

# MOLD AND MOISTURE

## Background Materials

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CEHRC's Mold and Moisture Background Materials give an introduction to the hazards posed by mold and moisture in housing and information on mold and moisture assessment strategies in high-risk communities. These materials are intended to assist community-based organizations conducting indoor environmental sampling campaigns in understanding the issues around mold and moisture, and accompany CEHRC training in mold and moisture assessment. The Background Materials may also be of interest to the general public concerned about indoor environmental health issues.

### **What is Mold?**

Mold is a natural part of our ecosystem and helps break down dead leaves, trees and other elements in our environment that contain sugars, starches, and cellulose. Molds reproduce by forming spores that can be found outdoors and inside buildings. Most exposure to mold does not cause health problems for most people. The keys to staying healthy in a world with mold are keeping homes dry, avoiding conditions that allow mold to grow and cleaning up existing mold on building surfaces.

Moisture causes mold growth. In addition to moisture, mold needs a warm temperature and "food" (e.g., any living or once living material such as paper, glues, fabric, wood, solid surfaces or food) to grow. A mold problem can't be solved unless we find and fix the water/moisture problem. A moisture problem can come from a small but steady plumbing or roof leak, or a single flooding event. Condensation from high humidity in a home and/or situations where cold surfaces meet warm air (on pipes, for example) are other possible sources of moisture inside a home. After a flood or extensive leak, mold generally begins to grow within a day or two. It is best to dry out the affected wet areas within 48 hours. More information on cleaning up mold is offered in the resource section at the end of this document.

### **Why Are Mold and Moisture Health Concerns?**

Mold can cause three types of health problems: allergic reactions (that include asthma), toxic reactions, and infections.

Mold produces allergens (substances that can cause an allergic reaction) and irritants. The American College of Occupational and Environmental Medicine estimates that about 10% of the population is allergic to mold (including fungi). For people with an allergy to mold, exposure can trigger hay-fever-like symptoms (sneezing; irritation to eyes, skin, and nose) and/or respiratory problems including asthma. For most people, severe health problems will only result when there is long term exposure.

Asthma is a chronic swelling of the airways that causes wheezing, coughing, and difficulty breathing. It is among the most common diseases in the U.S. Approximately 15 million people suffer with asthma, which costs the nation about \$12.7 billion each year. Asthma often begins in childhood and is the leading cause of elementary school absences as well as many missed workdays, emergency room visits, and hospitalizations. Between 1980 and 1994, self-reported asthma prevalence rates increased 75% in the U.S., with increases in all age groups. According to the Centers for Disease Control and Prevention (CDC), about 7% of adults report that they have had asthma or been treated for asthma in their lifetime.

The rates of deaths, hospitalizations, and emergency visits caused by asthma have been increasing for more than two decades, especially among African Americans and children. In 1997-99, hospitalization rates were more than three times higher for African Americans than for whites.

Children under the age of five accounted for the highest rates of emergency room visits. Hospitalization rates also rose during this time period. Between 1979-99, hospitalization rates for children under five increased 48%.

A very smaller number of mold species (e.g., *Stachybotrys*) produce poisonous substances called **mycotoxins**. There is some evidence that inhaling mycotoxins causes severe health problems, such as bleeding lung disease in children. Research continues to help us better understand this linkage. A small number of fungi and mold may also result in minor **infections** (in skin and nails especially). Some mold may also spur internal infections (e.g., lung infections) in a small percentage of people who have weakened immune systems (e.g., patients receiving chemotherapy, organ transplant patients, patients with HIV or AIDS).

Mold and moisture can also attract cockroaches, dust mites, rodents, and other pests. Cockroach and dust mite remains are known asthma triggers. Exposure to rodent droppings and urine may also trigger respiratory problems in some individuals. Minimizing moisture problems will also help avoid these additional exposures. For more information on cockroaches, including how to determine cockroach infestations, please see CEHRC's cockroach sampling protocol.

More information on asthma can be found in CEHRC's on-line resources for mold and moisture.

### **Reasons to Look for Evidence of Mold and Moisture Problems**

- To identify areas where no wetness is visible but hidden mold may be possible. It is important to identify problems early so they can be corrected before major damage is done.
- Chronic dampness and moisture are often classified as code violations. Mold and moisture also allow for cockroaches and rodents to flourish – cockroach and/or rodent infestation may also be considered code violations. Local projects may wish to document moisture problems when conducting the home hazard assessment and assist the resident in getting code enforcement to follow-up with an inspection of the unit.
- To characterize mold hazards throughout a building with multiple apartments, where solutions involve the overall structure (e.g., roof or major plumbing repairs, work on drainage and ventilation systems, structural repairs).
- To document that mold and moisture hazards exist in multiple properties owned by the same owner.

Identifying specific species of mold by “sampling” mold spores can be a very expensive process. Unless there is a reason to identify the species of mold (research, etc.), CEHRC does not conduct mold spore sampling. In order to advocate that moisture and mold problems be fixed, local programs can instead rely on the Visual Survey (report and photographs) and moisture meter readings to identify where the main problem, wetness, is located so that it can be fixed.

More information on sampling for mold spores can be found near the end of this document.

### **Measuring Mold and Moisture**

#### ***Measuring Mold***

First, look and smell for mold and moisture during the Visual Survey. If you see mold, you can be sure that you have it and do not need to test for it (photographs will be enough). However, even if you do not see mold, it may still be in places that are hard to see (e.g., inside wall cavities, in crawl spaces, behind cabinets, near heating and cooling systems, appliance drip pans, attics). Sometimes you can smell moldy growth - a

musty odor is a possible indication. If the Hazard Investigator smells a musty smell, it will be documented on the Visual Survey Report, and corresponding photographs will also show mold or moisture stains.

### **Measuring Moisture**

Second, test for moisture problems. CEHRC uses a moisture meter to detect moisture problems in places you *can't* see such as inside walls and ceilings. The meter's results are credible. Sometimes the meter can help trace moisture to its source.

### **About the Moisture Meter**

A moisture meter measures the movement of two slow-moving (low frequency) signals sent from pads on the back of the instrument. Moisture significantly changes the signal. The strength of the signal gives the user information about the dryness/wetness of the surface being tested. The signal emitted by the moisture meter is not dangerous.

The CEHRC protocol uses a Tramex Moisture Encounter Meter<sup>1</sup>. This moisture meter costs about \$350<sup>2</sup>. The meter will last many years and can be used in thousands of homes (with routine battery replacement). Other meters may also be used.

### **Standards for Mold and Moisture**

There are no federal health-based standards for mold. Many state and/or local codes identify "chronic dampness and/or moisture" as a code violation. The U.S. Environmental Protection Agency (EPA) has developed guidance related to assessing and controlling mold. The EPA materials instruct residents to conduct visual assessments to look for mold, but do not encourage testing for mold spores. A few states are developing professional licensing standards for mold testing and remediation. Be sure to check for regulations in your state to make sure you are in compliance. (see [www.epa.gov/iaq/molds/mold\\_remediation.html](http://www.epa.gov/iaq/molds/mold_remediation.html))

### **Training and Qualifications for Assessing Mold and Moisture**

Assessing mold and moisture is fairly simple. CEHRC Hazard Investigators should receive CEHRC's classroom training to understand the background materials, learn how to use the moisture meter, understand how to report the results to residents, and know exactly what the results do and do not tell you. There is no federal mold assessment training course.

### **What Do the Results Mean?**

Documented mold (photographs) and records of clearly identified visual observations of mold provide clear signs of mold growth and chronic (constant) moisture problems. Without ongoing moisture, mold is unlikely to grow. Chronic moisture and dampness are often code violations.

Documented moisture meter readings and pictures of moisture stains are signs of a potential mold problem. The resident may wish to use this information to contact their code enforcement agency about possible code violations.

### **Explaining the Results to Residents**

If a mold or moisture problem is found, the residents should immediately be notified. Information should also be given to the residents about hazard control options.

Notification to other individuals (such as the landlord) or organizations (such as the health department or

code enforcement agency) depends on three things:

- The consent of the resident,
- The need for and desire of the resident to have immediate repairs and/or control activities take place in the individual home, and
- The advocacy strategies of the local organization.

While residents can help minimize mold and moisture issues, a rental property owner is responsible for fixing ongoing moisture problems (leaks, poor ventilation, appliance failures) and solving mold problems.

Efforts to clean mold will be of limited benefit unless steps are *also* taken to fix any related moisture problem that is creating the mold.

### **Situations When Testing for Mold Spores May Be Appropriate**

With all sampling, the key question to ask before undertaking such action is “will the results help answer an important question and can we have confidence in the results?”

Currently mold sampling can answer 2 questions:

- Is there any type of mold here at all?
- How much of one particular species of mold is present on a particular surface or in the air?

Two common forms of mold sampling are:

1) A tape lift sample, which is a piece of tape applied to the surface to be sampled. The sticky side of the tape lifts up whatever mold or dirt may be on that surface. A lab can analyze this or the person collecting the sample can analyze it on the spot with a microscope in order to determine mold growth. It is useful to use this when looking at a stain (on the ceiling, wall, etc.) to determine if the stain is caused by mold growth or just dirt.

2) Air sampling. This involves collecting samples using machinery that sucks in air. This method is useful for determining the total amount of mold spores and the amount of each species present.

The difficulty with such sampling is that it can produce varying results and there are no clear standards to evaluate the results. While it is impossible at this point to say at what level a particular mold species may create a health problem, some experts suggest that if indoor mold levels are much greater than outdoor levels, there are building conditions that are creating mold growth. Because of the problems with reliability and interpretation, as well as the high cost of such sampling, these methods are probably not necessary or cost-effective for most mold assessments.

Sampling for mold may make sense in some situations, including the following:

- Complex building structures, such as multi-family buildings with complex heating and cooling systems;
- Structures where there is no visible or documented (through use of a meter) moisture or mold, yet residents are complaining of poor health); and/or
- Insurance investigations, lawsuits, or medical inquiries where additional and specific information is necessary.

Sampling for mold in the air or settled on a surface is best performed by a trained industrial hygienist. Sample analysis should follow analytical methods recommended by the American Industrial Hygiene Association (AIHA), the American Conference of Governmental Industrial Hygienists (ACGIH), or other professional organizations.

**For More Information....**

Please see CEHRC's Mold and Moisture On-line Resources for more information.

**(Endnotes)**

<sup>1</sup> These materials do not constitute an endorsement of a particular product.

<sup>2</sup> Tramex: [dennisw@tramexltd.com](mailto:dennisw@tramexltd.com); (tel) 303-972-7926; Review product materials on the web site [www.tramexltd.com](http://www.tramexltd.com).

# MOLD AND MOISTURE: Assessment Checklist



## ASSESSMENT INSTRUCTIONS:

1. Review the **Visual Survey** to determine whether to test for mold and moisture and the locations for the tests.
2. Test the moisture meter by placing your hand under the sensor.
3. Check for moisture.
  - a. Using the Tramex moisture meter, set the scale to match surface to be tested.

### Setting 1

- Wood
- Carpet on concrete (usually in basement)

### Setting 2

- Wall paper
- Drywall
- Carpet

### Setting 3

- Brick
  - Plaster (usually on older walls)
  - Concrete
- b. Test: Where you see/smell mold, wet spots, and on **all** walls below windows.
  - c. Hold meter against surface – count to 3.
  - d. If you get a **Yellow** or **Red** reading, move the meter around to confirm that the reading was not caused by metal studs or nails.
4. Turn the moisture meter off, thoroughly wipe off any mold with disinfectant wipe, and dry the rubber pads well.
  5. Record “Red” and “Yellow” results that were not false readings on the Mold and Moisture Assessment Form.
  6. Take photographs of all moldy spots and areas that give you a “Red” reading. Record photo number on Mold/Moisture Assessment Form.

## Supplies:

- Moisture Meter (e.g., Tramex)
- CEHRC Mold and Moisture Assessment Form
- Completed Visual Survey Report
- Completed Floor Plan (**Visual Survey**)
- Camera
- Pen
- Disinfectant wipes
- Spare batteries (9-volt for Tramex)



## FOLLOW-UP

Give a copy of the **Mold and Moisture Assessment Form** to the resident when you deliver other sampling results (lead lab reports, the Sampling Results Report, etc.).

# MOLD AND MOISTURE

## Assessment Instructions

CEHRC's Mold and Moisture Assessment Instructions are intended to outline the steps Home Hazard Investigators should take in order to assess homes for mold and moisture problems. These materials complement CEHRC's mold and moisture assessment training for community-based organizations working to improve housing conditions in high-risk communities through indoor environmental sampling activities.

These steps assume you have already decided which units to assess, completed the Visual Survey, have your supplies, have the resident's agreement to assess their home, and know how you plan to use the results. For more information on mold and moisture, please see the **Mold and Moisture Background Materials** and **Mold and Moisture Decision Guide**.

## I. Supplies

- Moisture Meter<sup>1</sup> (e.g., Tramex Moisture Encounter Meter)
- CEHRC Mold and Moisture Assessment Form
- Completed Visual Survey Report
- Completed Floor Plan (done as part of the Visual Survey)
- Tape measure or ruler
- Camera
- Pen
- Disinfectant Wipes
- Spare Batteries for Moisture Meter<sup>2</sup>

## II. Avoid Common Mistakes

**Set the moisture meter to the right setting for each reading.** Remember to change the scale to match the wall, ceiling, trim or floor surface you are testing.

**Move the meter around to prove that “Yellow” or “Red” readings are moisture and not nails/metal staples.** A moisture meter will produce a (false) red alarm reading if placed over a metal (studs, metal corner strips, nails).

**Remember to turn the meter off when you are done.** When you are done testing, turn the meter off using the switch on the left side. If you forget to turn it off you can run down the battery. The meter will not work if the battery is dead. Carry extra batteries to use as backup.

**Remember the meter only measures moisture, not mold.** The meter tells you about the moisture in a wall, floor, or ceiling. It doesn't tell you if mold is present. While moisture often leads to mold, a wet reading from the meter does not always mean that mold is always present. Testing for mold involves other tools that are not recommended as part of a CEHRC assessment.

**Pay attention to record keeping.** Sloppy recording can happen when you are in a rush. Record the results from the meter when you take them. Once you move to another spot, it is easy to forget which areas gave you a yellow or red reading.

## III. Assessment Instructions

1. **Review the Visual Survey.** If, when you completed your Visual Survey, there were no signs of mold, moisture or a musty smell, you probably do not need to do a mold and moisture assessment. If there were signs of mold, moisture or a musty smell, you should consider doing an assessment for mold and/or moisture problems in the home. Review the Visual Survey and Floor Plan to decide where to test.
2. **Test the moisture meter** by placing it on your hand and confirming that it sounds and reads in the “Red” zone. (It shows red because your hand is moist.)
3. **Check for moisture by putting the rubber pads on the underside of the moisture meter against the surface being tested for a few seconds.**
  - a. Set the scale on the top of the meter to the setting that matches the surface you are testing. (2 is the most sensitive to moisture, 1 is the middle setting, 3 is the least sensitive)

### Setting 1

- Wood
- Carpet on concrete (usually found in basement)

### Setting 2

- Wall paper
- Drywall
- Carpet

### Setting 3

- Brick
- Plaster (usually on older walls)
- Concrete

- b. Test where you see mold, wet spots, smell mold **and** on **all** walls below windows.
- c. Hold the moisture meter against the surface to be tested and count to 3. When testing carpet, press or wiggle the meter into the carpet.
- d. If you get a **Yellow** or **Red** reading, move the meter 3 inches to the left and right, up and down, and on a diagonal to check that you are not reading a metal stud, series of nails, or metal pipe\*. Moving the meter to the left and right should ensure the problem the meter is finding is moisture and not metal. If the reading is still **Yellow** or **Red**, keep moving outward until the meter reads Green. This helps tell you the size of the potential moisture problem.

\* Metal studs, metal bead on gypsum board corners, foil wall paper, groups of nails and metal pipes can sometimes cause false readings on the meter.

4. **When finished, turn off the moisture meter**, thoroughly **wipe** off rubber meter pads if they are wet or have mold on them with a disinfectant wipe, and **dry** the pads thoroughly.
5. **List ALL areas with a true “Yellow” or “Red” moisture reading.** Record results on the mold and moisture assessment form. (Don't record false readings from a metal stud or other metal object.) Note the room, location, surface type, and approximate size of the surface that shows evidence of moisture.\*  
*\* 2 ft<sup>2</sup> is the size of ½ a regular newspaper; 10 ft<sup>2</sup> is the size of many regular windows; 15 ft<sup>2</sup> is the size of a regular door. Carrying a tape measure at all times will help with accuracy of measurements.*
6. **Take pictures of all moldy spots and areas that give you a “Red” reading.** Record picture number on Mold/Moisture Assessment Form.

**(Endnotes)**

<sup>1</sup> CEHRC uses the Tramex Moisture Encounter Meter. These assessment instructions assume you are using this moisture meter.

These materials do not constitute endorsement of a particular product.

<sup>2</sup> 9-volt batteries for Tramex; battery type may differ for other moisture meters

# MOLD AND MOISTURE

## Decision Guide

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This guide is intended for CEHRC project managers considering whether they want to test for and document moisture and mold problems as part of their community-based environmental sampling campaign strategy. The **Mold and Moisture Assessment Instructions** provide step-by-step instructions that the Home Hazard Investigator needs to assess and document mold and moisture problems. CEHRC's **Mold and Moisture Background Materials** offer added reference information.

**Why look for mold and test for moisture?** Molds produce substances that can cause an allergic reaction (allergens), irritants, and in some cases, potentially toxic substances. Mold can trigger respiratory (breathing) problems including asthma, particularly in people who have a mold allergy. Asthma is a growing national health problem in children; the number of children with asthma has doubled in the past 10 years and is now the leading cause of missed school days. Breathing or touching mold can also cause allergic reactions resulting in: hay fever-like symptoms, rashes, and irritation to eyes, skin, nose, throat and lungs. Moisture is a key ingredient that helps mold grow. In addition to moisture, mold needs a warm temperature and food (e.g., paper, glues, fabric, wood, solid surfaces or food) to grow. A mold problem cannot be solved without finding and fixing the water/moisture problem.

**What type of testing is used in this protocol?** Following CEHRC's protocol, Hazard Investigators perform a Visual Survey to look and smell for mold and moisture. If you can see mold, there is no need to test to show there is a problem: taking photographs and documenting the problem on the Visual Survey Report is enough. CEHRC tests for moisture to provide added information to help the resident determine the source of the water causing the mold/moisture problem (leaks, etc.), if it is not obvious. The approach CEHRC takes is consistent with EPA's mold guidance.

**Which homes should be checked?** Any home can have a mold and moisture problem. Homes with ongoing water leaks (e.g., from plumbing or rainwater) or musty/moldy smells have a higher likelihood of mold and moisture problems.

**What training is required?** CEHRC Hazard Investigators should receive CEHRC's classroom training to understand the background materials, learn how to use the moisture meter, and understand how to report the results. Using CEHRC's protocol, assessing moisture and mold is simple. You look for mold and moisture and then use a moisture meter to test for moisture in places you can't see.

**How much does it cost?** CEHRC has experience using a Tramex Moisture Encounter Meter<sup>1</sup>. This moisture meter costs about \$350. Other meters may be used. Moisture meters will last many years and can be used in thousands of homes (with routine battery replacement).

**Any limits on scheduling of visits?** Only one visit is needed, and this can happen at any time during the year.

**Are there standards?** No, there are no government health-based standards for mold or moisture. Many state and local codes consider chronic dampness or moisture a code violation. However, most codes don't define "moisture" or "chronic." Moisture meters have been used for about 15 years with good results to document moisture problems by a variety of organizations. A moisture meter provides three readings:

- Green - the surface is dry
- Yellow - the surface is somewhat wet but may dry out
- Red - the surface has excessive moisture (probably enough for mold to grow)

**How useful are the results?** The results from the moisture meter are credible and complement the findings of the Visual Survey. Sometimes, the meter can help trace a trail of moisture from the place where it is wet to the source. Since many local sanitary codes consider "chronic dampness and moisture" a violation, proving moisture or dampness problems can be helpful in getting the problem corrected. The CEHRC moisture and mold assessment, along with the photographs of water stains and mold, will provide further documentation of the problem.

**Are there any safety concerns to the Hazard Investigator?** If the Hazard Investigator has reactions to mold, take precautions to limit his or her contact (wear mask<sup>2</sup> & gloves and/or limit time in the home) and avoid touching or disturbing mold to avoid releasing mold spores into the air. Walking out of the house may make initial symptoms go away. If one Investigator has severe reactions, another Hazard Investigator should perform the assessments in homes with moisture and mold problems.

**What other potential issues must be considered?** Some people may ask why you did not sample for mold spores. Refer them to the EPA guidance on mold that says that if mold is visible, sampling is not needed ([www.epa.gov/iaq](http://www.epa.gov/iaq)). According to EPA, sampling a surface for mold may only be useful to determine if mold was cleaned up properly. It is also important to recognize that the science on the health effects from mold exposure or contact is still evolving. We do not know very much about which molds may cause health problems and in what amounts. Based on the current science and EPA guidelines, CEHRC recommends looking for mold and testing for moisture, if appropriate, as these conditions can cause negative health reactions for some individuals. (Information on sampling for mold spores can be found near the end of the mold and moisture background materials).

**(Endnotes)**

<sup>1</sup> These materials do not constitute endorsement of a particular product.

<sup>2</sup> Many CEHRC Hazard Investigators do not wear any kind of surgical mask or respirator because it can scare the family that lives in these conditions every day. CEHRC has no position on the use of surgical masks or respirators other than that local projects should take the precautions necessary to protect the health of their hazard investigation team.

# Mold and Moisture Report

Prepared by: \_\_\_\_\_  
 Organization: \_\_\_\_\_  
 Address: \_\_\_\_\_  
 Date: \_\_\_\_\_

Resident: \_\_\_\_\_  
 Address: \_\_\_\_\_  
 Unique ID: \_\_\_\_\_  
 Unit #: \_\_\_\_\_  
 Phone #: \_\_\_\_\_  
 Notes: \_\_\_\_\_  
 Property Owner Name: \_\_\_\_\_

Room	Location (inside wall, outside wall, floor, ceiling)	Surface type (painted plaster or drywall, wallpaper, wood carpet, concrete, other)	Mold (list size of mold area in ft <sup>2</sup> *)	Meter Setting (1, 2, 3)	Moisture Problem Circle Highest Level <sup>1</sup>	Photo #	Comments
					Yellow/Red		
					Yellow/Red		
					Yellow/Red		
					Yellow/Red		
					Yellow/Red		
					Yellow/Red		
					Yellow/Red		
					Yellow/Red		

**Key:** A=Attic; O=Basement; BA=Bathroom; BR=Bedroom; CS=Crawl Space; EN=Entry; DR=Dining Room; K=Kitchen; LR=Living Room; NV=Not Visible

# of Rooms with mold:

# of Rooms with red reading:

\* 2 ft<sup>2</sup> (square feet) is the size of 1/2 a regular newspaper; 10 ft<sup>2</sup> is the size of most double hung windows; 15 ft<sup>2</sup> is the size of a door.

<sup>1</sup> Green = dry; yellow = somewhat wet; red = excessive moisture