to the workers, the staff, the occupants, and the environment are minimized. If staff chooses to conduct these inspections it is strongly recommended that the requirements for worker protection and containment control outlined in Appendix C are followed.

It is also important to note that any intrusive work completed by any individual could result in that individual being liable for the results or repairs of this intrusive work. If such work is to be done, the staff should ensure that the proper approvals have been received by the homeowner or that the housing authority is contacted to complete the intrusive work and the repairs. This is another reason why BAIHS EHSS encourages that this work be done by individuals who have the proper training and resources to complete the work and ensure the safety and health of the occupants and workers.

4. Remediation

In all situations, the underlying cause of water accumulation must be rectified or fungal growth will recur. Any initial water infiltration should be stopped and cleaned immediately. An immediate response (within 24 to 48 hours) and thorough clean up, drying, and/or removal of water damaged materials will prevent or limit mold growth. If the source of water is elevated humidity, relative humidity should be maintained at levels below 60% to inhibit mold growth.³¹ Emphasis should be on ensuring proper repairs of the building infrastructure, so that water damage and moisture buildup does not recur.

Procedures for five different levels of abatement are described below. The size of the area impacted by fungal contamination primarily determines the type of remediation. The sizing levels below are based on professional judgment and practicality; currently there is not adequate data to relate the extent of contamination to frequency or severity of health effects.

The goal of remediation is to remove or clean contaminated materials in a way that prevents the emission of fungi and dust contaminated with fungi from leaving a work area and entering an occupied or non-abatement area, while protecting the health of workers performing the abatement. The BAIHS EHSS has included, in Appendix D, a document entitled “Mold Prevention and Detection: A Guide for Housing Authorities in Indian Country” created by HUD, the Office of Native American Programs, and the Building Research Council at the University of Illinois. This guidance document is designed to provide specific information on how to complete remediation and to provide suggestions to control moisture problems in new home construction projects.

The listed remediation methods were designed to achieve this goal, however, due to the general nature of these methods it is the responsibility of the people conducting remediation to ensure the methods enacted are adequate. The listed remediation methods are not meant to exclude other similarly effective methods. Any changes to the remediation methods listed in these guidelines, however, should be carefully considered prior to implementation.

The use of gaseous, vapor-phase, or aerosolized biocides for remedial purposes is not recommended. The use of biocides in this manner can pose health concerns for people in occupied spaces of the building and for people returning to the treated space if used improperly. Furthermore, the effectiveness of these treatments is unproven and does not address the possible health concerns from the presence of the remaining non-viable mold. For additional information on the use of biocides for remedial purposes, refer to the American Conference of Governmental Industrial Hygienists' document, "Bioaerosols: Assessment and Control."

4.1 Level I: Small Isolated Areas (10 sq. ft. or less) - e.g., ceiling tiles, small areas on walls. **Cleanups of this type can often be completed by homeowners, tenants, or building maintenance staff following the guidelines listed in this section; however, if homeowners are unsure of their capability to complete this clean up safely and properly assistance should be made available to them.** For more detailed guidelines on remediation refer to page 16 in Appendix D.

1. Remediation can be conducted by regular housing or building maintenance staff. Such persons should receive training on proper clean up methods, personal protection, and potential health hazards. This training can be performed as part of a program to comply with the requirements of the OSHA Hazard Communication Standard (29 CFR 1910.1200).
2. Respiratory protection (e.g., N95 disposable respirator), in accordance with the OSHA respiratory protection standard (29 CFR 1910.134), is recommended. Gloves and eye protection should be worn.

3. The work area should be unoccupied. Vacating people from spaces adjacent to the work area is not necessary but is recommended in the presence of infants (less than 12 months old), persons recovering from recent surgery, immune suppressed people, or people with chronic inflammatory lung diseases (e.g., asthma, hypersensitivity pneumonitis, and severe allergies).
4. Containment of the work area is not necessary. Dust suppression methods, such as misting (not soaking) surfaces prior to remediation, are recommended.
5. Contaminated materials that cannot be cleaned should be removed from the building in a sealed plastic bag. There are no special requirements for the disposal of moldy materials.
6. The work area and areas used by remedial workers for egress should be cleaned with a damp cloth and/or mop and a detergent solution. **It is important to recognize that bleach and other biocide cleaners are NO longer recommended for cleaning areas contaminated with mold.** Because of the hazards associated with using these chemicals and the ability of these chemicals to kill molds, which could cause the release and spread of spores, they are no longer recommended for use in cleaning contaminated materials or areas.
7. All areas should be left dry and visibly free from contamination and debris.

4.2 Level II: Mid-Sized Isolated Areas (10 - 30 sq. ft.) - e.g., individual wallboard panels. For more detailed guidelines on remediation refer to Appendix D.

1. Remediation can be conducted by regular building maintenance staff. Such persons should receive training on proper clean up methods, personal protection, and potential health hazards. This training can be performed as part of a program to comply with the requirements of the OSHA Hazard Communication Standard (29 CFR 1910.1200).
2. Respiratory protection (e.g., N95 disposable respirator), in accordance with the OSHA respiratory protection standard (29 CFR 1910.134), is recommended. Gloves and eye protection should be worn.
3. The work area should be unoccupied. Vacating people from spaces adjacent to the work area is not necessary but is recommended in the presence of infants (less than 12 months old), persons having undergone recent surgery, immune suppressed people, or people with chronic inflammatory lung diseases (e.g., asthma, hypersensitivity pneumonitis, and severe allergies).
4. The work area should be covered with a plastic sheet(s) and sealed with tape before remediation, to contain dust/debris.
5. Dust suppression methods, such as misting (not soaking) surfaces prior to remediation, are recommended.

6. Contaminated materials that cannot be cleaned should be removed from the building in sealed plastic bags. There are no special requirements for the disposal of moldy materials.
7. The work area and areas used by remedial workers for egress should be HEPA vacuumed (a vacuum equipped with a High-Efficiency Particulate Air filter) and cleaned with a damp cloth and/or mop and a detergent solution.
8. All areas should be left dry and visibly free from contamination and debris.

4.3 Level III: Large Isolated Areas (30 - 100 square feet) - e.g., several wallboard panels. For more detailed guidelines on remediation refer to Appendix D.

A health and safety professional with experience performing microbial investigations should be consulted prior to remediation activities to provide oversight for the project. Appendix D provides an outline of what staff might expect from professional mold investigations. This could be used as a guide when developing a contract for services with these professionals.

The following procedures *at a minimum* are recommended:

1. Personnel trained in the handling of hazardous materials and equipped with respiratory protection, (e.g., N95 disposable respirator), in accordance with the OSHA respiratory protection standard (29 CFR 1910.134), is recommended. Gloves and eye protection should be worn.
2. The work area and areas directly adjacent should be covered with a plastic sheet(s) and taped before remediation, to contain dust/debris.
3. Seal ventilation ducts/grills in the work area and areas directly adjacent with plastic sheeting.
4. The work area and areas directly adjacent should be unoccupied. Further vacating of people from spaces near the work area is recommended in the presence of infants (less than 12 months old), persons having undergone recent surgery, immune suppressed people, or people with chronic inflammatory lung diseases (e.g., asthma, hypersensitivity pneumonitis, and severe allergies).
5. Dust suppression methods, such as misting (not soaking) surfaces prior to remediation, are recommended.
6. Contaminated materials that cannot be cleaned should be removed from the building in sealed plastic bags. There are no special requirements for the disposal of moldy materials.

7. The work area and surrounding areas should be HEPA vacuumed and cleaned with a damp cloth and/or mop and a detergent solution.
8. All areas should be left dry and visibly free from contamination and debris.

If abatement procedures are expected to generate a lot of dust (e.g., abrasive cleaning of contaminated surfaces, demolition of plaster walls) or the visible concentration of the fungi is heavy (blanket coverage as opposed to patchy), then it is recommended that the remediation procedures for Level IV are followed.

4.4 Level IV: Extensive Contamination (greater than 100 contiguous square feet in an area)

A health and safety professional with experience performing microbial investigations should be consulted prior to remediation activities to provide oversight for the project. Appendix D provides an outline of what staff might expect from professional mold investigations. This could be used as a guide when developing a contract for services with these professionals.

The following procedures are recommended:

1. Personnel trained in the handling of hazardous materials equipped with:
 - Full-face respirators with high efficiency particulate air (HEPA) cartridges
 - Disposable protective clothing covering both head and shoes
 - Gloves
2. Containment of the affected area:
 - Complete isolation of work area from occupied spaces using plastic sheeting sealed with duct tape (including ventilation ducts/grills, fixtures, and any other openings)
 - The use of an exhaust fan with a HEPA filter to generate negative pressurization
 - Airlocks and decontamination room
3. Vacating people from spaces adjacent to the work area is not necessary but is recommended in the presence of infants (less than 12 months old), persons having undergone recent surgery, immune suppressed people, or people with chronic inflammatory lung diseases (e.g., asthma, hypersensitivity pneumonitis, and severe allergies).
4. Contaminated materials that cannot be cleaned should be removed from the building in sealed plastic bags. The outside of the bags should be cleaned with a damp cloth and a detergent solution or HEPA vacuumed in the decontamination

chamber prior to their transport to uncontaminated areas of the building. There are no special requirements for the disposal of moldy materials.

5. The contained area and decontamination room should be HEPA vacuumed and cleaned with a damp cloth and/or mop with a detergent solution and be visibly clean prior to the removal of isolation barriers.
6. Air monitoring should be conducted prior to occupancy to determine if the area is fit to reoccupy.

4.5 Level V: Remediation of HVAC Systems

4.5.1 A Small Isolated Area of Contamination (<10 square feet) in the HVAC System

1. Remediation can be conducted by regular building maintenance staff. Such persons should receive training on proper clean up methods, personal protection, and potential health hazards. This training can be performed as part of a program to comply with the requirements of the OSHA Hazard Communication Standard (29 CFR 1910.1200).
2. Respiratory protection (e.g., N95 disposable respirator), in accordance with the OSHA respiratory protection standard (29 CFR 1910.134), is recommended. Gloves and eye protection should be worn.
3. The HVAC system should be shut down prior to any remedial activities.
4. The work area should be covered with a plastic sheet(s) and sealed with tape before remediation, to contain dust/debris.
5. Dust suppression methods, such as misting (not soaking) surfaces prior to remediation, are recommended.
6. Growth supporting materials that are contaminated, such as the paper on the insulation of interior lined ducts and filters, should be removed. Other contaminated materials that cannot be cleaned should be removed in sealed plastic bags. There are no special requirements for the disposal of moldy materials.
7. The work area and areas immediately surrounding the work area should be HEPA vacuumed and cleaned with a damp cloth and/or mop and a detergent solution.
8. All areas should be left dry and visibly free from contamination and debris.
9. A variety of biocides are recommended by HVAC manufacturers for use with HVAC components, such as, cooling coils and condensation pans. HVAC manufacturers should be consulted for the products they recommend for use in their systems.

4.5.2 Areas of Contamination (>10 square feet) in the HVAC System

A health and safety professional with experience performing microbial investigations should be consulted prior to remediation activities to provide oversight for remediation projects involving more than a small isolated area in an HVAC system. Appendix D provides an outline of what staff might expect from professional mold investigations. This could be used as a guide when developing a contract for services with these professionals. The following procedures are recommended:

1. Personnel trained in the handling of hazardous materials equipped with:
 - A. Respiratory protection (e.g., N95 disposable respirator), in accordance with the OSHA respiratory protection standard (29 CFR 1910.134), is recommended.
 - B. Gloves and eye protection
 - C. Full-face respirators with HEPA cartridges and disposable protective clothing covering both head and shoes should be worn if contamination is greater than 30 square feet.
2. HVAC system should be shut down prior to any remedial activities.
3. Containment of the affected area:
 - A. Complete isolation of work area from the other areas of the HVAC system using plastic sheeting sealed with duct tape.
 - B. The use of an exhaust fan with a HEPA filters to generate negative pressurization.
 - C. Airlocks and decontamination room if contamination is greater than 30 square feet.
4. Growth supporting materials that are contaminated, such as the paper on the insulation of interior lined ducts and filters, should be removed. Other contaminated materials that cannot be cleaned should be removed in sealed plastic bags. When a decontamination chamber is present, the outside of the bags should be cleaned with a damp cloth and a detergent solution or HEPA vacuumed prior to their transport to uncontaminated areas of the building. There are no special requirements for the disposal of moldy materials.
5. The contained area and decontamination room should be HEPA vacuumed and cleaned with a damp cloth and/or mop and a detergent solution prior to the removal of isolation barriers.
6. All areas should be left dry and visibly free from contamination and debris.

7. Air monitoring should be conducted prior to re-occupancy with the HVAC system in operation to determine if the area(s) served by the system are fit to reoccupy.
8. A variety of biocides are recommended by HVAC manufacturers for use with HVAC components, such as, cooling coils and condensation pans. HVAC manufacturers should be consulted for the products they recommend for use in their systems.

5. Hazard Communication

When fungal growth requiring large-scale remediation is found, the staff, building owner, management, and/or employer should notify occupants in the affected area(s) of its presence. Notification should include a description of the remedial measures to be taken and a timetable for completion. Group meetings held before and after remediation with full disclosure of plans and results can be an effective communication mechanism. Individuals with persistent health problems that appear to be related to bioaerosol exposure should see their physicians for a referral to practitioners who are trained in occupational/environmental medicine or related specialties and are knowledgeable about these types of exposures. Individuals seeking medical attention should be provided with a copy of all inspection results and interpretation to give to their medical practitioners.

6. Conclusion

In summary, the prompt remediation of contaminated material and infrastructure repair must be the primary response to fungal contamination in homes and buildings. The simplest and most expedient remediation that properly and safely removes fungal growth from the structures should be used. In all situations, the underlying cause of water accumulation must be rectified or the fungal growth will recur. Emphasis should be placed on preventing contamination through proper building maintenance and prompt repair of water damaged areas.

Widespread contamination poses much larger problems that must be addressed on a case-by-case basis in consultation with a health and safety specialist. Effective communication with building occupants is an essential component of all remedial efforts. Individuals with persistent health problems should see their physicians for a referral to practitioners who are trained in occupational/environmental medicine or related specialties and are knowledgeable about these types of exposures.

APPENDIX A

Rationale for Recommendations

BAIHS EHSS staff and Tribal Programs should maintain a focus on solutions when investigating problems related, or potentially related, to indoor mold in their facilities. Efforts should rely mainly on the most practical and cost-effective methods of finding mold growth and moisture problems that need correction. Contrary to popular opinion, mold testing is often unnecessary and there is no practical health-based reason to test visible mold growth once it is found.

While some mold testing may be useful when it is done properly, it should not be done unless performed competently and for the purpose of testing specific hypotheses to aid in solving the problem, such as, locating hidden mold growth or determining the extent of secondary contamination. As a health-protective assumption, BAIHS EHSS suggests that any signs of mold growth in homes or facilities be regarded as a potential health hazard which warrants corrective action, regardless of the type of mold or amounts measured. Evidence of active mold growth indicates that conditions exist which may foster the rapid growth and spread of mold, some of which can be harmful to some people. Testing should not delay prompt corrective actions, nor should it divert resources from the practical solutions of moisture control and thorough cleaning to remove mold contaminants.

The following provide the basis for cautioning against using limited resources on indiscriminate, inadequately funded or poorly performed mold testing. In addition, these points underscore the view that mold testing is inherently uncertain and cannot be relied upon to answer questions about health and safety. Finally, the issues described below also illustrate some of the limitations that investigators should be able to address in their sampling plan when they propose mold testing as part of an investigation.

Point 1. The nature and quantity of contaminants present at, and released from, sites of mold growth are typically dynamic and complex. When mold grows and multiplies indoors, the contaminant mixture in the air or even that which is growing on, or deposited on, surfaces can be very expensive to characterize because it may vary over time and space based on the following:

- A. Both the types of mold and their absolute and relative numbers in air or on surfaces are likely to vary with an array of potentially changing micro-environmental factors such as temperature, relative humidity, surface water activity level, type of substrate, nutrient availability, presence of competing micro-organisms, and amount of light.
- B. The amount of mold products released to the air from a site of growth and how they are distributed can change dramatically over short periods of time.
- C. The mixture of contaminants in the air can be influenced by factors such as ventilation patterns, air speed and occupant activities, and will change over time and location as the spores of some species settle out at different rates.

- D. The deposition and accumulation of mold particles onto surfaces can depend on releases from growth sites, airborne transport patterns, effectiveness of removal mechanisms, and frequency of resuspension caused at least partly by occupant activities such as foot traffic or cleaning.

Point 2. Mold testing is incapable of completely characterizing and measuring the contaminant mixture produced by most indoor mold problems. Because there are fairly reliable, practical and cost-effective investigation techniques which don't require mold testing, the following are reasons to question the usefulness of mold testing in many situations:

- A. Any test method is selective in which molds it can possibly detect out of the broader universe of those molds that may be present -- consequently, testing results cannot be relied upon to give a complete picture of all types of mold present.
- B. The quantities of mold detected (both the total numbers and relative frequencies) are not precise counts; that is, the numerical results can vary by the sampling and analytical method used, and should be regarded as fairly crude estimates at best.
- C. The results for any particular sample are only applicable to the specific time and location of the sample – test results only represent a “snapshot” in time. They cannot be assumed to estimate the contaminant load at a different location from where the sample was taken and do not necessarily represent past or predict future conditions.

Point 3. It is fundamentally impossible to rule out mold-related health risks by any currently available environmental testing methods. Even if it was practical to collect enough data to identify and quantify the entire mold present for a specific time and location, health risks and occupant safety would not be fully understood or predicted due in part to the following:

- A. The identity of most mold species, and even strain or isolate, does not adequately predict the amount or types of potentially harmful agents produced. A particular mold that can produce harmful substances does not always do so -- and the types and amounts it produces may change over time and from one location to another.
- B. Molds may produce agents which have not yet been identified or are not currently recognized as harmful.
- C. Mold testing results alone are not adequate to represent a person's exposure to mold particles or to the mold's harmful products.
- D. Much remains unknown about how and why some individuals are affected by mold when others are not, and what factors particular to the agent, the exposure, and/or the person lead to health problems.
- E. Numerical criteria are not appropriate for determining if a health concern exists, because there is no agreement on what minimum level of any specific mold, much

less a complex mixture of various organisms and their product, is safe or is necessary to cause health effects.

APPENDIX B

Inspection Form

Embedded document if using from CD double click to access Adobe PDF file



IAQ INSPECTION CHECKLIST

BASED ON A SURVEY THIS DAY, THE ITEMS BELOW ARE INDICATORS OF MOISTURE AND WATER INSTURSION PROBLEMS LEADING TO MOLD GROWTH. THIS SURVEY IS BASED UPON GUIDELINES ESTABLISHED BY THE US EPA, NYC DEPT. OF HEALTH, WISCONSIN DEPT OF HEALTH AND FAMILY SERVICES AND THE MINNESOTA DEPT. OF HEALTH.

Facility ID	Date of Survey
Address	No. of Residents

SITE CHARACTERISTICS

SOIL TYPE (e.g. clay, sand, grave, loam, consult soil survey)
SOIL DRAINAGE CHARACTERISTICS
DEPTH TO WATER TABLE (ft.)
LANDSCAPING: (shrubs, trees, gardens against building)
BUILDING DISTANCE TO Swamps/wetlands _____ Dry-cleaners/Laundry _____ Compost _____ Other _____
EXPLAIN SITE DRAINAGE

INTERIOR

TYPE OF WALLS (circle all that apply) plaster with lathe paneling vinyl other _____ sheetrock/gypsum wood wallpaper
CONDITION OF WALLS (circle all that apply) good poor damaged visible mold/mildew rot fair leaks corroded warping blistering paint
TYPES OF FLOORS (circle all that apply) wood tile vinyl sheet goods carpet other _____
BASEMENT (circle one) yes no
CRAWL SPACE (circle one) yes no
TYPE OF BASEMENT/CRAWLSPACE FLOOR poured concrete carpet dirt other _____ vinyl tile stone block
SUMP PUMP (circle one) yes no
DAMP (circle one) yes no
STANDING WATER (circle one) yes no history
CRACKS IN WALLS (circle one) yes no
CRACKS IN FLOOR (circle one) yes no
IN FLOOR DRAIN/PUMP (circle one) yes no
DEHUMIDIFIER (circle one) yes no
BASEMENT WALLS (circle all that apply) plaster paneling stone other _____ sheetrock poured concrete concrete block
CONDITION OF BASEMENT WALLS (circle all that apply) good poor damaged visible mold/mildew rot fair leaks corroded warping blistering paint staining/efflorescence

EXTERIOR

TYPE OF HOME (circle one) conventional apartment attached garage mobile one-story detached garage pre-fab (modular) multistory
YEAR OF CONSTRUCTION
SIZE (sq. ft.)
TYPE OF SIDING: (circle all that apply apply) brick concrete vinyl earth EFFS stone wood aluminum Stucco OTHER:
CONDITION OF SIDING: (circle one) good poor damaged visible mold/mildew warping fair leaks corroded rot blistering paint
TYPE OF WINDOWS/DOOR: (circle all that apply) wood aluminum vinyl other
CONDITION OF WINDOWS/DOORS good poor damaged visible mold/mildew rot fair leaks corroded warping
ROOFING CONDITION (circle all that apply) good poor damaged shingles fair leaks corroded flashing
ROOF VENTILATION (circle all that apply) ridge vent soffits gable end vent Roof Vent Fan
ROOF GUTTER SYSTEM (circle one) yes no
GUTTERS DRAINS WATER >5FT FROM BLDG (circle one) yes no

HVAC SYSTEM

PRIMARY SYSTEM (circle one) gas LP wood oil electric kerosene wood burning stove coal burning stove fireplace unvented space heater other _____
DISTRIBUTION SYSTEM (circle one) forced air gravity hydronic electric radiant other _____
FURNACE FILTERS (circle one) fiberglass fabric electronic plastic chemical adsorption devices (activated charcoal, alumina)
COOLING SYSTEM (circle one) central air windows window air conditioner water cooler none

HVAC SYSTEM con't

HOT WATER HEATER (circle all that apply)			
electric	part of boiler	gas	
gravity vented	power vented		
properly drained	improperly drained		
CHIMNEY (circle one)	yes	no	
Condition (circle one)	good	fair	poor
Gas-fired appliance connected (circle one)	yes	no	
ASBESTOS (circle one)	yes	no	
Condition (circle one)	good	fair	poor
Friable (circle one)	yes	no	
HUMIDIFIER (circle one)	yes	no	
WATER SUPPLY(circle one)	private well	PWS	
SEWAGE (circle one)	city	septic	mound
COOKING APPLIANCES (circle one)			
Type:	gas	electric	
Mechanical Ventilation	recirculation	outside exhaust	

OTHER

BATHROOM			
Mechanical Ventilation (circle one)	yes	no	window
Mech. Ventilation wired to (circle one)	lighting	humidstat	individual switch
Condition/Functioning of Bathroom Ventilation (circle one)	good	fair	poor
	visible mold/mildew/dust	damaged	
TOILET			
insulated tank (circle one)	yes	no	
supply line tempered (circle one)	yes	no	
LAUNDRY FACILITIES			
Dryer vented outside (circle one)	yes	no	
WATER SOFTENER (circle one)	yes	no	
properly drained (circle one)	yes	no	
ATTIC			
Living space mechanical ventilation vents to the attic (circle one)	yes	no	
Unprotected and non-insulated openings into Attic (circle one)	yes	no	

ENVIRONMENTAL SAMPLING MEASUREMENTS

SAMPLING /MEASUREMENTS	Basement	Kitchen	Living Room	Master Bedroom	Bedroom	Bathroom	Attic	Other	
RELATIVE HUMIDITY									
TEMPERATURE									
CARBON DIOXIDE									
CARBON MONOXIDE									
VENTILATION EFFECTIVENESS									
MOISTURE METER READINGS									
OTHER									

ENVIRONMENTAL SAMPLING MEASUREMENTS

SAMPLING /MEASUREMENTS	Other								
RELATIVE HUMIDITY									
TEMPERATURE									
CARBON DIOXIDE									
CARBON MONOXIDE									
VENTILATION EFFECTIVENESS									
MOISTURE METER READINGS									
OTHER									

NOTES

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INSPECTION FINDINGS

OBSERVATIONS	Basement	Kitchen	Living Room	Bathroom	Bedroom	Laundry	Hallway	Closet
VISIBLE MOLD								
MUSTY SMELL								
ANIMAL/FECAL ODOR								
PLUMBING LEAKS								
CONDENSATION ON PLUMBING/WINDOWS ETC.								
CHEMICAL STORAGE								
HOUSEKEEPING*								
HOBBIES/CRAFTS								
LIST PESTICIDES								
WATER STAINS								
STAINS (OTHER)								

OBSERVATIONS	Basement	Exterior	Garage	Other				
VISIBLE MOLD								
MUSTY SMELL		/						
ANIMAL/FECAL ODOR		/						
PLUMBING LEAKS		/						
CONDENSATION ON PLUMBING/WINDOWS								
CHEMICAL STORAGE								
HOUSEKEEPING*		/						
HOBBIES/CRAFTS		/						
LIST PESTICIDES								
WATER STAINS								
STAINS (OTHER)								

* Housekeeping: General housekeeping rating guidelines. This is subjective and is loosely based on inspectors point of view.

Good: well maintained, items in normal lived in appearance

Fair: maintained, some disarray, the day's dishes in sink, clothes scatter in bedrooms, unswept floors

Poor: several days dishes in sink, soiled laundry scattered over floor, presence of animal excrement

Notes

APPENDIX C

Personal Protection and Contaminant Control

PERSONAL PROTECTION: When mold contaminated surfaces are physically disturbed, greatly elevated levels of airborne mold particles often result. Such releases can occur during investigation, especially from destructive efforts to get at hidden areas of growth, and clean-up activities. Workers performing such mold related activities may breathe in or their skin may contact mold contaminants. In general, the exposures to a mold worker or other occupant will likely increase as the amount of mold present increases and the more it is disrupted. The Staff in cooperation with the district's Health and Safety staff, and the Area Institutional Officer should determine what type of personal protective equipment is required for in-house staff and under what circumstances. If district staff is unable to make such a determination, professional assistance should be sought. BAIHS EHSS recommends that workers handling small amounts of moldy materials that are manageable by routine custodial or building maintenance activities on an occasional short-term basis be provided the following types of protective equipment, at a minimum:

- F. Respiratory protection capable of filtering particles at least as small as 2 microns in diameter. A NIOSH approved N-95 filtering face piece respirator is recommended at a minimum. A HEPA filtered respirator, for example P-100, is strongly recommended when large areas of contamination are expected to be disturbed.
- G. Eye protection; use goggles or respirator which excludes fine dusts.
- H. Skin protection; wear disposable or washable outer clothing, long sleeved tops and long pants.
- I. Gloves; select those that are impervious to any chemicals used.

CONTAMINANT CONTROL: It is critical, whenever investigation or cleanup activities expose and agitate moldy materials, to control the release and movement of mold particles and any other contaminants that are liberated by the work. Such control is important to protect school occupants from exposure to contaminants that may adversely impact their health and to prevent the spread of contaminants into other areas of the building. Examples of pathways through which contaminants are spread from their site of origin include movement via foot traffic leaving the contaminated area, physical movement of improperly encased contaminated materials or by movement through the air.

Staff should determine the need for contaminant control measures based upon the likelihood that planned activities will disturb and/or disperse large quantities of mold particles in areas where occupants may be exposed. The following considerations may be useful in evaluating the risks for a particular situation.

Determining the Need for Contaminant Control

- A. The amount, density of growth and size of area affected, of visible mold growth and that which may be hidden;

- B. The amount of contaminants deposited on surfaces, such as carpet, from past problems;
- C. The intensity and duration of physical forces that will be applied to the contaminated materials and the likelihood that this will disturb the mold and release contaminants into the air;
- D. The wetness of materials that will be disturbed -- wet materials may produce less dusts than drier materials;
- E. The ability to enclose or cover contaminated materials before they are disturbed;
- F. The proximity of the contamination to occupants – especially potentially sensitive individuals;
- G. The existence of routes for airborne contaminants to reach occupied areas (via planned pathways, such as ductwork, and unplanned pathways, such as an air leakage caused by pressure differences);
- H. The length of time before remediation will begin and the expected project duration;
- I. The proximity of contamination to items that would be very difficult or costly to clean/remove if they become contaminated; and
- J. The skill, experience and level of care that may be expected of those doing the work. BAIHS EHSS strongly recommends that experienced, trained or otherwise skilled staff is used to perform the work when mold contamination is extensive.

The following generalizations are intended to illustrate the two ends of the spectrum of options for contaminant control. In the case of contamination that is limited to small and easily accessible areas and which should be correctable by routine custodial or building maintenance practices, only fairly limited contaminant control measures may be needed. In contrast, more extensive measures are usually warranted when heavy or large scale contamination is expected to become disturbed. While these examples may be used as guidance, specific needs must be determined on a case-by-case basis by the professional judgment of school district staff or their consultants.

In the simpler cases, the following control methods may be used. These are best done before Enclosing mold growth and contaminated materials within permanent structures is NOT recommended -- on its own, this will not control further mold proliferation or degradation of structural materials.

Performing activities that will physically disturb the areas of growth or as contamination is gradually encountered and becomes accessible.

- A. Thoroughly vacuum all visible mold and materials surrounding the area of growth using a HEPA vacuum;
- B. After vacuuming, damp clean surfaces in the area surrounding the growth;
- C. Bag or cover areas of growth with plastic prior to removal of material; and
- D. Securely bag waste and dispose.

When contamination is extensive and will likely become airborne, the following methods may also be warranted in addition to those above:

- A. Isolate the air handling system from the contaminated/work area;
- B. Construct containment around work area using plastic sheeting;
- C. Establish negative pressure inside the containment zone using HEPA-filtered ventilation equipment; and
- D. Test or monitor containment for leakage.

If staff desire more detailed guidance on contaminant control, they should refer to one of the documents listed in Appendix F, seek advice from an experienced professional remediation service provider, or contact BAIHS EHSS.

DECONTAMINATION: A protocol for decontaminating workers and equipment should be developed and in place before beginning work that greatly disturbs mold contamination. The level of decontamination needed for a given situation will depend on the nature and amount of contaminants, the type of activities performed, and the use and arrangement of any containment around the work area. For example, when removing personal protective equipment and tools or supplies from an area where elevated airborne mold levels are expected, it is advisable that all such items be decontaminated or bagged for disposal. Hard cleanable surfaces should be HEPA vacuumed and damp cleaned. Clothing should be bagged for disposal or laundering. Bulk, contact, or tease tape samples are sometimes collected for the sole purpose of confirming that a suspect material is mold – these can be of value in an investigation and need only be interpreted as positive or negative for the presence of mold growth structures.

For the purposes of this document, the term “control” is roughly interchangeable with “reference”, “comparison”, or “background.” These terms are used to refer to samples taken from presumably uncontaminated areas. The fungal load of a specific suspect media area and media may be partially assessed through a comparison to that in the uncontaminated area(s). However, for accuracy it is acknowledged that these are not true controls.

Raw values or actual counts of organisms should be considered in the interpretation of the results because the concentration will depend on sampling duration. When raw numbers or actual counts for the sample indicate only one or two spores of a species were detected, these can generally be disregarded unless their presence is confirmed in several other samples. Repeat sampling may also need to be considered under these circumstances.

APPENDIX D

Mold Prevention and Detection

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MOLD PREVENTION AND DETECTION:

A GUIDE FOR HOUSING AUTHORITIES IN INDIAN COUNTRY

Disclaimer

Although great care has been taken in preparation of this document, no warranties, either expressed or implied, are made in connection with the accuracy or completeness of the information contained herein, and no responsibility can be assumed by SWA, the U.S. Department of Housing and Urban Development, or any of their respective consultants for any claims arising herewith. Comments, criticisms, clarifications, and suggestions regarding format and content are welcome.



MOLD PREVENTION AND DETECTION:

A GUIDE FOR HOUSING AUTHORITIES IN INDIAN COUNTRY

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Introduction

News has been spreading about mold problems in Indian Country and Alaskan Native housing, as it has throughout many parts of North America. There are many questions being raised about how these situations should be handled, how people's health can be protected, and how costly emergencies can be avoided. Mold that is not attended to can damage homes, and combined with dampness, can lead to sagging walls, ceilings, or floors. It can be unsightly, and can sometimes cause discomfort and health problems. Having mold in one's home does not mean that health problems will necessarily follow; however, persistent dampness should be attended to.

This Guide has been prepared with the latest information on mold and moisture, and with survey information gathered from tribal housing agencies and occupants. It deals with these types of questions:

- *How should I respond to mold and dampness?*
- *What can a homeowner or renter do?*
- *What types of construction failures can lead to mold damage?*
- *Who should I work with?*
- *Where can I go for more information?*

This Guide presents information that will substantially increase housing providers' and residents' understanding of mold and moisture conditions in homes. It offers helpful advice on how to establish procedures for addressing moldy conditions and build viable partnerships that can help resolve problems. The procedures involved in mold prevention, detection, and resolution are not always obvious. In some situations, it may be necessary to enlist the expertise of specialized professionals.

This Guide includes information for the various partners, who may be involved in mold prevention and detection, including:

- Housing agencies (directors, resident services, and maintenance staff);
- Home residents;
- Housing inspectors;
- Tribal council members;
- Health providers;
- Building specialists, contractors, renovators, and architects.

A series of site visits have been conducted throughout Indian Country and Alaskan Native villages for the purpose of providing technical assistance to tribes, Housing Authorities (HA), and Tribal Designated Housing Entities (TDHEs) and/or assessment of mold and moisture problems on reservations. To date, literally hundreds of homes have been inspected.

One important lesson is that, while many of the relevant principles are universal, housing practices must be specific to the local climate, soil conditions, house type, and code. In new

construction, things seem to work best when the builders and their crews are accustomed to the local area, the economy, the people, and the climate; when they receive feedback on what works and what doesn't; and when builders apply what they've learned about mold prevention when building new homes. For homes that are already experiencing problems, skill in determining the source of moisture is the key to addressing and resolving moldy conditions.

A second important lesson is that although tribes may employ different strategies for dealing with mold and moisture issues, we recommend an underlying approach that employs a team, made up of housing authority staff, tribal government, health workers, and maintenance staff. The team can dissect the problem of mold and moisture and set up working strategies to

- Stop any water or moisture problems
- Identify why mold is growing, how much material is damaged, and what safety precautions are needed
- Remove the mold, make repairs, and dry out the homes
- Encourage residents to keep their homes dry to prevent mold from coming back
- Check on homes later to see that plans worked
- Develop plans to deal with moisture or mold problems while they are still manageable. .

Case Studies

On all the reservations that were visited, several homes were investigated for moldy conditions. Whenever possible, the occupants were present to answer general questions, such as whether kitchen and bathroom fans are used. A wide range of housing conditions were observed, including age of the units, occupancy type, structural soundness, siting and environmental factors (such as flooding or groundwater problems), and reported levels of health and safety discomfort. Some units were quite new, built just in the past few years, while others dated from the 1950s.

In tribal communities, natural gas, kerosene, propane, coal, and wood stoves are commonly used for cooking and heating. Increased indoor humidity is a by-product of combustion. Furthermore, housing shortages combined with the tradition of multi-generational households found in some areas may result in overcrowded homes. In newer, more 'tightly built' houses, residents need to regularly use exhaust fans to counteract the moisture that results from daily activities. Older homes may lack exhaust fans especially fans ducted to the outside and may therefore exhibit problems associated with moisture build-up. High humidity and crowded conditions, combined with inadequate ventilation, can lead to the development of mold. Other common mold causes are described in this guidebook.

Several tribal communities have reported the following repair strategies and preventive maintenance procedures to reduce the amount of moisture and mold in homes:

- Repairing plumbing, mechanical, and electrical items;;
- Replacing carpet with hard surface flooring (vinyl composition tile);

- In northern climates, adding rigid insulation to the exterior of the house, especially upper basement walls and slab foundation edges;
- Removing the home from its crawl space and reinstalling it on a slab;
- Relocating families and renovating the vacant houses;
- Removing and replacing water-damaged drywall in basement exterior walls, stopping drywall 5” above the slab. This is covered by a 6” baseboard screwed in place (to allow for future removal and inspection). Replacing ceramic tile bathtub enclosures with surround resin bathtub/shower enclosures;
- Adding thoroughly sealed vapor barriers in crawlspaces;
- Replacing drywall in bathrooms with water-resistant green board;
- Adding perimeter drainage systems and/or sumps to basements and crawlspaces;
- Replacing rotted, under-performing windows with more energy-efficient windows;
- Replacing wood plates in basement framing with pressure-treated lumber;
- Adding pressure-reducing valves and shutoff valves on water lines;
- Providing dehumidifiers in basement bedrooms during summer months;
- Replacing circulating kitchen range hoods with hoods that exhaust directly to the outside
- Installing upgraded fans in all bathrooms vented directly to the outside. The fans are now controlled by a ‘smart’ control.

While not always the case, it was observed that mold was located in many of the same places within a specific group of houses which share the same floor plan and foundation type (crawl space, basement, or slab) and were built on sites with similar drainage, soil, and groundwater conditions. In these cases, the same level of repair can be scheduled for each house in the area, conserving the time and money spent on home inspections for other home maintenance projects.

We have found that housing authorities, which have already 'gotten the message' about moisture control are hampered, not by a lack of understanding of necessary construction techniques, but by opportunities to apply that knowledge during the course of the work. This is true both in new construction and in repairs to existing homes. Funding for remediation is limited; therefore, greater focus should be placed on preventive maintenance. An important part of any preventive maintenance program is ongoing skills training. Discussions with some housing authorities generally indicated a level of sophistication about moisture control strategies and an awareness of 'lessons learned' from working with the existing housing stock but others need help

Overview – What is Mold?

Mold decomposes dead matter. Without it, there would be no decay of dead leaves on the forest floor, and the environment would soon be overwhelmed by dead plant material. For mold to grow, it needs organic matter – leaves, wood, paper, cloth, carpet, leather, wood, drywall – and moisture. Mold grows by digesting, and thereby destroying, what it grows on. As such, it can seriously damage books, rugs, walls, and even the structure of a house, making it dangerous to occupy.

Mold can be black, white, red, orange, yellow, blue, violet, or brown. Sometimes, soot or salt stains on masonry or concrete can be mistaken for mold. Dab a drop of bleach on the stain – if it loses color, it may be mold.

Mold is found indoors as well as outdoors. Mold spores can be found virtually anywhere inside the home. When the right conditions are present, spores will germinate and mold will grow. Spores are like microscopic seeds: lightweight, unseen, and traveling through the air. Usually, the types of mold spores found in a house are similar to those occurring outdoors, as they have either been tracked in or blown in through open windows and doors.

Mold doesn't always cause a health problem. In order for mold to affect people living in a house, they must either touch it or breathe it in. While some people appear to be quite sensitive to mold, others are not. Some experience wheezing, stuffy nose, eye or throat irritation. Allergic reactions (like hay fever) are the most common symptoms.

Those with specific sensitivities may include:

- People who already have allergies or asthma;
- Those with weakened immune systems (such as cancer patients and those returning from the hospital – they can be susceptible to infections);
- Infants and young children; and
- Older people (especially those with emphysema or other conditions that affect their breathing).

According to the National Academy of Science, Institute of Medicine's Committee on the Assessment of Asthma and Indoor Air, mold may lead to a worsening of asthma in susceptible people. We do not know, however, whether mold can cause asthma in otherwise healthy people. Many theories have been raised to explain why asthma rates have been increasing, including people spending more inactive time indoors, houses being built with less ventilation, increasing use of cool-wash cycles (cold water does not effectively remove allergens), and widespread use of carpeting, among other reasons. Most of these theories have not been adequately supported through well-controlled scientific studies.

Mold is often a sign of excess moisture or dampness. Dampness also supports dust mites, which are known to cause and worsen childhood asthma. Dampness should be avoided, particularly in rooms where people spend a lot of time (for example, in basement bedrooms).

If you can see or smell mold in the house, steps should be taken to find the source of the excess moisture and clean up and remove the mold. Mold can appear as patches or speckled growth, and it may smell musty. Examples of obvious moldy conditions include discolored carpeting on annulated cold, damp basement floors or flood-damaged drywall. Common sense should prevail, with the focus not only on mold but also on returning the house to a dry condition. Mold can be seen as a warning sign that a water problem exists and needs to be fixed. If dampness or water damage is already a problem, repairs should be made so that mold doesn't keep coming back.

It is not necessary to identify the type of mold in order to fix the underlying moisture problem. Testing for mold is expensive and can be confusing. The Indian Health Service (IHS) and others are recommending against testing. If you already know you have a mold problem, spend the available time and money getting rid of the mold and solving the moisture problem. Taking action as soon as possible to remove the mold and fix the moisture problem is more important than testing. Consider taking photos of the damaged areas if you need documentation. If possible adjust the camera to show the date the photo was taken. If you have the resources and decide in favor of sampling, consider having it done by qualified staff in tribal Environmental or Health Departments, Indian Health Service, or by an outside consultant, such as an industrial hygienist (see *How to Get Special Help/Finding Equipment*). Often, the local Health Department can make recommendations.

More valuable than sampling is the survey for evidence of water damage and the extent of mold that can be seen. Those who are familiar with construction and home maintenance may be best qualified to do this type of work. Typically, the survey includes an inspection for sources of moisture coming into the home; for example, defects in construction (poorly installed windows, roof, or exterior siding; improperly laid foundations; absence of vapor barriers) or plumbing leaks or resident activity (not using fans or drying clothes on lines). In many cases, mold grows inside walls or in other hard-to-reach locations. It is often necessary to pull up carpet, crawl under the house, and inspect ceiling spaces. Be prepared for what you might find - don't disturb anything unless absolutely necessary and unless you are ready to handle it. Flashlights, mirrors, bore scopes, and moisture meters are the tools of choice (see Equipment in *How to Get Special Help/Finding Equipment*).

It is important to know about past water damage, because hidden mold may be an ongoing problem. Review whether the home has had flooding, roof leaks, plumbing problems, or other damage. Ask the residents to recall past incidents of water damage and look carefully for signs of mold in areas they identify. Be very careful not to disturb mold behind walls – without adequate precautions, pulling walls apart is not a good idea. Non-destructive methods are much better. For example, a bore scope can be inserted into a small hole in the wall and used to survey internal conditions to see whether there has been water damage or mold growth.

Homeowner's/Renter's Mold Prevention Suggestions

Simple changes inside the home can sometimes improve conditions, and prevent mold from ever becoming a problem. Here are several suggestions.

In General . . .

Keep the house clean, dry and free of clutter.

Vacuum often. If you need a new vacuum, choose a **High-Efficiency Particulate Air (HEPA)** vacuum cleaner (see *How to Get Special Help/Finding Equipment* for more information).

Check for mold – blotchy stains on ceilings, walls, floors, and window sills; musty odors; 'shadow marks' behind furniture.

Fix leaks right away.

Throw away any wet or badly damaged materials.

Ensure that nothing that smells or looks moldy (such as beds, sofas, or carpets) is brought into the house.

Keep windows open during dry, mild weather.

Reduce humidity by limiting the amount of showering, cooking, and other activities that bring water into the house; use a dehumidifier or an air conditioner, especially during muggy weather.

Vent the clothes dryer, bathroom exhaust fan and kitchen exhaust fan to the outside, and not to the attic, basement or other area inside the house.

Insulate pipes to prevent condensation.

Use storm windows.

Outside

Check to see if water is coming into the house from leaks in the foundation, walls, roof, or from the sump pump pipe. Make repairs.

Slope the ground surrounding the house so that rainwater runs away from the building, not towards it.

If there are gutters, install downspout extenders to carry rainwater and melted snow at least 3 ft. away and sloping from the foundation.

Keep downspout extenders from being damaged or disconnected.

If there are no gutters, place hard material where the rainwater drips off the roof and make sure that the yard allows rainwater to flow away from the foundation.

Ensure that the sump pump pipe is discharging foundation drain water away from the house, not into it.

Prune trees and bushes to prevent excessive shading and encourage air circulation around the house.

Bushes planted 3 ft. or so away from the foundation are helpful. Bushes planted against the house are not as helpful.

Periodically remove leaves and dirt from gutters or install gutter guards.

Front Door/Entry

Ask family and friends to leave their shoes by the front door.

Use mats at the front door to collect dirt, and vacuum them regularly.

In snowy climates, place a heavy mat and a brush in a sheltered area outside the door and encourage people to brush snow from boots, hats and coats before entering the house.

Insure doors are weather-stripped and sills are properly flashed to avoid leaking.

Basement or Crawlspace

Inspect for leaky plumbing, wet flooring, or sagging structure. If the basement is damp, do not convert it into living space. Wherever possible, keep the bedrooms on the ground floor or on upper floors.

If there is carpet in basement bedrooms, remove it. Basement floors are often damp and cool. If carpet is desired, use throw rugs that can be taken up and cleaned. Any carpet should be able to be pulled up for cleaning.

Keep mattresses off the floor – use a frame and box spring or plywood and concrete block frame to allow air to circulate under the bed.

Store firewood on a porch, shed, or garage – not inside.

Clean the floor drain by pouring half a cup of bleach into the drain, letting it sit a few minutes, and then flushing with water. Keep the drain trap filled with water.

Any house that may have a water problem in the basement or crawlspace should have a sump pump.

Keep the sump pit covered and sealed

In summer or in wet weather, use a dehumidifier to remove the moisture from the basement. Empty it periodically and keep it clean.

Vent the clothes dryer to the outside.

Don't hang wet clothes indoors to dry.

Periodically clean or replace filters in furnaces, air conditioners, dehumidifiers, and other equipment.

Keep boxes on raised platforms and away from basement walls.

Don't store clothing, cardboard or paper in the basement.

Don't store things in the crawlspace.

Use a strong flashlight to inspect the crawlspace. Look for signs of mold, plumbing leaks, and signs of termites, mice, or other pests. If you need to enter the crawlspace to inspect it, be sure to protect yourself with coveralls, long sleeve shirt, gloves, eye protection and a respirator (at least an N-95 respirator, available at a local hardware store).

Make certain that the crawlspace vapor barrier is intact and properly sealed

Bathroom

Check to see that the bathroom fan works and exhausts to the outside, not to the attic.

Have everyone make a habit of using the bathroom fan when showering. Keep the fan running afterwards, at least until the mirror is clear and the walls are dry-usually 15 minutes.

Don't use carpet in bathrooms.

Keep the shower curtain inside the tub during showering

Check under the bathroom sink and around shower stalls and toilets; repair any plumbing leaks that are found. Discard anything that is damaged or moldy.

Don't store linens in the bathroom.

Kitchen

Check to see if the exhaust fan over the stove vents to the outside. If so, use it when cooking.

Check under the kitchen sink for plumbing leaks and repair any that are found. Discard materials that are damaged or moldy.

Empty kitchen garbage cans daily to prevent odors and spoiling.

Closets and Bedrooms

Keep only what you need – give away unneeded clothes, blankets, and other items that may get moldy.

If closets are on an outside wall, make sure some space is left between stored items and the wall for air to circulate.

Open doors (including doors to closets, which may be colder than other rooms) to increase circulation and to warm cold spots. Open drapes regularly as well.

Use area or throw rugs instead of permanently installed carpet in bedrooms.

Clean rugs frequently.

Keep furniture away from walls so air may circulate.

Family Room

Open drapes regularly to allow air movement

Keep sofas and other furniture away from the outside walls to allow air to circulate.

Vent heaters and fireplaces to the outside. As much as seven gallons of water per day can be produced by an unvented heater (the health risks from carbon monoxide and other gases are even greater).

Heating Equipment

Change filters often and make sure all equipment covers are in place.

Inspect flues for proper operation.

Finding the Cause of the Condition

To help you understand what mold in different locations may be telling you about water damage, and what to do about it, the following pages present a series of photographs. They show the moldy condition (or signs of water damage), what the possible cause of mold/water damage in that location might be, and then what can be done to resolve the moisture problem and stop mold from growing. In some cases, it will be necessary to do more work to figure out the cause before developing a solution. In others, the best approach is to try different ways of fixing the problem until arriving at the best one for a particular condition. When diagnosing a moldy condition, don't touch mold or moldy items with bare hands, be careful not to get mold in your eyes, and don't breathe in mold. (See Protective Measures Section.

Condition: Mold on Attic Access Panel

Possible causes:

The ceiling is insulated, but the attic access door is not. In the winter, the door is cold so the warm wet air from the bathroom wets the cold surface of the access door. Mold can grow on this wet plywood.

Things to try:

Insulate the access door.

Run weather-stripping around the panel to seal it.

Condition: Bathroom Wet Wall Deterioration

Possible causes:

Poor use of shower curtain, or failure to clean up wet areas after shower.

Plumbing defect.

The seal around the tub may be deteriorated or missing.

If on the outside wall, insulation and air barrier may be missing.

Things to try:

Insure that the bath fan works and is vented to the outside. Improve shower habits of occupants.

Make plumbing repairs.

Use surround resin bathtub/shower enclosure. If walls need to be replaced, use cement board or fiberglass covered gypsum board, not paper-covered gypsum (whether white, blue or green board) behind shower, tub and tile work.

Condition: Mold Between a Basement Slab and Carpeting

Possible causes:

Rugs, boxes, mattresses, and furniture that sit on basement slabs may be continually dampened by water beneath the slab.

Water may not be draining properly around the perimeter of the foundation.

During warm weather, elevated humidity in the warm air can condense on the cold concrete.

Things to try:

On basement slabs, use only rugs that can be washed in the home washing machine.

Improve rainwater discharge away from the home.

Install a sump pump.

Insulate the exterior side of the foundation wall in cold climates

Condition: Discolored Ceiling Corner

Possible causes:

Insulation is sagging inside the walls.

Poor detailing of insulation at the eaves, permitting air flow through insulation during cold weather.

Elevated or slightly elevated indoor humidity.

In houses with wood stoves, chilly closed-off bedrooms can have this condition.

Things to try:

Improve the insulation. Use non-porous insulating materials, such as foam or cellulose in revised details.

Find excess moisture sources, such as a humidifier, wet foundation, or a back drafting combustion appliance.

Install additional permanent ventilation in high density living areas.

Check for ice damming.

Check to determine if discoloration is due to mold or carbon particles from combustion.

When wood stoves are used, keep the bedroom doors open.

Condition: Dilapidated Conditions (wall shown at the inside and outside)

Possible cause:

Lack of insulation or air barrier

Inadequate construction

Things to try:

Build houses with materials that (1) allow rainwater to escape if it gets into the outside walls, (2) prevent indoor moisture from getting into the walls, and (3) keep moisture from condensing on cold surfaces. Use the right sequence of vapor barriers, insulation, air sealing, house wrap and drainage planes for the outside walls, as dictated by the climate.

Condition: Mold- Possible Plumbing Leak, Away from Exterior Wall

Possible cause:

Plumbing defect.

Lack of insulation.

Moisture escaping to attic or soffit from unsealed penetrations of pipes or wires.

Things to try:

Make plumbing repairs.
Check insulation.
Seal attic and soffit penetrations.

Condition: Flood Event

Possible causes:

Failure to keep rainwater away from the home foundation.
High or rising water table.

Things to try:

Anticipate possible flooding Take emergency precautions
Improve grading so that water runs away from the building foundation.
Provide adequate sump pump protection.
Dry immediately

Condition: Wet Crawlspace

Possible causes:

Plumbing leak, water softener discharge
Poor rainwater discharge away from the house.
High water table.
Water entry from plumbing leak, garden hose, or A/C condensate.
Evaporation of water from exposed wet soil.
Rainwater entry through vent or access opening.

Things to try:

Check plumbing.
Provide a lapped and sealed ground cover.
Improve the rainwater discharge away from the foundation.
Check access and vents.
Install drainage and a sump pump.

Other thoughts:

Wet crawlspaces lead to many moisture problems in the living space and in framing cavities.

Condition: Mold Growth at Window

Possible causes:

Elevated indoor humidity leading to condensation that runs onto frame and sill.
Old or damaged window frame or glazing
Poor detailing/manufacture of window or window installation leading to rainwater entry.
With replacement windows, opening not properly insulated
Window unit of low insulating value.

Things to try:

Reduce the wintertime humidity by finding the source, or, if due to resident practice, install adequate ventilation.
Determine if this is the condition of all windows; if so, consider installing better windows.
Determine if problem is primarily at corners or ganged units; if so, consider re-installation with better insulation or flashing.

Try adding storm windows
Consider low-e replacement windows to reduce problem.

General Clean-Up Procedures

This is a brief outline of what can be done to fix moisture problems and clean up mold. The right approach will depend on specific conditions present in the house. A good understanding of the extent of damage caused by moisture and mold may require careful inspection. The most important skills are those of a detective.

There are many useful guides available on this subject. A great deal of information is readily available at no cost through reliable sources on the Internet. Some of the best sources of information are listed in the References section at the back of this Guide. After reviewing the general steps outlined below, see the References section for further guidance.

Steps to Take:

1. Identify and stop the source(s) of water or moisture.
2. Inspect for dampness and mold growth. Check for any past flooding, leaks, or plumbing problems. Record your findings in writing and with photographs, noting locations on floor plan sketches if possible.
3. Clean and dry moldy areas using special precautions.
4. Bag and dispose of all moldy items.

When you are done, everything that's going to be reused should be dry, and should appear to be free of mold. The area should be checked regularly to see if the work was effective. Mold is likely to return if the moisture/water problem has not been fixed.

Consider how your work, for example, sealing gaps, can affect the air supply and pressures for the heater. You could cause dangerous back drafting or unexpected changes in airflow. Also, if there are residents who seem to be sensitive to the mold, you might refer them to health care workers for further evaluation.

What a Homeowner or Renter Can Handle

Homeowners and renters can normally remove small amounts of mold and make simple repairs to fix moisture problems. This type of job, like house cleaning and yard work, is usually considered part of running a home. If you are a tenant or homeowner, you can and should remove small areas of mold as soon as they become apparent. Don't postpone repairs.

If the moldy area is less than 10 square ft. in size, you can probably handle it. Protect the health of your family when you clean up mold. Ask them to leave the area. Protect your own health by buying and using an N-95 respirator (available from a hardware store). This device covers the nose and mouth, and will filter out 95% of the particles in the air. Wear goggles to protect your eyes. Wear disposable or old clothing that can be cleaned or discarded. Use gloves to protect the

skin from contact with mold and cleaning agents. Long gloves that go up to the elbow are recommended. The glove material should be selected for the types of materials handled. Generally a mild detergent is used and ordinary dishwashing gloves are sufficient. Hard surfaces can be cleaned with water and detergent. Clean a small test area. **It is NOT recommended to use bleach to clean these areas.** Not only is the bleach hazardous to use for cleaning these areas, but it has been determined that bleach can cause the mold to release any remaining spores and contribute to the spreading of the mold.

If you feel that this cleaning activity is affecting your health, you should consider contacting the Housing Authority for assistance. Work for short periods of time, resting outside or in a different area of the house. Dry the area you've cleaned. Air out the house during cleaning and afterwards.

Damaged ceiling tiles, drywall, and carpet generally need to be discarded by bagging the items and placing them with the household trash. It is preferable to bag it wet, because when moldy materials dry out, spores can be released. Unless it is dried within 24 hours and cleaned, carpet will often need to be discarded.

If mold grows back and you are now using your bath and kitchen fans vented to the outside, you should notify the tribal Housing Authority and request an evaluation by the Environmental Health Specialist or Maintenance staff. You may not be alone in this situation.

Identifying the Need for Maintenance or Professional Help

In situations where mold covers an area greater than 10 square ft., or where sewer or other contaminated water is involved, qualified maintenance staff or outside contractors should be called in. Proper safeguards should be taken to protect these workers. Note that the Occupational Safety and Health Administration (OSHA) have special requirements for occupational use of respirators and other protective gear, see www.osha.gov.

Generally, work orders will be needed to guide the job (see Appendix B for information on Work Orders).

Work Orders must be carried out in a way that does not endanger residents, and that actually fixes the undesirable conditions. During the course of repair work, hidden moisture and mold damage may become obvious. This may increase costs and require additional time. All work should be performed with proper planning and foresight. Mold can be removed from indoor environments, but it is often difficult to completely eradicate. Dead mold contains substances that can cause allergic reactions. The actual health benefits of mold clean up have not been extensively studied.

In cases where there has been a history of flooding, or damage has continued over a long period of time, the structure (walls, floors, or roof) may have to be opened up and inspected. This must

be done with care and planning to avoid making conditions worse (spreading mold). If flooding has occurred, the drywall will have to be removed to the high water mark and replaced.

Refer to the New York City Department of Health and the U.S. EPA publications in the References section for guidance on mold remediation that is beyond the capabilities of the homeowner/tenant.

The most important aspects of extensive mold clean-up involve good planning to assure that:

1. The work is handled properly;
2. The occupants of the house are protected; and
3. The problem is resolved.

It is often helpful to carefully review the situation at each step of the process.

Questions to Ask When Maintenance or Professional Help is Used

To check that your job is ready to be done and that it's being done properly, ask yourself these questions:

Before the Work Begins

- Have the possible risks to residents been identified?
- Have the residents been informed of possible risks and their responsibilities?
- Have the causes of problems been adequately identified?
- Should more time be spent assessing the problem?
- Are you satisfied that work is ready to begin?
- Is the work area set up?
- Is the work area closed off from residents?

During Work

- Is the cause of the problem being corrected?
- Is the work area safely set up?
- Are dust and debris being contained in the work area?
- Is mold kept from spreading beyond the work area?
- Are workers wearing necessary protective clothing and equipment (respirators, coveralls)?

Are workers cleaning up each time they leave the work area?

Are workers cleaning thoroughly and avoiding the use of unnecessarily harsh chemicals?

At the End of the Job

Was cleaning done thoroughly?

Were repairs properly performed?

Did workers fix the cause of the problem?

Did workers remove all visible mold and moisture damage?

Is the area clean and dry?

For Long-Term Success

Is there a plan to prevent leaks and dampness in the future?

New Construction and Home Maintenance Repairs

In this section, we look at strategies for preventing moisture and mold in new homes, as well as in homes that are already in use. When new homes are being planned, there are numerous opportunities to avoid moisture and mold problems. In existing homes, regular maintenance and careful inspections can also prevent problems. Clean, dry houses almost never have mold problems. The homeowner/tenant's job is to keep the floors, walls, ceilings, and other surfaces in the home dry enough to prevent mold from starting, and the suggestions below will help you do that. There are many other rules of good practice, but these count the most.

Cleaning Surfaces

If a surface is dirty, it is hard to tell whether it is moldy or not. You need to keep the floor, walls, ceilings, trim, fixtures, appliances, cabinets, counters – all surfaces – clean enough to tell if they are moldy or not. If they look moldy, clean them off, then wait and see if mold forms on the clean surface. If it does, then you have a mold problem that you need to fix.

Roofs

Water from a roof leak might go almost anywhere in the house and cause mold to grow, so it is essential to repair all roof leaks. Here are some of the things you should do if you have a sloped roof that is covered with asphalt shingles:

- When you roof a house with shingles, follow all the directions in the manufacturer's installation handbook from the shingle supplier and follow its detailed installation and flashing recommendations.
- Flash the roof carefully where the roof meets any wall, around items that come through the roof (like chimneys and flues), and at all valleys. Use drip edges at the eaves. Build up flashings and diverters where water running down a roof hits a chimney or other blockage.

Seal up all holes between the ceiling and the attic or rafters to keep the hot, damp air in the house from getting into the attic and causing serious trouble

If you have another kind of roof, see *How to Get Special Help/Finding Equipment*.

Gutters and Downspouts

Water that runs off the roof must not soak in around the house; send it as far away from the perimeter as possible. One way is to install gutters and downspouts that catch all the water running off the roof.

In addition...

- Don't let water run down behind the gutters.
- Add leaf guards over the gutters, or keep the gutters clean by using a broom or hose.
- It is o.k. to set gutters dead level, but it is better to slope them toward the downspouts. Never slope a gutter away from a downspout.
- If the house is on a slope, try to put the downspouts on the downhill side of the house.
- Make sure the gutters and downspouts are securely fastened to the house so that snow, ice, and wind don't loosen or knock them off.
- To send water from the downspout away from the house, add downspout 'extenders' and splash blocks to send the water coming out of the downspouts away from the house.
- Surround these extenders and splash blocks with plants or objects so that they don't get knocked off by mowers.
- The water from the downspouts should come out at least 3 feet away from a house that has a crawlspace and 5 feet away from a house with a basement.
- Be sure to keep downspouts clean, or water will run down the wall and soak the ground next to the house.

Roof Overhangs and Drips

If there are no gutters, then the roof should have an overhang. Here are some tips on using overhangs to control roof water:

- The larger the overhang the better, as long as it's built strongly enough to resist the wind and snow loading effects.
- At the drip line under the edge of an overhang, install a trench of hard material to prevent erosion. The trench should form a ground level gutter, which drains water well away from the building foundation.
- Fill the trench with round stones to keep the water falling off the roof from 'back-splashing' and making the siding wet.
- Design the trench like a gutter, so that water courses away from the house.

Grading Around the House

It is extremely important to keep soil that is in contact with the foundation of the house from becoming saturated with water. Anything that sends water away from the house is helpful. One important way to do this is to grade the ground around the house like a roof – a 'ground roof' – so that the ground acts like a sloped skirt, forcing water to course away from the house. Here are some rules for grading around the house:

- Ensure that water coming down a hill toward the house can run sideways around the house (keep it 10 feet from the house).
- If the house is right up against a slope, see *Special Help*.
- Be sure to fill in low spots or soft spots in the ground around the house so that water won't collect there.
- It is very important to slope paved areas (like porches, patios, walks, and driveways) away from the house.
- Seal up any cracks in the paving and between the paving and the house to keep water from collecting under the paving or porch.
- If the paving has to have cracks, like brick or stone paving without grout, make sure the area under the paving drains away from the house. You may need to dig down and put in a drain.
- Plant bushes and small trees at least three feet away from the house. Plants that are away from the house help soak up water and keep the house dry. If they are too close, they collect water and cause water problems in the house.

Entryways

Consider building an enclosed porch, mudroom or vestibule at the front or side door of the house, where people will be protected from blowing rain or snow and a “track off” mat can be placed, to prevent dirt and water from being tracked into the house.

Exterior Walls and Windows

Like the roof and the ground around the house, the exterior walls and windows need to shed water. Here are some helpful tips:

- Every drop of water that lands on the walls or windows of a house needs to run down, out, and away from the house.
- Siding or shingles that overlap horizontally are better at shedding water than sheets of plywood, wallboard, or stucco.
- Water can get behind any siding material. When it does, it needs to run into a continuous sheet of building paper or house wrap, which makes it run down the wall and keeps it from coming inside and getting the framing wet.
- Water running down a wall will sooner or later hit an obstacle like a sill or window frame. When it does, it should always run onto flashing that sends it out to the surface of the wall.
- If vapor control is a concern, it is better to use insulating sheathing than to install a polyethylene vapor barrier on the inside.

Below-Grade Drainage

Taking care of roof and surface water will solve most of your water problems. Sometimes, underground water is the culprit. If you are in a low-lying area with poor drainage, or in an area with clay soils, hidden layers of clay, or rock ledges, see *Special Help* to deal with underground water. Here are some hints for ordinary conditions:

- If you're sure that ground water will never reach the footings, you don't need to do anything special.

In addition...

- Footing drains are used to protect basements and crawlspaces from rising ground water.
- For these drains to work, they must be laid at the bottom of the footings, not at the top.
- An additional drain can be installed inside the footings and connected to the outside drains or to a sump pump.
- Footing drains must slope to discharge to a community storm water system; to a low point on the site; or to a sump pump, community storm water treatment, or daylight.
- Water from downspouts should stay on the surface. Never connect them with the footing drains.
- Footing drains must, in all cases, flow constantly downward from the foundation drain and be drained to a location having a water table which is reliably lower than that of the drain at the foundation. Otherwise, the drain could bring water to the house.

Basements

- Concrete basement walls may be preferable to block basement walls, because they stand up better to side loads caused by water and are less likely to leak.
- Always damp-proof the part of a basement wall that can't be seen.
- Insulation works better on the outside of a basement wall than on the inside because it keeps the wall dryer. Also, it provides mechanical protection for the damp-proofing or waterproofing, and lowers the potential for condensation on the inside because the concrete will be warmer.
- If you insulate on the outside, be sure termites cannot reach framing by tunneling through or behind the insulation and the insulation is protected from damage.
- If you insulate on the inside, make it removable or the baseboard trim removable to inspect for and repair water damage behind the insulation.
- If basement walls become moldy, they can be cleaned with a detergent and water solution.

Crawlspaces (*continued*)

Most moisture problems in single-family houses occur in homes with crawlspaces, because water problems may persist for long periods of time and go unnoticed. Here are some important tips about crawlspaces:

- Crawlspace should have easy access and good lighting, so as to enable regular inspections.
- Water in a crawlspace typically comes from poor rainwater management, plumbing leaks, ground water problems, air conditioner condensate, or water softener discharge.
- If there is no mechanical equipment or ductwork in the crawlspace, insulate the floor framing, add a continuous vapor-tight material to the underside of the floor, and install large vents (larger than required by code) that provide cross ventilation.
- Otherwise, design the crawlspace like a stubby basement, without vents and with easy access. If you do this, you may need to check for building code requirements.)
- Cover the soil surface with a ground cover: a slab of concrete, a sealed polyethylene sheet, or other vapor-proof material.
- Ordinary (built to code) vents can only deal with small amounts of moisture. The choice of ground cover and adequately controlling surface drainage are much more important.
- Vents should never be installed near grade. Otherwise, they might let water into the crawlspace.

Slabs

- Slabs are usually placed over sand or gravel base; it is very important to keep water from downspouts from getting into this gravel or sand base.
- The lack of slab edge insulation is a problem in many cold climate houses
- Radiant heating should not be used if there is water near the underside of the slab.
- Carpets on slabs are a common source of mold inside homes.
- Any carpet or other fabric on a slab should be removable for complete cleaning and disinfecting. If that is difficult, make the part near the outside walls removable (for example, use carpet tiles).

Sump Pumps

Any foundation with water problems of any type should be equipped with a sump pump in a sump pit. Whenever possible . . .

- Locate the sump pit near the wettest or lowest spot in a basement or crawlspace.
- Provide a way for water from other potential wet spots at the foundation to get to the sump pit.
- In a basement, you can use the gravel base under the slab to drain water to the sump. Make the ground under the gravel slope to the sump pit.
- In a crawlspace, try to install the sump pit near the access point, and have the soil surface drain to the sump pit.
- The pump should discharge to a site downhill and away from the home, so that the water cannot migrate back to the house.
- In areas subject to severe storms and power outages, a back-up generator is a very good idea.
- If necessary, a sump pit that can be covered may be used for radon evacuation.

Water Softener Recharge

Resin-exchange water softeners require occasional recharging, and this process produces large quantities of water with high salt content.

- Discharge water from a water softener should never be dumped into the crawlspace.
- Check with the provider of the water softener to determine the appropriate procedure for discharging the recharge water.

Plumbing and Fixtures

Another major source of water is leaky plumbing. The following rules of thumb apply:

- Plumbing systems should not leak, and if they do, they should be promptly repaired.
- Leaks in the water supply system may produce large quantities of water, but it will be clean.
- Leaks in the Drain Waste Vent (DWV) system may be small, but are often unpleasant and unhealthful.
- Water from leaks may lead to deterioration of surrounding materials.
- Any damaged or moldy material should be removed.
- The shelf under the kitchen sink is a common site of damaged materials.
- If the damaged or moldy material is extensive, professionals who are trained to confine work areas from the living space should be responsible for repairs. (See earlier clean-up recommendations)
- Regularly check crawlspaces for leaking plumbing.

Furnaces, Boilers, and Stoves

Furnaces, boilers, and stoves burn fuel to produce heat. In turn, combustion produces moisture. This moisture should be discharged out of the house through a chimney (or, in energy efficient condensing equipment, through the discharge piping).

- Unvented combustion equipment, including heaters sold as 'ventless' heaters, unvented kerosene stoves, and the kitchen range, should never be used for space heating.
- The risks of moisture damage are great, but the risks to health from carbon monoxide and other pollutants are even greater.
- Before every heating season, the chimney should be checked to ensure that it draws properly.

Air Conditioning and Condensate

The work of an air conditioner takes place at the coil inside the furnace or air handler, and it won't do its job in humid weather if the A/C unit is too big. The process is as follows:

- Return air passes along the coil and its temperature drops.

- After about 15 minutes of service, water begins to drip from the coil into the condensate pan, down the condensate pipe or tube, and away from the equipment.
- To prevent mold and maintain comfort, air conditioning equipment needs to remove humidity from the air.
- Overly large air conditioners cannot remove humidity from the air because the coil will satisfy the thermostat too quickly, resulting in a 'short cycle.' This doesn't allow enough time for the air conditioner to remove the moisture from the air. The moist air can then end up condensing on cold inside walls and ceilings, making them moldy. More tons are not better.
- Use Manual J for sizing new air conditioners. See *How to Get Special Help/Finding Equipment*.
- If the air conditioner that is in the house is oversized, sometimes lowering the temperature setting can help. Or, sometimes the flow rate through the air conditioner can be reduced.
- The condensate pan should be cleaned at the start of each season, and the condensate piping should be checked to ensure that it is open.
- Condensate should discharge safely, not onto crawlspace or basement surfaces.

Dehumidifiers

Dehumidifiers are very helpful and useful during the cooling season. They may be quite expensive to run, but they do a good job of reducing potential moisture damage and mold in a home. Consider buying a dehumidifier with a built-in humidistat. With the humidistat, it will run only when needed. Keep it set to maintain humidity below 60%.

Insure that the dehumidifier is connected to or discharges close to a drain.

Consider a TDHE program to provide dehumidifiers temporarily to those houses experiencing moisture problems to dry out areas.

Fans and Vents

- Having and using a bathroom fan that is vented to the outside is generally good for moisture control.
- Many newer homes are built so tightly that, unless dry outdoor air is brought in, the moisture naturally produced by a family can cause high indoor humidity levels.
- In muggy weather, outdoor air cannot help make the indoor air drier. During muggy weather, the only way to reduce indoor humidity is to close up the house and use dehumidifiers or air conditioning.
- Fans should be selected for quiet and energy efficient operation.
- Fans should discharge air out of doors, not into attics or crawlspaces.
- 'Smart' controls that operate fans for certain time periods or at certain humidity levels are recommended.
- Opening windows during mild weather is usually a good idea, but don't alternate between open windows and air conditioning. Once you start air conditioning, keep the windows closed until you don't need it any more.

Checking for Wetness

- Indoor air should smell fresh. Odors from cooking or smoking may mask odors from molds.
- Don't store anything in crawlspaces.
- Leave outside corners – especially those near downspouts – visible for inspection.
- Inspect crawlspaces regularly. Look for signs of mold and leaks including the area of the band joist (the outside perimeter floor framing).
- Check for plumbing leaks. Look especially under sinks, under tubs and shower stalls, and around toilets.
- Peel carpet back from the floor along the outside walls of the home. If there is a persistent problem, devise a way to make the carpet or the carpet edge easily removable.
- At the first sign of moisture problems in the foundation area, look for leaking hose bibs, correct the grading and downspout discharge in that location.
- Scrub any mold-damaged areas clean. Wait before repainting to see if the moisture source has been solved. After, if the paint finish is harmed, investigate further to see where moisture may be coming from and make repairs. The damaged wall may need to be removed. If there is only minor damage, prime with a stain-covering primer, and then repaint. Keep an eye out for recurring problems.
- If closets contain moldy surfaces or contents, and keeping the doors open for a time while moving contents away from closet walls doesn't solve the problem, you may need to provide greater air exchange with the adjacent room using grilles or undercuts in the door. Reduce clutter in the closet.

Flooding Events

If a flood occurs in the home, proceed safely...

- Beware of drowning, electrical shock, chemical and biological contamination, vermin (snakes, rats, etc.), and emotional distress. See FEMA reference material listed in Resources.
- If materials are cleaned and dried within a few days after flooding, they can usually be salvaged.
- Soaked drywall and soaked fiberglass or cellulose insulation must be disposed of. Exercise care in handling fiberglass insulation.
- Concrete, masonry, wood, and closed-cell foam materials can usually be scrubbed or scraped clean and salvaged (see *How to Get Special Help/Finding Equipment*).

Partnerships

The sources of mold and moisture problems are not always obvious, nor are they always simple to resolve. In some situations, creating viable partnerships is the best way to resolve problems that homeowners or renters cannot handle on their own. These partnerships can be formed by

working with other agencies at the federal, tribal, and state levels. These agencies can often provide technical information and assistance, funding, and help in locating the services of specialized professionals who can resolve environmental conditions.

The following section describes some of the key programs and technical assistance resources that are available at the time of this Guide's publication. We have organized the descriptions by affiliation; that is, Federal-, Tribal-, and State-based resources, with a fourth subsection titled Other Entities that covers consultants, contractors, non-profits, educational and medical organizations, and resources. Depending on the conditions to be addressed, partnering with one or more of these entities may be required.

Federal Resources

U.S. DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT (HUD)

Office of Native American Programs (ONAP)

NAHASDA Funds

The Native American Housing Assistance and Self-Determination Act of 1996 (NAHASDA) requires HUD to make grants on behalf of Indian Tribes to carry out affordable housing activities. NAHASDA funds can be used to aid families and individuals seeking affordable homes in safe, healthy environments – essential elements in the effort to improve housing conditions. NAHASDA assistance is provided in a manner that recognizes the right of tribal self-governance.

Eligible affordable housing activities include acquisition, new construction, reconstruction, and moderate or substantial rehabilitation of affordable housing. According to NAHASDA, proceeds from the sale of homeownership units can be used for any housing activity, community facility, or economic development activity that benefits the community. Refer to www-domino.hud.gov/ihp/newhome.nsf for the NAHASDA homepage, or call (800) 366-6827 and choose option 4 to connect to the ONAP system hotline.

Indian Community Development Block Grant Program (ICDBG)/Imminent Threat Funding

The primary objective of this program is to provide competitive funding for the development of viable Indian and Alaskan Native communities, including the creation of decent housing, suitable living environments, and economic opportunities. The program also provides funding for identified imminent threats. Imminent threat funding is available under specific circumstances: to alleviate or remove conditions that have been identified as a threat to the health or safety of tribal community members and that require an immediate solution per 24 CFR 1000.48.. For more information on ICDBG, contact the Eastern/Woodlands Office of Native American Programs at (800) 735-3239.

Office of Healthy Homes and Lead Hazard Control

Healthy Homes Demonstration and Education Program

U.S. HUD's Healthy Homes Demonstration and Education Program develops, demonstrates, and promotes cost-effective, preventive measures designed to correct multiple safety and health hazards in the home environment that can result in serious diseases and injuries in children. The Program also supports effective hazard assessment and intervention methods, as well as projects focusing on public education and outreach. During each fiscal year, the Program awards grants and/or cooperative agreements to state, local, and tribal governments, as well as to not-for-profit and for-profit organizations.

HUD is very interested in reducing health threats to residents – especially those affecting children. Goals include:

- Mobilizing public and private resources to enable cooperation among all levels of government, the private sector, and community-based organizations in the development of promising, cost-effective methods for identifying and controlling housing-based hazards.
- Fostering sustainable programs at the local level that will continue to prevent – and where they occur, to minimize and control – housing-based hazards in low- and very-low income residences when HUD funding is exhausted.

Tribal entities will be afforded considerable latitude in designing and implementing preventive and corrective home safety and health measures; especially those which help prevent serious diseases and injuries in children.

The following direct activities are eligible under this grant program:

- 1) Performing evaluations of eligible housing to determine the presence of housing-based hazards (e.g., mold growth, allergens, unvented appliances, exposed steam pipes or radiators, deteriorated lead-based paint) through the use of generally accepted testing procedures.
- 2) Conducting medical examinations of young children for conditions caused or exacerbated by exposure to hazards where this is considered essential to the project, and where alternative funding sources are unavailable to cover these costs.
- 3) Conducting housing interventions to remedy existing housing-based hazards and address conditions that could result in their recurrence.
- 4) Carrying out temporary relocation of families and individuals, when necessary, during the intervention period.
- 5) Performing medical testing.
- 6) Undertaking housing rehabilitation activities that are specifically required to carry out effective control of housing-based hazards, and without which the intervention could not be completed and maintained.
- 7) Conducting clearance testing for lead hazard control activities and analysis for lead, mold, carbon monoxide, and/or other toxins as appropriate, in keeping with generally accepted standards or criteria.
- 8) Carrying out architectural, engineering, work specification development, and other construction management services to control housing-based hazards and to remedy existing hazards.

- 9) Providing training on safe maintenance practices to homeowners, renters, painters, remodelers, and housing maintenance staff people working in low- or very-low income housing.
- 10) Providing cleaning supplies for hazard intervention and hazard control.
- 11) Conducting general or targeted community education programs on environmental health and safety hazards.

For more information, contact HUD's Office of Healthy Homes and Lead Hazard Control at (202) 755-1785 ext. 126, and at www.hud.gov, which provides a link to the Office's home page.

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES

Indian Health Service

Indian Health Service is a public health services agency within the U.S. Department of Health and Human Services. Indian Health Service is responsible for providing federal health services to American Indians and Alaskan Natives. The goal of Indian Health Service is to ensure the availability of comprehensive health services for AIAN individuals and to raise their health status to the highest possible levels. Either directly or through tribal governments, Indian Health Service administers health clinics and environmental health departments in tribal areas. In situations where medical issues arise, it is strongly recommended that an appropriate health care professional be consulted. Appendices A and B contain listings of useful IHS contacts; you may also call (301) 443-1083 for assistance.

ENVIRONMENTAL PROTECTION AGENCY (EPA)

General Assistance Program (GAP)

The purpose of the General Assistance Program is to strengthen the tribes' ability to manage environmental programs. The program allows tribes to create a reservation-based position specifically charged with handling environmental issues. The EPA provides general assistance grants to tribal governments and inter-tribal consortia for planning, developing, and establishing the capability of implementing environmental protection programs in Indian Country. For more information, see www.epa.gov/indian or contact (202) 260-9840.

Indoor Environments Division

This office provides regional Indoor Air Quality coordinators to assist with technical issues. See www.epa.gov/iaq or call (800) 438-4318 for the contact information of the coordinator serving your area. For information on mold, see www.epa.gov/iaq/pubs/moldresources.html.

CENTERS FOR DISEASE CONTROL (CDC)

The Centers for Disease Control and Prevention (CDC) is recognized as the leading federal agency responsible for protecting the health and safety of people at home and abroad, providing credible information to enhance health decisions, and promoting better health through strong partnerships. CDC serves as a national clearinghouse for developing and applying disease

prevention and control techniques, as well as for information on environmental health and educational activities designed to improve the health of the people of the United States. Contact CDC in Atlanta, GA at (404) 639-3311, or see www.cdc.gov.

FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA)

The Federal Emergency Management Agency is an independent agency of the federal government. FEMA's mission is to reduce loss of life and property and protect our nation's critical infrastructure from all types of hazards through a comprehensive, risk-based, emergency management program of mitigation, preparedness, response, and recovery. In this capacity, FEMA provides support to homeowners and communities in reducing losses associated with flood damage. Contact FEMA in Washington, D.C. at (202) 646-2500, or see www.fema.gov.

U.S. DEPARTMENT OF AGRICULTURE – RURAL DEVELOPMENT

The mission of the U.S. Department of Agriculture's Rural Development office is to improve the economy and quality of life for those living in rural areas, including those represented by tribal governments. Through financial programs, the USDA RD supports health clinics, housing, and emergency service facilities. Loans, grants, and loan guarantees are provided for single- and multi-family housing. Business loans and technical assistance is also provided. For further information, notices of funding availability, and a listing of field office locations, contact (202) 720-4323, or see www.rurdev.usda.gov

FEDERAL HOME LOAN BANK

The Federal Home Loan Bank System is a government-sponsored enterprise that offers affordable housing and community development lending services. It provides long- and short-term advances on the security of many types of mortgages, makes advances to member financial institutions at lower interest rates, and provides low-cost advances to members to support affordable housing and community investment programs. The Federal Home Loan Banks are government-chartered member-owned corporations. To find the FHL bank serving your area, contact (202) 408-2500 or see www.fhfb.gov/FHLBSys/FHLBS_districts.htm.

Tribal Resources

Housing Authorities (HAs) and Tribally Designated Housing Entities (TDHEs)

HAs and TDHEs are in a middle position between those responsible for building the housing (designers, general contractors, roofers, carpenters, electrical and plumbing contractors, excavators, and landscapers) and those living in the finished homes. They recognize that residents expect a dry home and that residents can play a role in keeping the home dry and mold-free. Through clear communication and active involvement, HAs and TDHEs can also help ensure that construction practices are appropriate.

Persistent mold can be a continuing source of annoyance, and may be associated with effects ranging from simple irritation to allergies, and more rarely, to hypersensitivity disease. Residents may report allergies, infections, fatigue, or childhood or adult onset asthma, which they may attribute to mold in their homes. It may not be possible to determine whether mold is the cause of these reported symptoms.

Building cooperation between residents, HAs, and TDHEs can help speed appropriate responses to mold and moisture problems. Renters and homeowners should know that moldy conditions they have not been able to correct themselves are to be reported to housing managers (for rental units) or appropriate tribal officials (for homeownership units) for prompt repairs.

Tribal housing authorities can:

- Ensure that residents understand appropriate reporting procedures;
- Encourage residents to provide notification in writing of any mold or moisture problems;
- Consider free distribution of equipment (such as dehumidifiers and cleaning supplies) to residents.

Tribal housing authorities can check for evidence of moisture and mold in rental units every time an annual home assessment is completed. These assessments are prepared as part of the annual housing quality standard inspections. Findings should be recorded in writing and with photographs, noting locations on floor plans whenever possible. This will allow HAs and TDHEs to track progress for each house, and to identify possible trends in groups of houses showing evidence of mold.

Tribal communities may also administer their own environmental offices and health clinics. Brief descriptions of these entities follow.

Environmental Offices

Environmental offices have been established to provide environmental protection in tribal communities. Many of these offices are funded by the EPA's GAP Program (referenced above). The EPA works with tribes to develop environmental programs that are tailored to individual tribal needs.

Health Clinics

Tribal clinics provide health care services to eligible Native American and Alaskan Native people. Members of tribal households who are experiencing health problems should see an appropriate health care professional to assess their health condition.

AMERIND Risk Management Corporation

AMERIND offers property and casualty insurance for tribal governments, tribally designated housing entities, and their subsidiaries. AMERIND also provides products and services for tribal homeowners and renters. They contract with independent claim adjusters across the U.S. to investigate and reach initial settlements for claims reported by tribes covered by their coverage.

Property coverage does not cover most cases of water damage and mold. However, AMERIND does provide to its membership Flood and Earthquake coverage with special limits and deductibles. AMERIND's definition of a flood is less restrictive than FEMA's. Generally speaking, a 'flood' means surface water, waves, tides, tidal water or tidal wave, overflow of streams or other bodies of water, or spray from any of the foregoing; weather-driven or not.

Flood does not include loss caused by any of the following:

- Water that backs up through sewer or drains;
- Water below the surface of the ground, including that which exerts pressure on or leaks through sidewalks, driveways, foundations, framed walls, or floors;
- Mudslide or mudflow.

AMERIND investigates each claim filed individually in order to apply the proper coverage, limits, and deductibles. AMERIND is committed to coordinating investigations, claim settlements, and defense with the member Housing Authorities and Tribally Designated Housing Entities (TDHEs).

All losses, including the peril of flood, should immediately be reported to AMERIND. Losses not reported to AMERIND within one year of the date of loss are not considered a covered loss. AMERIND's main office, which can be contacted for membership inquiries and procedural questions related to damage reporting, is:

AMERIND Risk Management Corporation
6201 Uptown Blvd., Suite 100
Albuquerque, NM 87110
(505) 837-2290
(505) 837-2053 (fax)
www.amerind-corp.org

State Resources

State health and environmental departments are often the best sources of information on regional programs addressing mold. State health departments may have community and environmental health specialists available who are trained to provide health inspections of homes, assessments of the level and type of molds, and health information and education on mold health concerns. State housing departments may maintain listings of technical experts capable of performing mold clean-up and housing repairs, and state health and housing departments may offer program assistance that can help resolve moldy conditions identified in the home. Check the Blue Pages of your telephone directory for appropriate listings.

Other Entities

Cleaning up moldy conditions in homes with serious moisture problems may require the expertise of technical service providers and environmental specialists. The following is a general listing of technical service providers.

Mold Specialists (Indoor Air Quality or Indoor Environmental Quality)

Mold specialists are trained to inspect mold conditions in homes, provide instructions on mold clean-up and removal, and offer technical support on indoor air quality issues. If requested, they may also conduct microbial sampling to confirm the presence and type of molds. See *How to Get Special Help/Finding Equipment* for contact information on industrial hygienists, sampling, and laboratories.

Mold Specialist (Building/Structural Analysis)

Mold specialists in building/structural analysis are trained to inspect building structures and identify the source of the mold problems, produce plans for mold removal and any needed structural repairs to the home, and provide cost estimates for the plans presented. They often include building inspectors, civil/structural engineers, and architects specializing in building technology.

Building Contractors

Building contractors provide home renovation services and/or new construction.

Non-Profits / Educational / Medical

The following organizations can provide additional information, assistance, and resources:

American Lung Association

For information on allergies and asthma, see www.lung.usa.org

American Academy of Allergy, Asthma & Immunology

For a physician referral directory and information on allergies and asthma, see www.aaaai.org

American College of Occupational and Environmental Medicine

This organization provides referrals to physicians who have experience with environmental exposures. Visit www.acoem.org for more information.

How to Get Special Help/Finding Equipment

FINDING ANSWERS TO BUILDING QUESTIONS

Asphalt shingles and roof flashing:

Asphalt Roofing Manufacturers Association (ARMA www.asphaltroofing.org)

National Roofing Contractors Association (NRCA www.nrca.net)

Other types of roofing and low-slope roofs:

National Roofing Contractors Association (NRCA www.nrca.net)

Grading on steep sites:

Geotechnical engineering services may be required. Check local Yellow Pages for these types of services.

Drainage and underground water control in clay and ledge:

Geotechnical engineering services may be required. Check local Yellow Pages for these types of services.

CLEAN-UP ADVICE

Procedures for cleaning up after a flood:

See <http://www.epa.gov/iedweb00/pubs/flood.html>

Procedures for salvaging wet carpet:

See “Caring for Water-Damaged Carpet”
Carpet and Rug Institute (CRI www.carpet-rug.com)

Procedures for salvaging water-damaged items of special value:

Institute of Inspection, Cleaning, and Restoration Certification (IICRC, www.iicrc.com)

EQUIPMENT, GEAR, AND LABS

Purchasing HEPA vacuum cleaners:

See the Carpet and Rug Institute's listing of tested vacuum cleaners for models to buy at www.carpet-rug.com.

Purchasing moisture meters and borescopes (borescopes are costly; they can also be rented from equipment rental companies):

See Equipment Suppliers such as Grainger, Inc. (www.grainger.com) or Professional Equipment (www.professionalequipment.com)

Refer to manufacturers' websites for technical guidance; see for example www.delmhurst.com or www.tramexltd.com or www.protimeter.com

Purchasing protective gear, including respirators:

See better hardware stores in your area.

Sampling and labs:

Hiring a professional to collect environmental samples in the house
American Industrial Hygiene Association (AIHA www.aiha.org)
Search for Certified Industrial Hygienists with special indoor air quality
experience.

Laboratories for analyzing mold samples:

American Industrial Hygiene Association
(www.aiha.org/LaboratoryServices/html/emlap.htm)
AIHA certifies laboratories that analyze environmental samples for mold.
Currently, there are less than 20 accredited laboratories in this program.

Appendix B: Work Orders

In many cases, a work order will have to be prepared by the Housing Authority to repair a condition that results in mold growth. A work order directs either an employee or a contractor to complete one or more tasks, and describes:

- The location of the required work;
- The type of work;
- Date and time of receipt;
- Date and time issued to those performing the work;
- Date and time work is satisfactorily completed;
- Materials used to complete the repairs;
- Cost of the materials used;
- Cause and damage;
- Charges to the resident for resident-caused damages, if applicable.

Typically, work orders are entered into a log that describes the status of all work orders according to type (emergency or non-emergency), when issued, and when completed. This allows the HA to track problems and measure progress.

The type of work order will need to be identified:

- **EMERGENCY**, for circumstances posing an immediate threat to life, health, safety, or property.
- **NON-EMERGENCY**, for situations that do not constitute immediate threats.

Emergency situations may develop because of chronic conditions, and not necessarily because of a sudden event. For example, if the ground doesn't slope away from the house and water continually seeps in, an emergency situation may develop. A successful work order may involve tasks as simple as landscaping or as extensive as excavation and waterproofing.

Once the emergency work order is completed, Emergency Status Abated work orders may be issued. In some situations, temporary relocation of a resident family away from the emergency conditions in their unit may be appropriate and qualifies as an abatement of the emergency.

Other types of work orders, which can be used to prevent mold problems from developing, include:

1. **Cyclical**, for routine maintenance work that is done in the same way at regular intervals (e.g., replacing furnace filters, cleaning out site and roof storm drains, etc.).
2. **Preventive Maintenance**, for work done on a regularly scheduled basis in order to prevent breakdowns in individual units or major systems (e.g., inspection/cleaning/maintaining roofing and flashing, gutters and downspouts, boilers, etc.).

3. **Vacant Unit Turnaround**, for all work needed to make a unit ready for occupancy. Houses that are left vacant for long periods of time may become musty and moldy.

There are many other factors unrelated to mold that may need attention. In some cases, a decision to wait may be in order:

Deferred for Modernization – Sometimes, it is reasonable not to expend resources right away to fix a particular deficiency that will be addressed soon as part of a larger physical improvement program. However, there are clearly times when waiting will cause the mold problem to become much harder – and more expensive – to eradicate. For example, when there has been flooding, cleaning and drying should not be delayed.

Appendix C: References

Provided below is a list of references for further guidance. Key references are those highlighted with a ✓

Air Conditioning Contractors of America (ACCA), **Manual J - Residential Load Calculations** ACCA: Arlington, VA. www.acca.org *Industry guide for sizing air conditioning and heating equipment.*

American Industrial Hygiene Association, Fairfax, VA: www.aiha.org *Information sheets on mold, as well as list of accredited laboratories for mold testing.*

American Lung Association, Washington, DC: www.lungusa.org/ *General information on health aspects of mold and other air quality topics.*

Ammann, H. **Is Indoor Mold Contamination a Threat to Health?** Washington State Department of Health, Olympia, WA: www.doh.wa.gov/ehp/oehas/mold.html *Detailed review of mold types and their health effects.*

✓ Building Science Corporation (BSC), three publications, “Read This: Before You Design, Build or Renovate”, “Read This: Before You Move In” and “Read This: Before You Turn Over a Unit” available at www.buildingscience.com/resources/mold. Also, **Builders Guides** (for 4 climate areas). Joseph Lstiburek. Available from Energy and Environmental Building Association (EEBA), Bloomington, MN: www.eeba.org *Guidebooks on moisture control, energy efficiency and ventilation for new home design.*

✓ California Department of Health Services, **“Indoor Air Quality Info Sheet: Mold in My Home – What Do I Do?”** July 2001. www.cal-iaq.org/mold0107.pdf *Basic information for people who have experienced water damage in their home, describing health concerns, general guidelines on prevention, mold detection and cleanup.*

✓ Canada Mortgage and Housing Corporation. **“Mold in Housing: An Information Kit for First Nations Communities”** a joint publication of CMHC, Health Canada, and Indian and Northern Affairs Canada, and a leaflet, **“First Nations Occupants’ Guide to Mold,”** both published in 2001. *The kit is intended for inspectors, housing departments, tribes, health providers, occupants, and building trades, and includes basic information, the responsibilities of key players and the training they need, and specific guidance for housing providers. The leaflet is a convenient guide for tenants and homeowners. CMHC also has an “About Your House” series, including these on-line documents: “Measuring Humidity in Your Home” (CE01), “After the Flood” (CE07), “Fighting Mold” (CE08), “The Importance of Bathroom and Kitchen Fans” (CE17), “Choosing a Dehumidifier” (CE27), and “The Renovation Project” (CE28), including “Before You Start Renovating Your Basement – Moisture Problems.” Simple guide sheets on key issues. “Building Solutions – A Problem-Solving Guide for*

Builders and Renovators” see www.cmhc-schl.gc.ca. For the **“About Your House”** series, see www.cmhc-schl.gc.ca/publications/aboutyourhouse/index.html

Centers for Disease Control and Prevention, National Center for Environmental Health, www.cdc.gov/nceh/airpollution/mold/default.htm. Resources include fact sheets on **“Molds in the Environment”**, **“Stachybotrys Chartarum and Other Molds”**, **“State of the Science on Molds and Human Health”**, **“Information on Aspergillus Molds”**, **“Pulmonary Hemorrhage in Infants”** and **“Mold Links”**. *Authoritative information from the federal center responsible for investigating outbreaks of illness.*

Home Energy: www.homenergy.org Magazine including topics on moisture control and building construction.

✓ Institute of Inspection, Cleaning and Restoration Certification (IICRC), **Standard and Reference Guide for Professional Water Damage Restoration**, S500-99.IICRC: Vancouver, WA: www.iicrc.org/ *One of the basic guides for dealing with extensive moisture damage.*

✓ Minnesota Dept. of Health, **Mold in Homes** St. Paul, MN: www.health.state.mn.us/divs/eh/indoorair/mold/index.html *Health information for consumers who want to know what to do about mold and moisture problems.*

Montana State University Extension Service **Healthy Indoor Air for America’s Homes: Training Manual**, Bozeman, MT, in cooperation with EPA and other Extension Programs. www.montana.edu/wwwcxair/ *Educational material on mold and other indoor air quality topics including bugs, mold and rot. Provides various modules for training extension agents.*

National Association of Homebuilders (NAHB), **Mold in Residential Buildings** ToolBase: www.toolbase.org/ (Search for Mold) *A primer on mold and moisture control for homeowners and builders. Includes list of documents and links to other resources.*

National Multi Housing Council (NMHC) and the National Apartment Association (NAA), **Operations and Maintenance (O&M) Plan for Mold and Moisture Control** Identifies “best practices” apartment owners and managers can use to manage mold growth and moisture problems on their properties. www.nmhc.org/ and www.naahq.org/moldReq.htm

New York City Department of Health, **“Facts about Mold.”** Bureau of Environmental & Occupational Disease Epidemiology, April 2000. [ww.ci.nyc.ny.us/html/doh/html/ci/cimold.html](http://www.ci.nyc.ny.us/html/doh/html/ci/cimold.html) *Fact sheet for homeowners answering common questions about mold.*

✓ New York City Department of Health, **“Guidelines on Assessment and Remediation of Fungi in Indoor Environments.”** Bureau of Environmental & Occupational Disease Epidemiology, November 2000. www.ci.nyc.ny.us/html/doh/html/epi/moldrpt1.html. *This 17-page guide is an update of original guidelines from 1993 that dealt with mold growth problems in several New York City buildings. It revises and expands those guidelines to include all types of mold, and provides a discussion of health issues, evaluation strategies and clean-up and*

control methods. It was developed by specialists in the fields of microbiology and health sciences, and has been widely cited on many mold remediation projects across North America. Other states have established specific guidelines regarding mold remediation. Check with your State Health Department.

Red Cross/Federal Emergency Management Agency, **“Repairing Your Flooded Home,”** particularly Step 4, **“Dry Out Your Home.”** www.fema.gov/library/repfhm.pdf Guidelines on lowering humidity, sorting contents and discarding debris, how floodwaters affect your home, drain the ceilings and walls, dry the ceilings and walls, and dry the floors.

U. S. Dept. of Housing and Urban Development, Office of Healthy Homes and Lead Hazard Control, **“Healthy Homes Issues: Mold”.** Healthy Homes Initiative (HHI) Background Information. www.hud.gov/offices/lead/hhi/Mold_v2_12-01.pdf. State of the science, covering extent and nature of mold hazards in the home, assessment and mitigation methods, and research needs.

✓ Healthy Homes Partnership, **“Help Yourself to a Healthy Home – Protect Your Children’s Health”** www.hud.gov/offices/lead/healthyhomes/healthyhomebook.pdf. Funded by U.S. Dept. of Housing and Urban Development, Office of Healthy Homes and Lead Hazard Control, U.S. Department of Agriculture and Cooperative State Research Education and Extension Service. Guide focusing on indoor air quality, asthma & allergies, mold & moisture, carbon monoxide, lead, drinking water, hazardous household products, pesticides, and home safety.

✓ U. S. Environmental Protection Agency, **“Mold Resources.”** www.epa.gov/iaq/pubs/moldresources.html. Summary of the key issues and extensive links to health-related groups and indoor air quality topics. See especially, “A Brief Guide to Mold, Moisture, and Your Home” at www.epa.gov/iaq/molds/images/moldguide.pdf

✓ U.S. Environmental Protection Agency, **“Mold Remediation in Schools and Commercial Buildings.”** Office of Air and Radiation Indoor Environments Division. March 2001. www.epa.gov/iaq/molds/graphics/moldremediation.pdf Widely referenced guide with principles that can also be useful for homes.

U.S. Environmental Protection Agency, **“Should You Have the Air Ducts in Your Home Cleaned?”** Indoor Environments Division, Office of Air and Radiation, www.epa.gov/iaq/pubs/airduct.html Prudent guidance for homeowners.

U.S. Environmental Protection Agency, Office of Children’s Health Protection. <http://yosemite.epa.gov/ochnp/ochpweb.nsf/homepage> Multi-faceted approach to protecting children’s health from environmental hazards, including mold.

University of Minnesota, Department of Health & Safety, **“Managing Water Infiltration into Buildings: A Systematized Approach for Remediating Water Problems in Buildings Due to Floods, Roof Leaks, Potable Water Leaks, Sewage Backup, Steam Leaks and Groundwater Infiltration”** www.dehs.umn.edu/iaq/flood.html Includes a water damage checklist, testing, a

flowchart to evaluate water damaged building materials and furnishings, and flood-related links to other sites.

U.S. Department of Health and Human Services, Indian Health Service,
www2.ihs.gov/IEH/mold.asp Webpage *on mold, providing links to common resources.*

✓ U.S. Department of Housing and Urban Development, Office of Native American Programs,
Mold Prevention and Detection: A Guide for housing Authorities in Indian Country [provide link] Includes *helpful advice as well as specific cause and effect examples with remediation suggestions.*

Appendix D: References

Canada Mortgage and Housing Corporation. "Mold in Housing: An Information Kit for First Nations Communities" a joint publication of CMHC, Health Canada, and Indian and Northern Affairs Canada, and a leaflet, "First Nations Occupants' Guide to Mold," both published in 2001. *The kit is intended for inspectors, housing departments, tribes, health providers, occupants, and building trades, and includes basic information, the responsibilities of key players and the training they need, and specific guidance for housing providers. The leaflet is a convenient guide for tenants and homeowners.* CMHC also has an "About Your House" series, including these on-line documents: "Measuring Humidity in Your Home" (CE01), "After the Flood" (CE07), "Fighting Mold" (CE08), "The Importance of Bathroom and Kitchen Fans" (CE17), "Choosing a Dehumidifier" (CE27), and "The Renovation Project" (CE28), including "Before You Start Renovating Your Basement – Moisture Problems." *Simple guide sheets on key issues.* "Building Solutions – A Problem-Solving Guide for Builders and Renovators" see www.cmhc-schl.gc.ca. For the "About Your House" series, see www.cmhc-schl.gc.ca/publications/aboutyourhouse/index.html

California Department of Health Services, "Indoor Air Quality Info Sheet: Mold in My Home – What Do I Do?" July 2001. www.cal-iaq.org/mold0107.pdf *An update providing basic information to people who have experienced water damage in their home, describing health concerns, general guidelines on prevention, mold detection and cleanup.*

University of Minnesota, Department of Health & Safety, "Managing Water Infiltration into Buildings: A Systematized Approach for Remediating Water Problems in Buildings Due to Floods, Roof Leaks, Potable Water Leaks, Sewage Backup, Steam Leaks and Groundwater Infiltration" see www.dehs.umn.edu/iaq/flood.html. *This reference includes a water damage checklist, testing, a flowchart to evaluate water damaged building materials and furnishings, and flood-related links to other sites.*

Centers for Disease Control and Prevention, "Molds in the Environment" National Center for Environmental Health, see www.cdc.gov/nceh/asthma/factsheets/molds/molds.htm. September 1999. *Useful fact sheet on mold.*

Centers for Disease Control and Prevention, "Questions and Answers on Stachybotrys Chartarum and Other Molds" March 9, 2000 see www.cdc.gov/nceh/asthma/factsheets/molds/default.htm. *This is the latest information available from the federal authority responsible for investigating outbreaks of illness.*

New York City Department of Health, "Guidelines on Assessment and Remediation of Fungi in Indoor Environments." Bureau of Environmental & Occupational Disease Epidemiology, November 2000. See www.ci.nyc.ny.us/html/doh/html/epi/moldrpt1.html. *This 17-page guide is an update of original guidelines from 1993 that dealt with mold growth problems in several New York City buildings. It revises and expands those guidelines to include all types of mold, and provides a discussion of health issues, evaluation strategies and clean-up and control methods. It was developed by specialists in the fields of microbiology and health sciences, and has been widely cited on many mold remediation projects across North America.*

New York City Department of Health, "Facts about Mold." Bureau of Environmental & Occupational Disease Epidemiology, April 2000. See www.ci.nyc.ny.us/html/doh/html/ci/cimold.html. *This is a fact sheet for homeowners answering common questions about mold.*

Red Cross/Federal Emergency Management Agency, "Repairing Your Flooded Home," particularly Step 4, "Dry Out Your Home." See www.fema.gov/library/repfhm.pdf. *Guidelines on lowering humidity, sorting contents and discarding debris, how floodwaters affect your home, drain the ceilings and walls, dry the ceilings and walls, and dry the floors.*

Burge, H.A., Otten, J.A., "Fungi". In *Bioaerosols: Assessment and Control*, pp. 19.1 – 19.13, J. Macher, H.A. Ammann, H.A. Burge et al., eds. American Conference of Governmental Industrial Hygienists. ISBN 1-882417-29-1. Cincinnati, OH, 1999. *Characteristics, health effects, sample collection, sample analysis, data interpretation. Other chapters in this text (Chapter 10, measures to control indoor mold growth; Chapter 15, cleaning and remediation practices, and Chapter 24, recommendations on limiting exposures to mycotoxins) may also be consulted.*

U.S. Environmental Protection Agency, "Mold Remediation in Schools and Commercial Buildings." Office of Air and Radiation Indoor Environments Division. March 2001. See www.epa.gov/iaq/molds/graphics/moldremediation.pdf. *General overview with principles that can also be useful for homes.*

U.S. Environmental Protection Agency, "Healthy Indoor Air for America's Homes." Office of Air and Radiation Indoor Environments Division. See www.montana.edu/wwwcxair. *Educational material on mold and other indoor air quality topics.*

Lstiburek, Joseph. "Builder's Guide" series, 1997. Westford, MA: Building Science Corporation. *Construction details for buildings that perform better, for different climate zones throughout North America.*

APPENDIX E

Expectations for Professional Mold Investigations

The following is intended to be a suggestion of what should be expected and requested from consultants who provide mold investigation services, **especially those which propose to perform mold testing** as part of their investigation. The expectations are presented in a format resembling an investigation report. BAIHS EHSS recommends that staff or programs make these expectations known early, and if possible include them in the contract for service, so that activities are planned to ensure the programs needs are met.

INTRODUCTION / BACKGROUND

The purpose of the introduction is to provide sufficient information about the problem to demonstrate that the investigation efforts were warranted, logical, and the objectives were clear. At a minimum, this section should include the following information:

- A. Description of facility history, any past moisture problems and/or occupant complaints;
- B. Description of all information provided by the operators/occupants related to the suspected problem or complaints;
- C. Description of parties involved in the current or previous investigations;
- D. Description of past issues already identified and how they were addressed;
- E. Outline of current problem; and
- F. Clear statement of the hypotheses and goals of the investigation.

SITE VISIT DESCRIPTION

Thorough visual assessment of the site is critical to a well reasoned and logical investigation. Information about the building's history, especially concerning moisture problems and any past or recent mold complaints, should be further evaluated during the inspection. Observations or measurements should be recorded and described in sufficient detail to convey what was done during the inspection and to demonstrate convincingly that the scope of inspection was reasonably adequate to determine: (1) if visible mold colonies were present, (2) if mold odors were detectable, and (3) if signs of current or past excess moisture were visible. At a minimum, the site visit description should include the following information:

- A. Identification of persons interviewed or providing information;
- B. Description of general building condition;
- C. Identification of specific areas inspected and their normal or intended uses;
- D. Description of building's mechanical systems, especially those which serve the areas being investigated;
- E. Documentation of relevant past moisture problems or description of evidence for recent or ongoing excess moisture accumulation or water intrusion such as, high relative humidity measurements especially at cold

surfaces, condensation especially on colder surfaces, water content measurements, water stains, decaying or warped wood, failing paint, peeling wall covering, roof leak, plumbing leak, flooding, lack of conditioning of humid outdoor, leaking windows;

- F. Description of any identified building system failures associated with the moisture intrusion, excess moisture build up, or high indoor humidity;
- G. Description of moisture migration pathways traced to sources as best as possible;
- H. Description of visual observations of potential sources of mold contamination;
- I. Description of pathways for dissemination of particulate mold contaminants or mold-produced volatile organic chemicals (odors); and
- J. Documentation of environmental conditions as well as the apparent effectiveness of the HVAC system; such as were all unit-ventilators operational, was a building designed to have air conditioning and was it operational?

SAMPLING/TESTING

NOTE: IN MOST CASES, BAIHS EHSS DOES NOT RECOMMEND MOLD SAMPLING AS PART OF THE INITIAL EFFORTS TO INVESTIGATE POTENTIAL MOLD PROBLEMS IN HOMES OR FACILITIES; however, properly conducted testing and the information it can provide when used appropriately may be useful and even necessary at some point in a program's response to mold contamination issues.

When mold testing is performed, BAIHS EHSS believes that is critical that investigation goals are clearly understood, logical and achievable. Unless there is a clear understanding of how test results will be helpful and how they will be used to assist in correcting the problem, testing is likely to be wasteful of scarce resources or worse yet, misleading. Experienced investigators and competent consultants should be expected to justify any recommendation to collect mold samples and should explain their reasoning and any underlying assumptions or anticipated limitations.

If environmental samples are collected to test for mold, the following minimum information should be provided:

- A. Discussion of why sampling/testing is being performed. Provision of a clearly identified, specific objective for sampling and how the specific sampling procedure will assist in meeting the objective.
- B. Description of how the data are to be interpreted and used to meet the objectives.
- C. Description of how the sampling protocol and choices achieved the objectives:
 - Clear identification of sample locations and reason(s) chosen;
 - Describe each sample collection method¹⁰ and reason(s) chosen;
 - Describe sample media used and reason(s) chosen; and

- Identify analytical procedures used and reason(s) chosen.

It is critical that samples be analyzed by a mycologist competent to provide the level of taxonomic identification needed for the intended uses of the data. When data regarding the types of mold and quantities are to be used in the assessment of the problem, MDH suggests that laboratories used for sample analyses be, at a minimum, accredited or certified by the American Industrial Hygiene Association's EMLAP program described on-line at www.AIHA.org. *Note that being a "participant" in the EMPAT program is not by itself an indication of competence.*

D. Description of QA/QC procedures used:

- Chain of custody for samples;
- Sample preservation methods;
- Date/time of sample analysis;
- Analytical methods; and
- Credentials of analyst/lab

E. Description of environmental conditions during and prior to sampling:

- Outdoor weather conditions;
- Temperature, relative humidity and dew point in the sampled space;
- Occupation of space, type and level of activity;
- Windows open or closed; and
- HVAC system isolated or not.

FINDINGS AND INTERPRETATION

All data from sampling efforts should be reported in a clearly labeled format indicating sample collection method, location, time and results. Raw data or actual counts should always be reported. Extrapolated or values normalized to a per sample unit basis can also be given, but these should not be the only data reported. Results from quality control samples should also be presented in the report along with the sampling data. Any laboratory notations relating to samples or calculations performed on the data should also be provided with the sampling results.

A fairly complete interpretation of the data should be provided. For any environmental media sampled for investigation purposes, MDH recommends that interpretation be consistent with the principles described in Appendix C. It is also imperative that all limitations or qualifications related to the data be clearly stated and all reasonable explanations or alternate interpretations be objectively presented.

The findings should describe all excess moisture accumulation/water intrusion and mold contamination identified or otherwise known. Where future excess moisture accumulation or water intrusion is obvious or likely, this too should be pointed out. Visual observations of

moisture and/or mold contamination should be described along with any building system failures found to be associated with excess moisture or water intrusion.

CONCLUSIONS AND RECOMMENDATIONS

This section should identify the source(s) of excess moisture which has allowed, is allowing, or is likely to permit indoor mold growth. The section should also describe what the observations and sample results objectively demonstrated about the presence of mold growth indoors, the pathways for dissemination of mold particles or mold-produced volatile organic compounds in occupied spaces, and the extent of areas that should be addressed to remove both viable and nonviable mold contaminants.

Conclusions should logically follow from and refer back to the findings, especially the observations reported. If evidence of indoor mold growth was identified, conclusions must address the source(s) of excess moisture that permitted mold growth and the extent of mold contamination that warrants removal.

Recommendations should be consistent with and responsive to the conclusions. If indoor mold growth was identified, the recommendations must include specific activities or procedures to:

- A. Correct or eliminate source(s) of moisture that supported mold growth;
- B. Remove all visible mold growth and any related contamination as prudent;
and
- C. Prevent further excess moisture accumulation or intrusion and/or future mold growth.

APPENDIX F

Mold Remediation References and Resources

There exist several mold remediation guidance documents which describe or recommend various control measures based upon the extent or type of mold contamination. Such materials can be used by staff and programs at their discretion if they feel more detailed advice on mold clean-up and removal is needed -- such as when very heavy or widespread contamination is encountered. The following are examples of such resources:

General References and Resources on Mold

*Fighting Mold...*Canada Mortgage and Housing Corporation (CMHC), Ottawa, Ontario. Website: www.cmhc-schl.gc.ca/en/index.cfm (Search for Mold; other resources available) CMHC documents cover various aspects of mold prevention and remediation. Specific documents are available for condominium owners and Indian tribes.

Fixes for Damp, Moldy Houses...Fred Lugano, *Fine Homebuilding*, Nov./Dec. 1999, no. 125, pp. 74-49. Illustrates several examples of moisture and mold problems and strategies for preventing and remedying them. Includes illustration of the various ways that moisture can enter and create problems in a home.

Mold, A Poltergeist...Philip Wemhoff, *Home Energy Magazine*, Jan./Feb. 2001, v. 18, no. 1, pp. 19 - 23. Describes mold detection and remediation work on a brick veneer home in Florida. Gives details on waterproofing brick veneer walls.

Mold Biology and Mold Diagnostic Chart...McGregor Pearce, Mold Sampling and Diagnostic Service, St. Paul, MN. *Home Performance Strategies, The Main Event, Selected Readings*, May 2001. Available from Affordable Comfort, Inc. or email: pearc010@tc.umn.edu.

*Mold Control in the House...*Johns Hopkins University Asthma and Allergy Center, Baltimore, MD. Website: www.hopkins-allergy.org/rhinitis/therapeutics-house.html Features an interactive model of a home, illustrating common sources of mold and moisture. Includes links to health topics, such as triggers for mold response and therapies.

Mold in Buildings: What It Is and How to Keep It Out...Alex Wilson, *Environmental Building News*, June 2001, v. 10, no. 6, pp. 1, 9 - 14. Overview of key mold topics, including detailed description of mold varieties and their health effects. Includes two-page checklist on ways to minimize moisture problems.

*Mold in Homes...*Minnesota Dept. of Health, St. Paul, MN, 2001. Website: www.health.state.mn.us/divs/eh/indoorair/mold/index.html Good source of health information for consumers who want to know what to do about mold and moisture problems.

Molds in the Environment... CDC, National Center for Environmental Health, Atlanta, GA. Website: www.cdc.gov/nceh/airpollution/mold/ Covers the CDC's perspective on health aspects of mold. Includes section on Stachybotrys and links to other sites.

Mold in Residential Buildings...National Association of Homebuilders (NAHB) ToolBase, 2001. Website: www.toolbase.org/ (Search for Mold) Provides a primer on mold and moisture control for homeowners and builders. Includes list of documents and links to other resources.

Mold Prevention and Detection: A Guide for Housing Authorities in Indian Country...Steven Winter Associates, Inc., Washington, DC and Building Research Council, Urbana-Champaign, IL, Sept. 2001. Prepared for U. S. Dept. of Housing and Urban Development, Office of Native American Programs. Website: www.codetalk.fed.us/MoldDetection.pdf Comprehensive guide on mold and moisture conditions for tribal housing agencies and residents.

Mold Resources...U. S. Environmental Protection Agency, Washington, D. C. Website: www.epa.gov/iaq/pubs/moldresources.html. Provides a summary of the key issues and extensive links to health-related groups and indoor air quality topics.

Operations and Maintenance (O&M) Plan for Mold and Moisture Control... National Multi Housing Council (NMHC) and the National Apartment Association (NAA), Identifies "best practices" apartment owners and managers can use to manage mold growth and moisture problems on their properties. Websites: www.nmhc.org/ and www.naahq.org/moldReq.htm

Public Housing Breaks the Mold, Part I...John Snell and Betsy Pettit, *Home Energy Magazine*, Sept./Oct. 2001, v. 18, no. 5, pp. 24 - 25. Part II: Veterans Era Housing, Nov./Dec. 2001, v. 18, no. 6, pp. 33-37. Case studies of mold and moisture problems in mid-rise and Veterans Era (low-rise) public housing.

What You Need to Know About Mold...Nathan Yost, Joseph Lstiburek, Terry Brennan, Building Science Corp., Westford, MA. Website: www.buildingscience.com Covers the essentials of what consumers should know about mold and ways to prevent moisture problems, in a reasoned. Other documents include: *Mold Remediation in Occupied Homes* and *Mold Causes, Health Effects and Clean-Up*.

Moisture Control and Building Envelope Guidelines

Before You Start Renovating Your Basement...CMHC, 2000, CE28c. Website: www.cmhc-schl.gc.ca/en/index.cfm (Search for specific topics) Covers moisture and mold issues to consider when renovating a basement as living space.

Builders Guides (for 4 climate areas), Joseph Lstiburek, Building Science Corporation, Westford, MA. Website: www.buildingscience.com Comprehensive series of guidebooks on moisture control, energy efficiency and good ventilation for residential construction. Other related publications are available or listed on the site. The Builder Guides are available from Energy and Environmental Building Association (EEBA), 10740 Lyndale Avenue South, Suite 10W, Bloomington, MN 55420-5615, Phone: 952-881- 1098, Website: www.eeba.org

Details for a Dry Basement...William B. Rose, *Fine Homebuilding*, August/September 199, No. 115, pp. 99 - 103. Provides step-by-step procedures for waterproofing a foundation and constructing a perimeter drainage system.

EIFS Industry Looks Forward to Brighter Days...*Energy Design Update*, September 2001, v. 21, no. 9, pp. 1 - 3. Also see *Exterior Insulation and Finish Systems*...N. Nisson and D. Best, November 1999, available from Cutter Information Corp., Arlington, MA. Discussion on moisture problems with EIFS cladding and ways the industry was trying to resolve the problem.

Home Energy Magazine is a good resource for information on Moisture Control and Building Envelopes. Website: www.homenergy.org 2124 Kittredge St., Berkeley, CA 94704, Phone: 510-524-5405.

Keeping a Basement Dry...Larry Janesky, *Fine Homebuilding*, June/July 200, No. 140, pp. 64 - 69. Provides more details on installing a foundation drainage system and ways to keep water out of basements.

Model Quality Plan for Use of Drainage-Type EIFS in One-and Two-Family Dwellings ...NAHB Toolbase, 2001. Website: www.toolbase.org/ (Search for EIFS) Protocol for how to construct EIFS walls to prevent moisture penetration.

Moisture Audit of Residential Structures...Environmental Health Watch, Cleveland, OH. Website: www.ehw.org/Healthy_House/HH_Moist_Audit.htm Comprehensive guide for conducting a moisture audit of a home.

Moisture Diagnostics: Measuring Humidity In Your Home...CMHC. Website: www.cmhc-schl.gc.ca/en/index.cfm Provides an easy to follow discussion of indoor humidity levels and describes basic tools and techniques for measuring humidity, including how to calibrate them.

Profiles of Airborne Fungi in Buildings and Outdoor Environments in the United States...Brian G. Shelton, et al. *Applied and Environmental Microbiology*, April 2002, v. 68, no. 4, pp. 1743-1753. Reports on the analysis of 12,026 fungal air samples (9,619 indoor samples and 2,407 outdoor samples) collected from 1,717 buildings located across the United States

Mold Abatement Procedures and Protocols

Guidelines on Assessment and Remediation in Indoor Environments...New York City Dept. of Health. Website: www.nyc.gov/html/doh/html/epi/moldrpt1.html A comprehensive set of guidelines for how to approach the investigation and cleanup of mold in buildings.

Mold in My Home: What Do I Do?...California Dept. of Health Services, Oakland, CA, July 2001. Website: www.cal-iaq.org/mold9803.htm Also: www.dhs.cahwnet.gov/org/ Provides guidelines for people who have experienced water damage in their home, including health concerns, mold detection and clean-up procedures.

Mold Remediation in Schools and Commercial Buildings...U. S. Environmental Protection Agency (EPA), Washington, DC, March 2001, EPA 402-K-01-001. Website: www.epa.gov/iaq/molds/index.html While geared to schools and commercial buildings, this guide has good information for all contractors and building professionals.

Standard and Reference Guide for Professional Water Damage Restoration, S500-99... Institute of Inspection, Cleaning and Restoration Certification (IICRC), Vancouver, WA. Website: www.iicrc.org/ One of the basic guides for dealing with extensive moisture damage.

Also see the Minnesota Mold in Houses information (See above.) Other states have established specific guidelines regarding mold remediation. Check with the Health Department of your state.

Medical Findings

Indoor Mold, Toxigenic Fungi, and Stachybotrys chartarum: Infectious Disease Perspective; D. M. Kuhn and M. A. Ghannoum; Division of Infectious Diseases, Department of Medicine, Center for Medical Mycology, Department of Dermatology, University Hospitals of Cleveland, and Case Western Reserve University, Cleveland, Ohio 441063
<http://cmr.asm.org/cgi/content/full/16/1/144>

*Is Indoor Mold Contamination a Threat to Health?...*Harriet M. Ammann, Washington State Department of Health, Olympia, Washington. Website: www.doh.wa.gov/ehp/oehas/mold.html
Extensive review of mold types and their health effects.

Mycotoxins: Of Molds & Maladies...Julia R. Barrett. *Environmental Health Perspectives*, January 2000, v. 108, no. 1. Provides a historical overview and details on the food-borne dangers of mold.

Reduction of Pulmonary Toxicity of *Stachybotrys chartarum* Spores by Methanol Extraction of Mycotoxins...Carol Y. Rao, Joseph D. Brain, and Harriet A. Burge. *Applied And Environmental Microbiology*, July 2000, v. 66, no. 7, pp. 2817-2821. Results of study from Harvard School of Public Health on the toxicity of *Stachybotrys* in rats.

Stachylysin May Be a Cause of Hemorrhaging in Humans Exposed to *Stachybotrys chartarum*....Stephen J. Vesper and Mary Jo Vesper. *Infection and Immunity*, April 2002, v. 70, no. 4, pp. 2065-2069. Reports on a recent attempt to identify the toxic agent that could have caused the infant deaths in Cleveland.

Study of Toxin Production by Isolates of *Stachybotrys chartarum* and *Memnoniella echinata* Isolated during a Study of Pulmonary Hemosiderosis in Infants....B. Jarvis, D. Dearborn, et al. *Applied and Environmental Microbiology*, October 1998, v. 64, no. 10, pp. 3620-3625. Results of a study to test the toxicity of *Stachybotrys*.

Toxic Effects of Indoor Molds (RE9736)...American Academy of Pediatrics, Committee on Environmental Health, Washington, DC. *Pediatrics*, 1998, v. 101, no. 4, pp. 712- 714.
www.aap.org/policy/re9736.html Describes molds, their toxic properties, and their potential for causing toxic respiratory problems in infants. Guidelines for pediatricians are given to help reduce exposures to mold in homes of infants.

The National Academy of Science (NAS), Institute of Medicine has just launched an extensive review of the medical findings on Damp Indoor Space and Health. For a description of the project and list of the review panel, check the website: www.nas.edu/ Search under Mold.

Note: This is a small sampling of the medical literature. Look for other materials at the NAS site or on Medline: medline.cos.com/

Other Indoor Air Quality and Building Envelope Resources

Healthy Indoor Air for America's Homes: Training Manual... Montana State University Extension Service, Bozeman, MT, in cooperation with EPA and other Extension Programs, 1999. Includes Bugs, Mold and Rot unit. Website: www.montana.edu/wwwcxair/ Provides various modules for training extension agents and anyone interested in indoor air quality.

American Lung Association, Washington, DC: www.lungusa.org/ Provides easy to understand information on health aspects of mold and other air quality topics.

U. S. Environmental Protection Agency, Washington, DC: www.epa.gov/iaq/homes.html Covers a wide range of indoor air quality topics. Includes extensive links to other sites.

U. S. Dept. of Housing and Urban Development, Healthy House Programs, Washington, DC: www.hud.gov/offices/lead/ Geared primarily to lead remediation, but does have links to other indoor air quality topics.

Insurance and Legal Concerns

Insurance Implications of Toxic Mold Claims... Independent Insurance Agents of America, Inc., Alexandria, VA, Website: vu.iaaa.net/default.htm Provides insight into how the insurance industry is approaching the mold issue.

Mealey's Litigation Report: Mold... Mealey Publications, King of Prussia, PA, Website: www.mealeys.com/specialreports.html Provides an extensive list of insurance claims and lawsuits that have been filed related to mold.

Mold in Buildings: New Frontiers in Construction Defect Litigation... C. Tapia and C. Parten, *Insurance Journal*, Website: www.insurancejrn.com/ (Search for Mold in Buildings) Another overview of the insurance perspective.

Mold & Mildew: A Creeping Catastrophe... *Claims Magazine*, August 2000. Website: www.claimsmag.com/Issues/aug00/mold.asp

Texas Insurance Commission: News Releases and Other Documents Related to Texas Mold Cases, Website: www.tdi.state.tx.us/commish/ Covers how the Commission has sought to deal with the extensive number of mold insurance claims and industries plans to limit coverage and raise rates.

Conference Proceedings

Bioaerosols, Fungi and Mycotoxins: Health Effects, Assessment, Prevention and Control... Eastern New York Occupational and Environmental Health Center. Johanning, E., editor. Albany, NY. 1999.

(Proceedings of the Third International Conference on Fungi, Mycotoxins and Bioaerosols: Health Effects, Assessment, Prevention and Control. September 23-25, 1998.)

Bugs, Mold and Rot, II, Conference Proceedings... William Rose and Anton TenWolde, eds., Building Envelope and Thermal Envelope Council (BETEC), Washington, DC., 1994. Website:

www.nibs.org/betecpubs.html. Volume III - Not released. Presents papers from two good conferences on mold and other indoor contaminants.

Health and Mold

EPA's publication, [Indoor Air Pollution: An Introduction for Health Professionals](#), assists health professionals (especially the primary care physician) in diagnosis of patient symptoms that could be related to an indoor air pollution problem. It addresses the health problems that may be caused by contaminants encountered daily in the home and office. Organized according to pollutant or pollutant groups such as environmental tobacco smoke, VOCs, biological pollutants, and sick building syndrome, this booklet lists key signs and symptoms from exposure to these pollutants, provides a diagnostic checklist and quick reference summary, and includes suggestions for remedial action. Also includes references for information contained in each section. This booklet was developed by the American Lung Association, the American Medical Association, the U.S. Consumer Product Safety Commission, and the EPA. EPA Document Reference Number 402-R-94-007, 1994.

Allergic Reactions - excerpted from [Indoor Air Pollution: An Introduction for Health Professionals section on: Animal Dander, Molds, Dust Mites, Other Biologicals](#).

"A major concern associated with exposure to biological pollutants is allergic reactions, which range from rhinitis, nasal congestion, conjunctival inflammation, and urticaria to asthma. Notable triggers for these diseases are allergens derived from house dust mites; other arthropods, including cockroaches; pets (cats, dogs, birds, rodents); molds; and protein-containing furnishings, including feathers, kapok, etc. In occupational settings, more unusual allergens (e.g., bacterial enzymes, algae) have caused asthma epidemics. Probably most proteins of non-human origin can cause asthma in a subset of any appropriately exposed population."

Consult the [Centers for Disease Control \(CDC\) website](#)

- CDC's [National Center for Environmental Health \(NCEH\)](#) has a toll-free telephone number for information and FAXs, including a list of publications: NCEH Health Line 1-888-232-6789.
- CDC's ["Molds in the Environment"](#) Factsheet

Stachybotrys or *Stachybotrys atra* (*chartarum*) and health effects

- CDC's ["Questions and Answers on Stachybotrys chartarum and other molds"](#)

Other Resources Cited

Accreditation for Testing Laboratories...American Industrial Hygiene Association, Fairfax, VA. Website: www.aiha.org Has series of articles on mold posted on website.

Manual J - Residential Load Calculations... Air Conditioning Contractors of America, Arlington, VA. Website: www.acca.org Industry guide for sizing air conditioning and heating equipment.

APPENDIX G

Technical Resources for Mold Assessments and Remediation

BEMIDJI AREA ENVIRONMENTAL HEALTH STAFF

Louis Erdrich, Director; OEHE
Office of Environmental Health & Engineering
216 Federal Building
Bemidji, Minnesota 56601
218/444-0507 - FAX 218/444-0510
louis.erdrich@mail.ihs.gov

Diana Kuklinski, Acting Chief, EHSS
216 Federal Building
Bemidji, MN 56601
218/444-0503 – FAX 218/444-0510
diana.kuklinski@mail.ihs.gov

Wayne Potter, District Sanitarian
Minnesota District Office
303 Federal Building
Bemidji, Minnesota 56601
218/444-0524 FAX 218/444-0533
wayne.potter@mail.ihs.gov

Vacant, Tribal Sanitarian
PHS Indian Hospital
Red Lake, Minnesota 56671
218/679-3912 - FAX 218/679-3990

MICHIGAN/WISCONSIN

Casey Crump, District Sanitarian
Rhineland District Field Office
Indian Health Service
9A South Brown Street
Rhineland, Wisconsin 54501
715/365-5112
FAX 715/365-5113
william.crump@mail.ihs.gov

Vacant, Chief, EHSS
Environmental Health Services Section
216 Federal Building
Bemidji, Minnesota 56601
218/444-0501 - FAX 218/444-0510

Christopher W. Allen, EHO/Safety
PHS Indian Health Center
25519 State Highway 224
Ogema, Minnesota 56569
218/983-6294 FAX 218/983-6217
Chris.Allen@mail.ihs.gov

Jennifer Barrows, SU Sanitarian
Minnesota District Office
303 Federal Building
Bemidji, Minnesota 56601
218/444-0523 - FAX 218/444-0533
jennifera.barrows@mail.ihs.gov

Gregg Anderson, Tribal Sanitarian
Leech Lake RT Health Division
Rt. 6530, Hwy 2 NW
Cass Lake, Minnesota 56633
218/335-8215 - FAX 218/335-8219
ganderson@llojibwehealth.com

Carolyn Garcia, SU Sanitarian
Rhineland District Field Office
Indian Health Service
9A South Brown Street
Rhineland, WI 54501
715/365-5120
FAX 715/365-5113
cgarcia@mail.ihs.gov

Richard A. Reese, R.S.
Northern Native American Health Alliance
Environmental Health Services
P.O. Box 529
Bayfield, Wisconsin 54814
715/779-3707 ext.236 - FAX 715/779-3777
dreese@cheqnet.net

Jennifer Falck, Tribal Sanitarian
Environmental Department – Suite 5
3759 W. Mason St., Box 365
Oneida, WI 54155
920/497-5812 Ext. 125 – FAX 920/496-7883
jfalck@oneidanation.org

Gary Schuettpelz, Director
Environmental Services-
P.O. Box 670 - Hwy 47 Forestry Center
Keshena, Wisconsin 54135
715/799-6152 - FAX 715/799-6153
gschuettpelz@frontiernet.net

Sandra Supinski, Tribal Sanitarian
Peter Christensen Health Center
450 Old Abe Road
Lac du Flambeau, WI 54538
715/588-4275 - FAX 715/588-7884
ssupinsk@mail.ihs.gov

Carol Rollins, Tribal Sanitarian (&Robert Voss)
Ho-Chunk Nation
P.O. Box 636, 720 Red Iron Rd.
Black River Falls, Wisconsin 54615
715/284-7830 – FAX 715/284-9592
CRollins@ho-chunk.com (Carol)
rvoss@ho-chunk.com (Rob)

Tom Sutter, Tribal Sanitarian
Inter-Tribal Council of Michigan, Inc.
Field Health Office
3601 Mackinaw Trail
Sault Ste. Marie, MI 49783
906/635-4208 FAX 635-4212
tsutter@itcmi.org

Dan Tadgerson, R.S.
Sault Ste. Marie Tribe
2864 Ashmun St.
Sault Ste. Marie, MI 49783
906/635-6050 – FAX 632-5276
dtadgerson@saulttribe.net

STATE OF MICHIGAN

Michigan State University Extension
Agriculture Hall, Room 108
Michigan State University
East Lansing, MI 48824-1039
Phone: 517-355-2308
Fax: 517-355-6473

Michigan DEQ/Health Department
Toxic Hot Line – 1-800-648-6942

Michigan Mold Information Hot Line (Recording) – 1-517-335-9436

IAQ:

Michigan Department of Community Health, Environmental Epidemiology
PO Box 30195
3423 N MLK Jr Blvd
Lansing MI 48909
517-335-8350
IAQ Contact: David Wade

NOTE: State of Michigan has only one individual that handles all calls regarding mold issues. It was suggested that this may not be the best resource for assistance.

STATE OF MINNESOTA

Minnesota Department of Health
Indoor Air Program
121 East Seventh Place
P. O. Box 64975
St. Paul, MN 55164-0975
651-215-0909 or 1-800-798-9050

Minnesota Department of Commerce
85 7th Place East, Suite 500
St. Paul, MN 55101
Energy Information Center
651-296-5175
1-800-657-3710 (MN only)
energy.info@state.mn.us

Environmental Health & Safety
Indoor Air Quality
University of Minnesota
W-140 Boynton Health Service
410 Church Street SE
Minneapolis, MN 55455
dehs@tc.umn.edu

STATE OF WISCONSIN

Wisconsin Department of Health and Family Services
Division of Public Health
Mark H. Chamberlain
608 266-7897
<http://www.dhfs.state.wi.us/eh/HlthHaz/fs/moldindx.htm>

FEDERAL

U.S. EPA
Indoor Environments Division
1200 Pennsylvania Avenue, NW
Mail Code 6609J
Washington, DC 20460

An Office Building Occupant's Guide to IAQ - epa.gov/iaq/pubs/occupgd.html

Biological Contaminants - epa.gov/iaq/pubs/bio_1.html

Building Air Quality Action Plan (for Commercial Buildings) -
epa.gov/iaq/largebldgs/actionpl.html

Floods/Flooding - epa.gov/iaq/pubs/flood.html

Mold Remediation in Schools and Commercial Buildings -
epa.gov/iaq/molds/mold_remediation.html

For more subject-specific links, go to: epa.gov/iaq/schools/links.html, or
epa.gov/iaq/asthma/links.html, or epa.gov/iaq/moreinfo.html.

EPA's [Antimicrobial Information Hotline](#)

(703) 308-0127/(703) 308-6467

email: Info_Antimicrobial@epa.gov

Other Links

The following list of resources includes information created and maintained by other public and private organizations. The BAIHS EHSS does not control or guarantee the accuracy, relevance, timeliness, or completeness of this outside information. Further, the inclusion of such resources is not intended to endorse any views expressed or products or services offered by the author of the reference or the organization operating the service on which the reference is maintained.

American College of Occupational and Environmental Medicine (ACOEM)

(847) 818-1800 www.siouxlan.com/acoem/

Referrals to physicians who have experience with environmental exposures.

American Conference of Governmental Industrial Hygienists, Inc. (ACGIH)

(513) 742-2020 www.acgih.org

Occupational and environmental health and safety information

American Industrial Hygiene Association (AIHA)

(703) 849-8888 www.aiha.org

Information on industrial hygiene and indoor air quality issues including mold hazards and legal issues

American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc. (ASHRAE)
(800) 527-4723 www.ashrae.org
Information on engineering issues and indoor air quality

Association of Occupational and Environmental Clinics (AOEC)
(202) 347-4976 www.aoec.org
Referrals to clinics with physicians who have experience with environmental exposures,
including exposure to mold; maintains a database of occupational and environmental cases

Association of Specialists in Cleaning and Restoration (ASCR)
(800) 272-7012 www.ascr.org
Disaster recovery, water and fire damage, emergency tips, referrals to professionals

Asthma and Allergic Diseases

American Academy of Allergy, Asthma & Immunology
(AAAAI)
(800) 822-2762
www.aaaai.org
Physician referral directory, information on allergies and
asthma

Asthma and Allergy Foundation of American (AAFA)
(800) 7-ASTHMA (800-727-8462)
www.aafa.org
Information on allergies and asthma

American Lung Association (ALA)
(800) LUNG-USA (800-586-4872)
www.lungusa.org
Information on allergies and asthma

Asthma and Allergy Network/Mothers of Asthmatics,
Inc. (AAN*MA)
(800) 878-4403 or (703-641-9595)
www.aanma.org
Information on allergies and asthma

National Institute of Allergy and Infectious Diseases
(NIAID)
(301) 496-5717
www.niaid.nih.gov
Information on allergies and asthma

National Jewish Medical and Research Center
(800) 222-LUNG (800-222-5864)

www.njc.org

Information on allergies and asthma

Canada Mortgage and Housing Corporation (CMHC)

(613) 748-2003 [International]

www.cmhc-schl.gc.ca/cmhc.html

Several documents on mold-related topics available and a discussion on mold at - http://www.cmhc-schl.gc.ca/en/imquaf/hehosu/hoast/hoast_001.cfm including

- ["Fighting Mold - The Homeowner's Guide"](#),
- ["The Condominium Owners' Guide to Mold"](#)

Carpet and Rug Institute (CRI)

(800) 882-8846

www.carpet-rug.com

Carpet maintenance, restoration guidelines for water-damaged carpet, other carpet-related issues

Centers for Disease Control and Prevention (CDC)

(800) 311-3435

www.cdc.gov

Information on health-related topics including asthma, molds in the environment, and occupational health

CDC's National Center for Environmental Health (NCEH) (888) 232-6789

Mold page - <http://www.cdc.gov/nceh/airpollution/mold/>

"Questions and answers on Stachybotrys chartarum and other molds" -

www.cdc.gov/nceh/airpollution/mold/stachy.htm

Energy and Environmental Building Association

(952) 881-1098

www.eeba.org

Information on energy-efficient and environmentally responsible buildings, humidity/moisture control/vapor barriers

Floods/Flooding

Federal Emergency Management Agency (FEMA)

(800) 480-2520

www.fema.gov/mit

Publications on floods, flood proofing, etc.

University of Minnesota, Department of Environmental Health & Safety

(612) 626-5804

www.dehs.umn.edu/remanagi.html

Managing water infiltration into buildings

University of Wisconsin-Extension, The Disaster

Network (608) 262-3980 www.uwex.edu/ces/news/handbook.html Information on floods and other natural disasters
--

Health Canada, Health Protection Branch, Laboratory Centre for Disease Control, Office of Biosafety

(613) 957-1779

www.hc-sc.gc.ca/main/lcdc/web/biosafty/msds/index.html

Material Safety Data Sheets with health and safety information on infectious microorganisms, including Aspergillus and other molds and airborne biologicals

Institute of Inspection, Cleaning and Restoration Certification (IICRC)

(360) 693-5675

www.iicrc.org

Information on and standards for the inspection, cleaning, and restoration industry

International Sanitary Supply Association (ISSA)

(800) 225-4772

www.issa.com

Education and training on cleaning and maintenance

International Society of Cleaning Technicians (ISCT)

(800) WHY-ISCT (800-949-4728)

www.isct.com

Information on cleaning, such as a stain removal guide for carpets

Material Safety Data Sheets (MSDSs) - Cornell University

msds.pdc.cornell.edu/msdssrch.asp

MSDSs contain information on chemicals or compounds including topics such as health effects, first aid and protective equipment for people who work with or handle these chemicals

MidAtlantic Environmental Hygiene Resource Center (MEHRC)

(215) 387-4096

www.mehrc.org

Indoor environmental quality training on topics such as mold remediation

National Air Duct Cleaners Association (NADCA)

(202) 737-2926

www.nadca.com

Duct cleaning information

National Association of the Remodeling Industry (NARI)

(847) 298-9200

www.nari.org

Consumer information on remodeling, including help finding a professional remodeling contractor

National Institute of Building Sciences (NIBS)
(202) 289-7800

www.nibs.org

Information on building regulations, science, and technology

National Institute for Occupational Safety and Health (NIOSH)
(800) 35-NIOSH (800-356-4674)

www.cdc.gov/niosh

Health and safety information with a workplace orientation

National Pesticide Telecommunications Network (NPTN)
(800) 858-7378

ace.orst.edu/info/nptn

Information on pesticides/antimicrobial chemicals, including safety and disposal information

New York Department of Health, Bureau of Environmental and Occupational Disease
Epidemiology
(212) 788-4290

[Guidelines on Assessment and Remediation of Fungi in Indoor Environments](#)

This document revises and expands the original guidelines to include all fungi (mold). It is based both on a review of the literature regarding fungi and on comments obtained by a review panel consisting of experts in the fields of microbiology and health sciences. It is intended for use by building engineers and management, but is available for general distribution to anyone concerned about fungal contamination, such as environmental consultants, health professionals, or the general public.

Occupational Safety & Health Administration (OSHA)
(800) 321-OSHA (800-321-6742)

www.osha.gov

Information on worker safety, including topics such as respirator use and safety in the workplace

Sheet Metal & Air Conditioning Contractors' National Association (SMACNA)
(703) 803-2980

www.smacna.org

Technical information on topics such as air conditioning and air ducts

Smithsonian Center for Materials Research and Education (SCMRE)
(301) 238-3700

www.si.edu/scmre

Guidelines for caring for and preserving furniture and wooden objects, paper-based materials; preservation studies

University of Michigan Herbarium
(734) 764-2407

www.herb.lsa.umich.edu

Specimen-based information on fungi; information on fungal ecology

University of Tulsa Indoor Air Program
(918) 631-5246

www.utulsa.edu/iaqprogram

Courses, classes, and continuing education on indoor air quality

Water Loss Institute, Association of Specialists in Cleaning and Restoration
(800) 272-7012 or (410) 729-9900

www.ascr.org/wli/

Information on water and sewage damage restoration