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MD Mold- Complete Mold Inspection Example Report

Thank you for choosing **MD Mold** to assist with your indoor air quality concerns. Below is a summary of findings, laboratory results, and my professional observations and recommendations.

A complete mold inspection was performed. This included an exterior inspection, interior inspection, thermal imaging and moisture mapping. Air, surface and dust sampling was conducted in several areas of the home.

Exterior Inspection

The exterior inspection serves as a comprehensive evaluation of the building's "shell" to identify any defects that allow moisture to penetrate the living space. By analyzing the site's topography, the integrity of the roofing, and the condition of the siding, can determine specific entry points that facilitate mold-conducive environments.

1. Grading

Grading, drainage and roofing systems were evaluated for proper operation and clearance from the house and foundation.

Southeast Corner

Southwestern Side

West Side

Northside

Eastside

Findings:

- Grading from foundation was appropriate.
- No negative grading noted. Egress window wells do not have cover, though this is optional it can help direct water away from foundation.

2. Drainage

Water from above is a primary culprit for attic and wall-cavity mold.

- **Gutter Integrity:** Gutter system appears intact. Leaf guard installed.
- **Downspout Extensions:** All but one extension, on the westside of the house, are intact.

3. Building Envelope and Siding

- **Findings:** Siding condition is ok. One deficiency was noted on the eastside wall of a gap of 1/3 inch between siding rows. Cracking in sealant is minimal throughout exterior.

  Recommendation: Use of a polyurethane based sealant for siding gap and fill spaces of current sealant cracks.

- **Windows and Doors:**

Findings: Many windows seals are degraded and have exposed gaps. This allows extra air intrusion and wind driven rain to enter this area contributing to the increased level of condensation on the interior window frames and sills.

Recommendation: These types of windows that have aluminum cladding with a wood frame are very prone to condensation. The aluminum window cladding transfers cold more easily into the warmer wooden frame, taken into consideration with the gaps and failing seals these windows may need replacement to avoid further condensation issues.

Window Flashing



Findings: Window flashing above some portion of the windows are lacking proper flashing clearance and have cracking sealant. This could lead to water intrusion through the cracked sealant and into the wall.

Recommendation: Dut to the likelihood of window replacement, proper flashing should be installed at that time.

4. Penetrations and Vents

Anywhere a pipe, vent or wire goes through a wall is a potential leak point.


Findings: All penetrations at ground level had proper sealant.

Recommendations: One vent on the northside of the house appears to be clogged with debris and should be cleaned.

5. Decking

Outdoor decking can be reservoirs of mold that can get indoors if nearby windows.



Findings: Wooden structural components under composite decking show signs of fungal growth. Area covers portions of many of the deck joists.

Recommendation: Observed fungal growth beneath the deck assembly is located outdoors and subject to normal environmental moisture conditions. Due to the proximity of operable windows, exterior fungal particulates may enter the structure under certain conditions, such as when windows are open. No corrective action is required at this time beyond routine exterior maintenance and moisture management. Monitoring of interior conditions is recommended.

Interior Inspection

An interior mold inspection included a visual evaluation of accessible indoor areas for conditions that may support mold growth, such as moisture intrusion, staining, and material deterioration. Indoor air quality may be assessed using air sampling to evaluate airborne mold levels in comparison to outdoor conditions when appropriate. Thermal imaging is used as a screening tool to identify temperature differences that may indicate missing insulation or potential moisture intrusion, with suspect areas further evaluated using moisture meters when appropriate. Moisture levels of building materials are checked using non-invasive instruments, and temperature and humidity conditions are documented. Findings are reviewed together to help identify potential moisture issues and areas of concern.

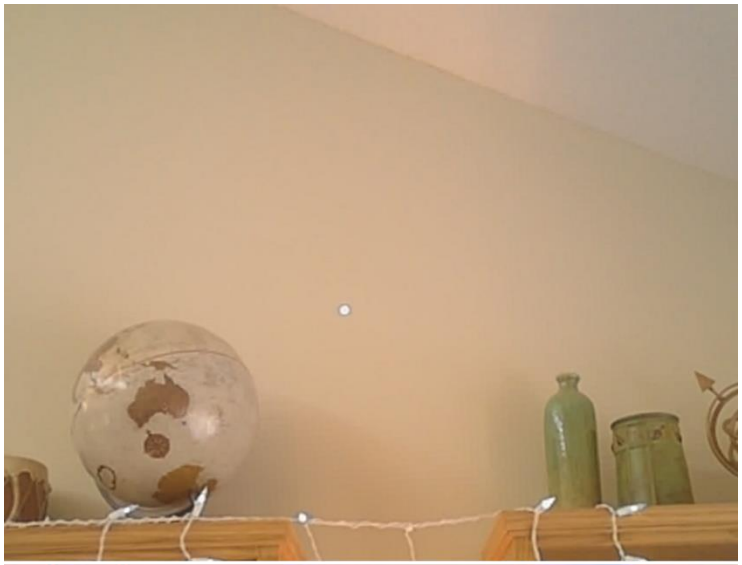
Thermal Imaging

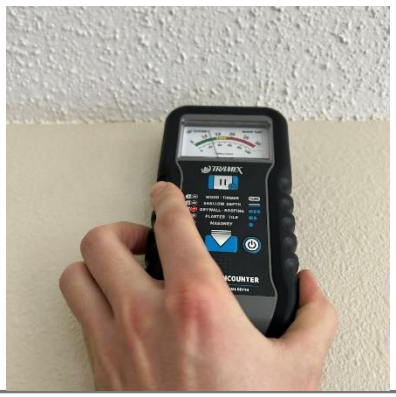
Infrared thermal imaging is utilized as a non-invasive diagnostic screening method to assess surface temperature differentials across building assemblies. The thermal camera detects long-wave infrared radiation emitted from surfaces and converts this data into a visual thermogram representing relative temperature variations. Thermal anomalies may be indicative of conditions such as thermal bridging, missing or compressed insulation, air infiltration or exfiltration, differences in material thermal mass, or evaporative cooling associated with moisture presence. Infrared thermography does not directly measure moisture content or identify concealed defects; therefore, observed anomalies are evaluated in conjunction with building construction details, environmental conditions, and follow-up measurements using complementary diagnostic tools when appropriate. In the thermal images the darker purple spots are colder while warmer locations are represented by increasing shades of yellow.

Moisture Mapping

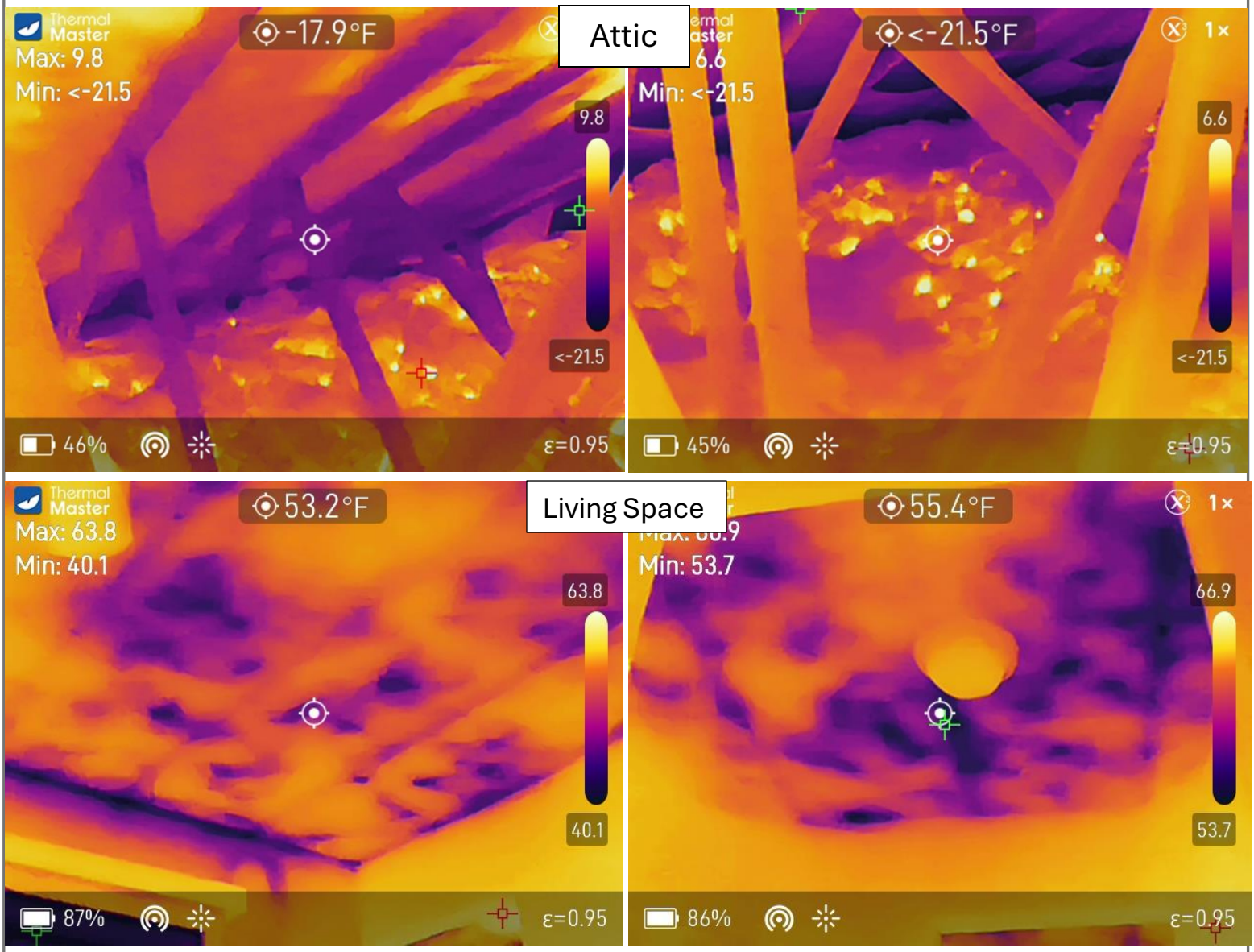
Moisture conditions within building materials are assessed using non-invasive capacitance-based impedance meters. This instrument operates by generating a low-frequency electromagnetic signal and measuring changes in the electrical impedance characteristics of materials, which correlate to relative moisture levels. The meter is suitable for comparative moisture assessment in materials such as gypsum board, wood, plaster, masonry, and concrete without surface penetration. Readings are qualitative and relative rather than absolute moisture content values and are used to identify anomalous areas exhibiting elevated moisture signatures when compared to adjacent reference materials. Moisture meter data are interpreted in conjunction with thermal imaging, visual observations, and ambient environmental conditions to evaluate the potential for moisture intrusion or prolonged material dampness.

Living Areas, Bedrooms





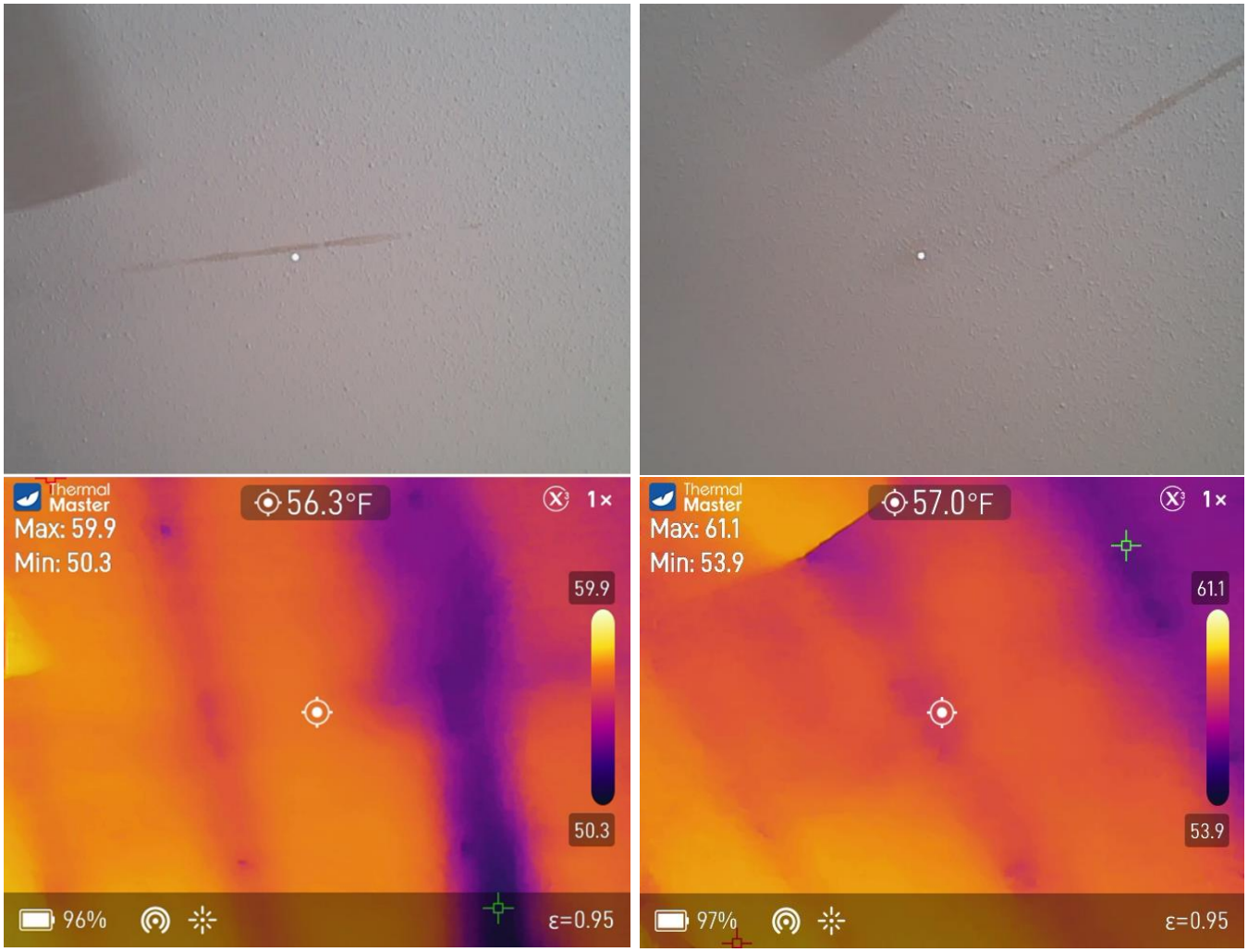
Multiple cooler (blue) thermal anomalies were observed in ceiling areas throughout the structure. Where accessible, these areas were evaluated using a non-invasive moisture meter to assess relative moisture content (representative images to the left). Moisture measurements did not reveal elevated moisture levels when compared to surrounding reference materials. The absence of elevated moisture readings suggests that the observed thermal anomalies are consistent with insulation-related deficiencies, variations in thermal mass, or thermal bridging between framing members rather than active moisture intrusion. Framing elements, including rafter ties, appear to contribute to localized temperature differentials by encapsulating cooler air within adjacent cavities, as demonstrated through infrared imaging.



Further investigation of the attic space revealed that thermal anomalies observed from within the occupied interior exhibited an inverse thermal pattern when viewed from the attic side of the assembly, consistent with areas of reduced insulation effectiveness. Inspection of attic insulation in corresponding locations identified multiple small, circular voids within the insulation layer, representing localized insulation discontinuities. Additionally, four deceased rodents were observed within the attic space at the time of inspection. The presence of rodents supports the conclusion that portions of the insulation may have been mechanically disturbed by animal activity, resulting in localized reductions in thermal resistance. These insulation voids provide a plausible explanation for the thermal anomalies observed via infrared imaging. No elevated moisture conditions were detected in these areas during moisture mapping.

Areas of Previous Water Intrusion:

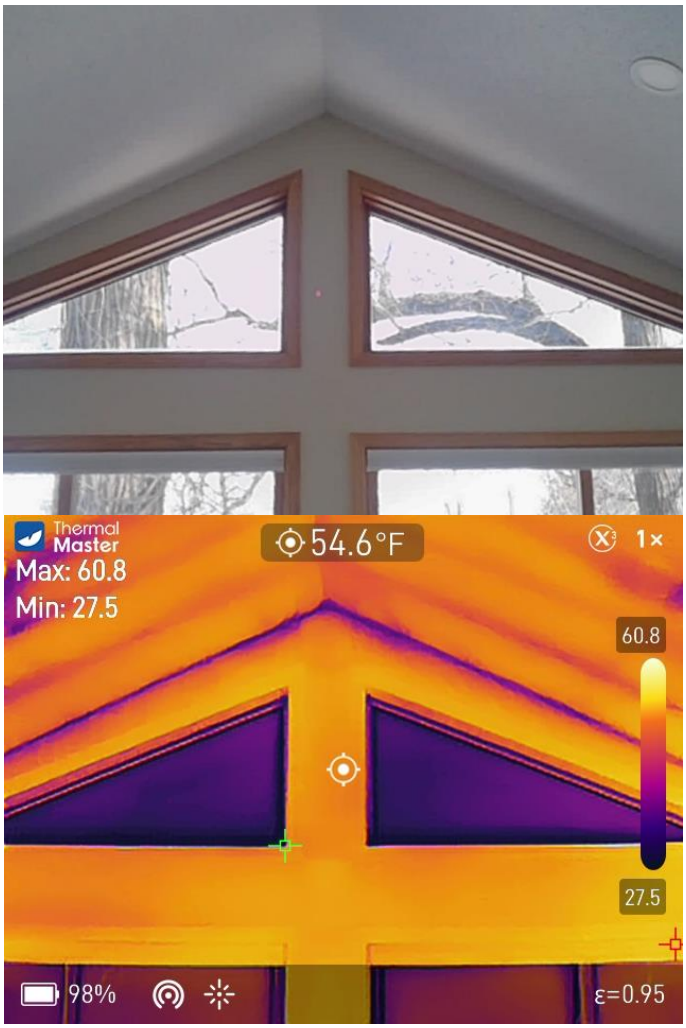
It was noted during the inspection that several locations within the ceiling particularly in the upstairs living room ceiling had signs of previous water intrusion. Special attention was paid to those areas but did not reveal any anomalies upon thermal scanning. As can be evidenced by the images below:

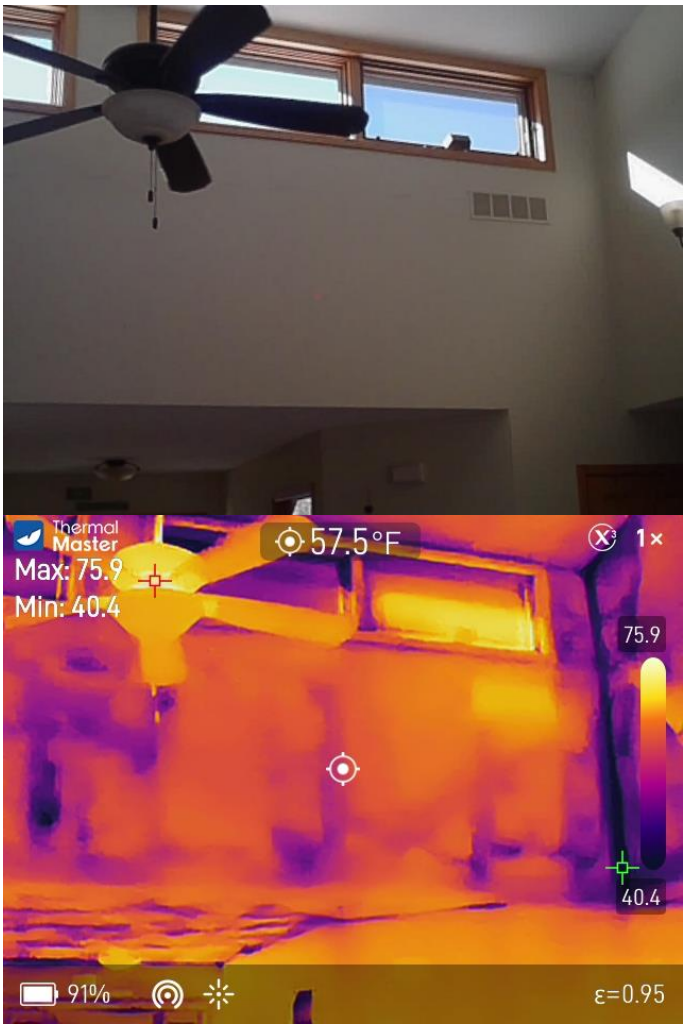


The uniform thermal characteristics of the surface at the location of the prior water intrusion staining indicate that the area does not currently exhibit elevated moisture conditions. The absence of thermal or anomalies suggests that the observed staining is consistent with a historical wetting event rather than active moisture intrusion. Such staining is commonly associated with seasonal rain events, during which liquid water enters the building envelope temporarily and subsequently dries.

It was also noted that the utility room showed signs of moisture wicking on the lower drywall edge adjacent to the floor. Area was inspected for signs of microbial growth but none was noted. Moisture readings were taken and did not indicate higher moisture content in that portion of the drywall.

Interior Windows





Transom windows were evaluated using infrared thermal imaging to assess for heat loss and potential air infiltration pathways. The thermal patterns observed showed a relatively uniform temperature profile surrounding the window assemblies, with a tight and well-defined thermal boundary at the perimeter. No significant thermal plumes, streaking, or diffuse cooling patterns were observed that would typically indicate active air leakage or convective air movement. These findings suggest that the transom windows are adequately sealed and do not appear to be a significant source of uncontrolled air infiltration or heat loss at the time of inspection.

The lower operable windows were assessed and found to have large areas of frozen condensation with some areas >10cm thick. The lower operable windows are aluminum-clad units with interior wood frames. Aluminum components exhibit high thermal conductivity and readily transmit exterior cold temperatures to interior surfaces, increasing the potential for interior surface temperatures to fall below the indoor air dew point. Several gaps were observed at the interior window frame assemblies, which may allow cold air infiltration and further depress interior surface temperatures.

Thermal Evaluation Summary: Windows

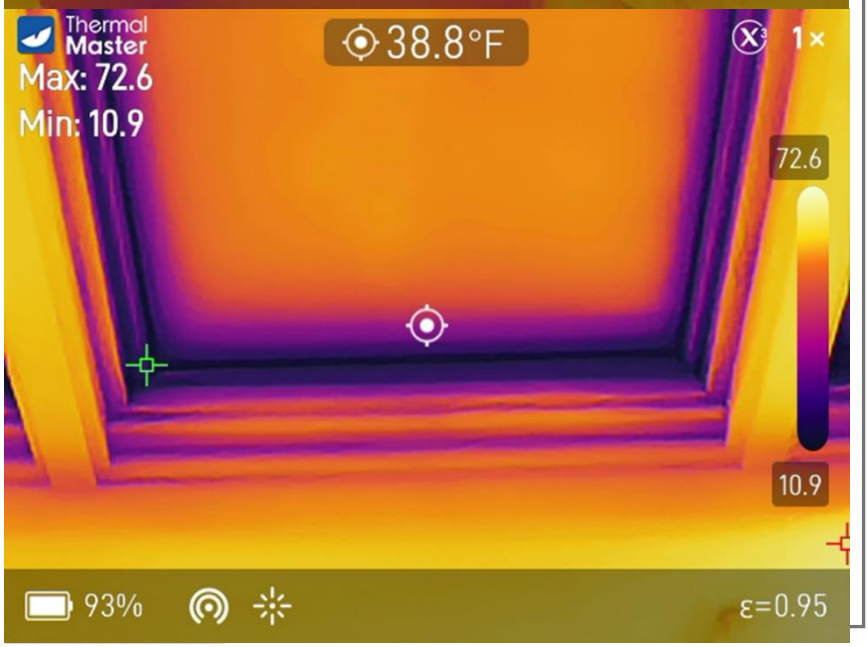
During the inspection, we used infrared cameras to measure DeltaT (ΔT), the temperature difference between your indoor air and the surface of your windows. This measures how well your windows "separate" your home from the cold outside.
Below are expected Delta T values for certain window types (at 0°F outside / 70°F inside)

Energy Star (North) ~15°F - 18°F

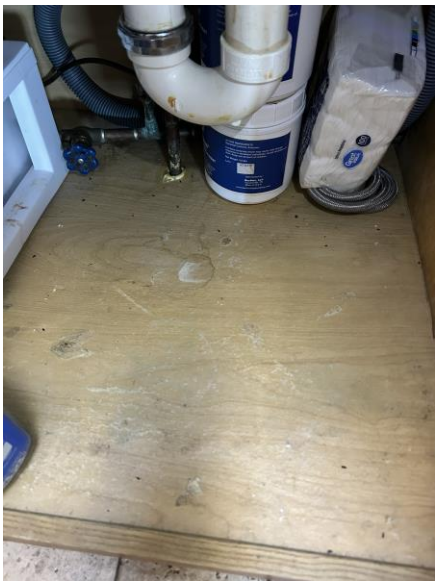
Standard Double-Pane ~25°F - 30°F

Single-Pane / Failed ~50°F+

Many windows in the house had a DeltaT (ΔT) that was greater than **30°F indicating a loss of insulating capacity of the windows.** This can be due to improperly sealed windows, old or failing windows. This would explain the massive condensation with the low RH of 43%.



Internal Water Sources (kitchens, bathrooms, sinks)



Sink cabinet areas and associated building materials at the kitchen sink, bathroom sinks, laundry room sink, and basement bar sink were evaluated due to reported or observable evidence of prior water intrusion.

A visual inspection was performed to identify staining, material deterioration, and the presence of apparent microbial growth. Moisture content measurements of accessible materials were obtained using a non-destructive moisture meter.

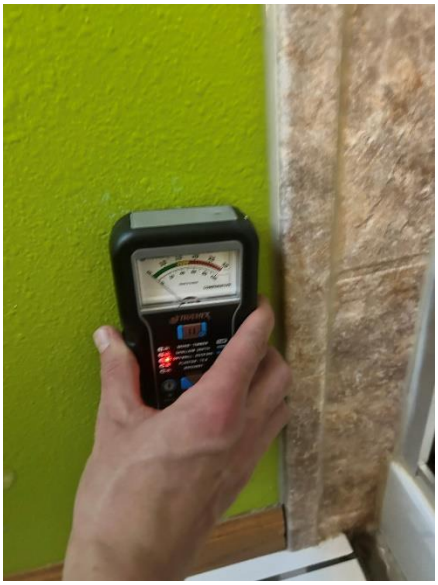
Visible indicators of historical water intrusion were present at select locations; however, moisture measurements did not indicate elevated moisture content at the time of inspection. No wet materials were identified.

Apparent microbial growth observed in the basement bathroom area was dry and desiccated in appearance and did not exhibit characteristics typically associated with active microbial growth at the time of inspection.

Moisture Mapping

Moisture mapping was performed to identify common areas with elevated moisture levels that could indicate hidden water intrusion or leaks. Common problem areas were carefully assessed, including around toilets where seals may fail, under sinks, flooring near showers and shower landings, and around plumbing fixtures such as washer supply and drain lines. Using specialized moisture detection tools, the inspection evaluated both surface and subsurface moisture to detect leaks, water accumulation, or conditions conducive to mold growth. This comprehensive approach helps pinpoint areas needing repair or further investigation before visible damage occurs.

No areas were measured with increased moisture content during this inspection. Even areas with previous water intrusion, such as the basement shower wall, did not show current moisture saturation. This assessment helps confirm that the inspected areas are currently dry and not exhibiting conditions conducive to mold growth.



Attic

An attic inspection was performed as part of the mold investigation. Thermal imaging was used throughout to identify areas of potential water intrusion through the roof, including leaks or roof penetrations that could introduce moisture. The inspection also evaluated attic ventilation to detect areas of inadequate airflow that could lead to condensation and elevated humidity. Additional conditions conducive to mold growth, such as damp insulation, roof decking moisture, or evidence of previous water events, were assessed. This approach helps identify hidden moisture risks and factors that could support mold growth in the attic space.

The horizontal wood sheathing in the attic was tested with a moisture meter and showed elevated moisture content, indicating water saturation in those areas. No visible drip lines or active water intrusion points were observed in the attic that would help identify the source of the moisture. These findings suggest the presence of retained or past moisture, which may contribute to conditions conducive to mold growth if not addressed.

The photo on the left shows frost accumulation in the attic space along with some apparent microbial growth on the roof sheathing. Current outdoor conditions are highly conducive to condensation forming within this space. It is common for attics inspected during prolonged cold periods to exhibit some degree of condensation. These conditions can increase the potential for moisture-related issues if not monitored or mitigated.

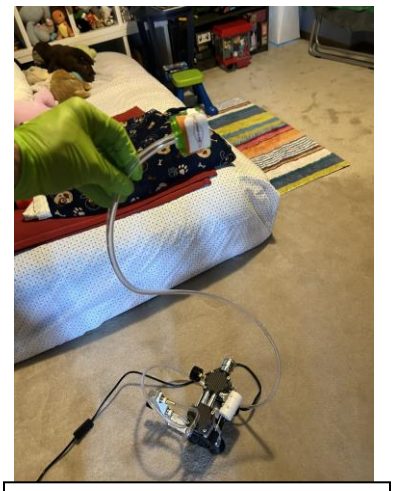
Mold Assessment

Overall mold assessment of the house did reveal several locations where mold was present predominately the window frames and sills. Mold was also identified in several other locations within the home in the upstairs guest bathroom toilet reservoir and the basement north storeroom floor. The basement recreation room with a concrete ceiling was also sampled due to the prevalence of humid conditions in these types of environments but did not show any fungal growth. Please find summary and laboratory results below.

Sampling Summary

The following locations were sampled:

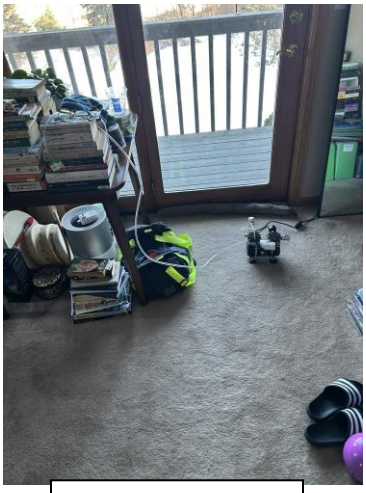
- Air Samples



Basement South Bedroom

Main Floor Living Room

Basement Living Room



Master Bedroom

Sampling Protocol:

Flow Rate: 15 Liters/minute
Total Flow Time: 10 Minutes
Total Air Captured (meters^3): 0.15m^3

During the mold assessment, apparent mold growth was observed on several window sills. Air sampling was conducted in areas of the home with high occupancy, where occupants spend extended periods of time, to evaluate potential exposure. These samples help determine the presence and concentration of airborne mold spores in spaces that are most relevant to daily living and occupant health. The assessment focused on identifying conditions conducive to mold growth and potential indoor air quality concerns.

- Surface Samples

  A total of 7 surface samples were collected to determine mold taxa present within the household environment and evaluate exposure risk.




Window Sill Samples

Upstairs ½ Bath

Basement Rec Room Ceiling

Basement Storeroom Floor

Surface lift samples from apparent mold growth or suspected microbial contamination to confirm the presence and type of mold. These samples allow microscopic evaluation in a laboratory to identify the genera or species of mold present, which can help distinguish between common environmental molds and those more likely to impact indoor air quality or health. Tape lifts also provide documentation of visible mold growth and help guide remediation decisions by confirming whether observed growth is active or dormant.

MD Mold
HOME HEALTH DIAGNOSTICS. LAB VERIFIED.

Laboratory Report

Client: Example Client	Address: Example Address	Date: January 23, 2025
Chain of Custody # COC-VSC-example	Lab Report # **VSC-exmp**	Test Type(s): Air, Surface Lifts

Overview

- Master bedroom air sample normal air quality.
- Upstairs living room air sample normal air quality.
- Basement living room air sample normal air quality.
- Basement southside bedroom normal air quality.
- Surface lift sample #1 positive for fungal growth.
- Surface lift sample #2 positive for fungal growth.
- Surface lift sample #3 positive for fungal growth.
- Surface lift sample #4 positive for fungal growth.
- Surface lift sample #5 positive for fungal growth.
- Surface lift sample #6 positive for fungal growth.
- Surface lift sample #7 positive for fungal growth.

MD Mold
HOME HEALTH DIAGNOSTICS. LAB VERIFIED.

Air Sample Results

Air samples are used to look at what particles are floating in the air at the time of testing including: mold spores, hyphal fragments, skin cells, dirt, insect particles and fibers. From this information we determine using comparative samples, what types of molds are present and whether there is an amplification of spores.

Air Sampling Spore Levels

Your air sampling results will categorize mold concentrations as Normal, Increase, or Elevated to help identify if your indoor air quality is healthy or a cause for concern. These rankings are determined by comparing the "problem room" to both the outdoor air and the cleaner rooms in your home to see if a specific area is out of balance.

1. Normal

A **Normal** result means the indoor sample matches the baseline and no amplification of mold spores was measured.

- **The Comparison:** The indoor levels are lower than the outdoor and/or relative levels.
- **Key Indicator:** The *types* of mold (genera) found inside are the same ones found outside. If you have the same number of spores of *Cladosporium* outside as inside, that is a healthy, normal environment.

2. Increase

An **Increase** sample has slight overamplification compared to baseline or may have a species elevation.

- A **Slight Increase** happens when one room looks suspicious compared to the rest of the house. This is often called **Indoor Amplification**.
- **What it means:** There may be a larger issue starting to occur or levels may be a spatial amplification over time.

3. Elevated

An **Elevated** reading is a red flag that indicates a bigger issue.

- **The Comparison:** The levels in this room are significantly higher than both the outside air and the other rooms in the building.
- **Key Sign:** The report might show "Indicator molds" These are specific types of mold that only grow on very wet building materials and are almost never found in normal, dry houses.

Your results:

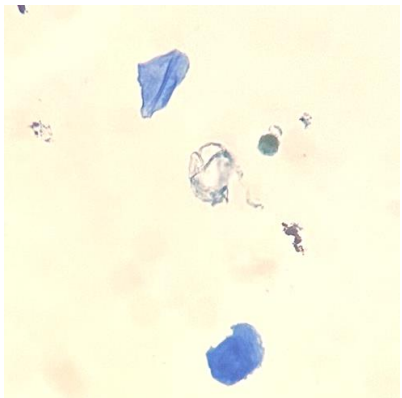
A total of 4 air samples were collected. samples were taken in the basement area and 1 sample was taken in the upstairs living room area. 2 surface lift samples were also taken in the basement of apparent fungal growth.

AIR SAMPLES

Sample Location	Mold Spore Count	Mold Types Present
1st floor Living Room	Normal	No elevated mold spores were detected
Basement S. Bedroom Sample	Normal	
Basement Living Room	Normal	
Master Bedroom	Normal	

Mold Spore Types	Basement #1	Basement #2	Upstairs Living Room	Master Bedroom
Alternaria/Ulocladium	<LOD	<LOD	<LOD	<LOD
Cladosporum	<LOD	<LOD	<LOD	<LOD
Aspergillus/Penicillium	<LOD	<LOD	<LOD	<LOD
Fusarium	<LOD	<LOD	<LOD	<LOD
Basidiospores	<LOD	<LOD	<LOD	<LOD
Ascospores	<LOD	<LOD	<LOD	<LOD
Total	0	0	0	0

<LOD= Below Limit of Detection



Skin Cells(blue) & Fibers

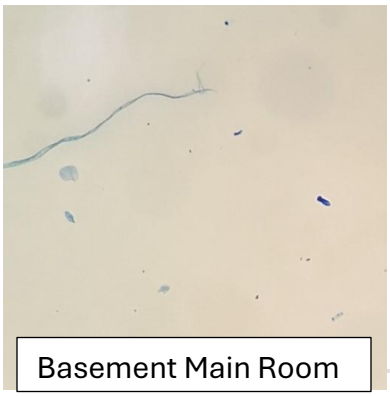
Impaction slides were used to evaluate the presence and relative concentration of airborne fungal spores and particulate matter. The slides were stained with lactophenol blue and analyzed using full-traverse microscopic examination. This method is used to assess whether elevated levels of fungal spores are present in the sampled air and does not determine active fungal growth.

Air Sample Particulate Counts

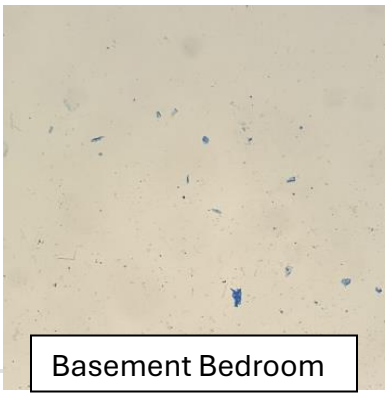
Air samples were analyzed for general particulate matter, which can include common airborne materials such as skin cells, hair and textile fibers, dirt, dust, and other non-biological particulates. This type of analysis is used to assess overall indoor air cleanliness and background particulate levels. All samples collected showed particulate concentrations consistent with normal indoor air quality levels, with no evidence of elevated particulate matter.

Particle Type	Living Room	Master Bedroom	Basement S.Bedroom	Basement Main Room
Skin Cells	52	35	82	75
Fibers/Hair	10	11	42	20
Hyphal Fragments	<LOD	<LOD	<LOD	<LOD
Pollen	<LOD	<LOD	<LOD	<LOD
Other Particulate	38	32	69	56

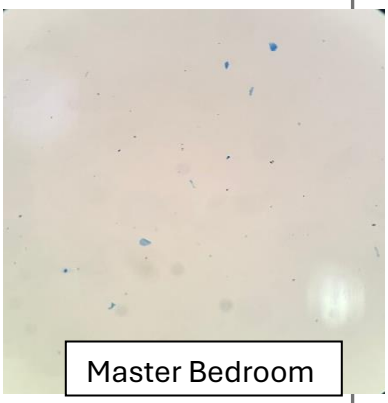
Living Room Air Sample



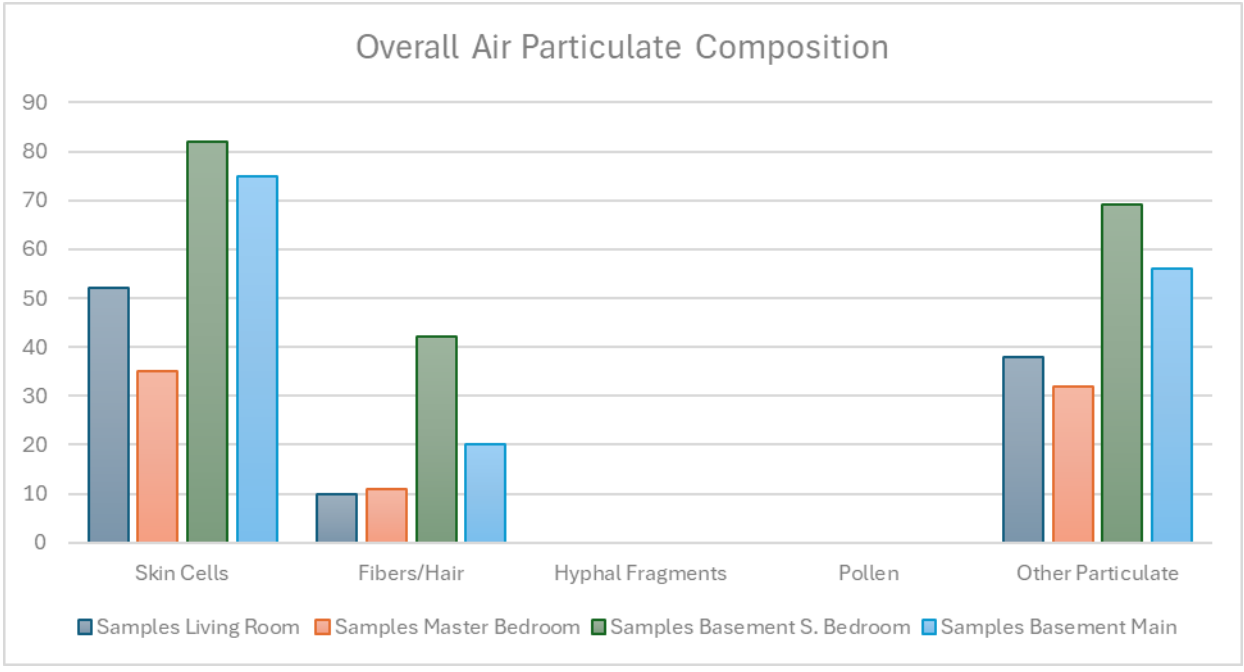
Basement Main Room



Basement Bedroom

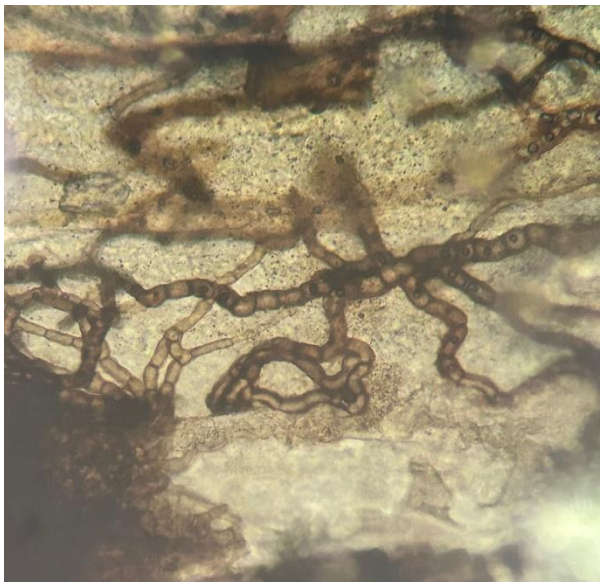


Master Bedroom



Surface Samples

Bedroom Windowsill

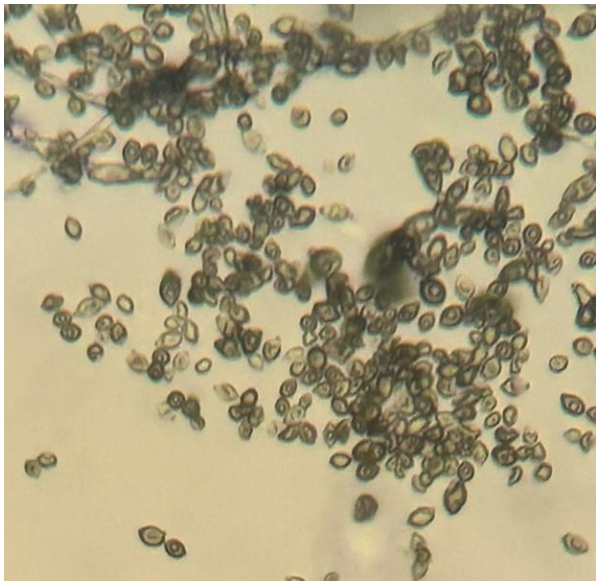


Mold Detected:

Aureobasidium type

Description: Septate Hyphae, dark, irregular hyphal structures consistent with *Aureobasidium*-type mold. *Aureobasidium* is commonly associated with intermittently damp indoor environments and is frequently found on window frames and sills where condensation occurs. This organism readily colonizes smooth or painted surfaces exposed to periodic moisture and temperature fluctuations.

Basement Storeroom Floor

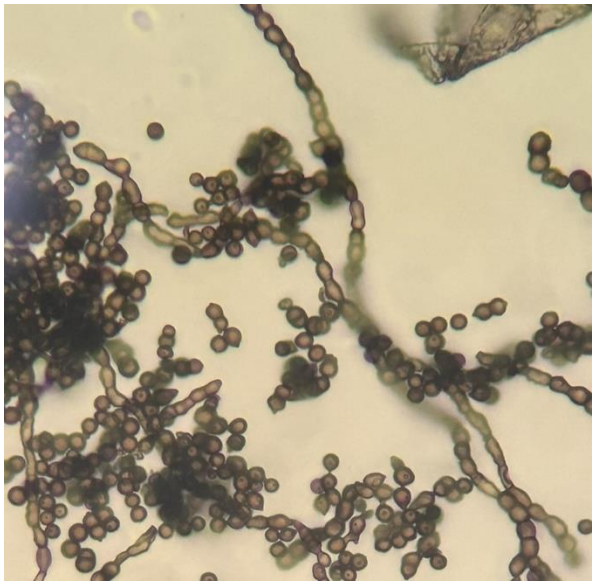


Mold Detected:

Ascomycete type, possible Chaetomium

Description: Surface sampling from a chronically damp, cellulose-based building material revealed dark, globose ascospores, morphology consistent with *Chaetomium*-type mold. *Chaetomium* species are commonly associated with persistent moisture conditions and preferentially colonize materials rich in cellulose, such as drywall, paper backing, wood,

Upstairs Guest Bathroom Toilet Reservoir

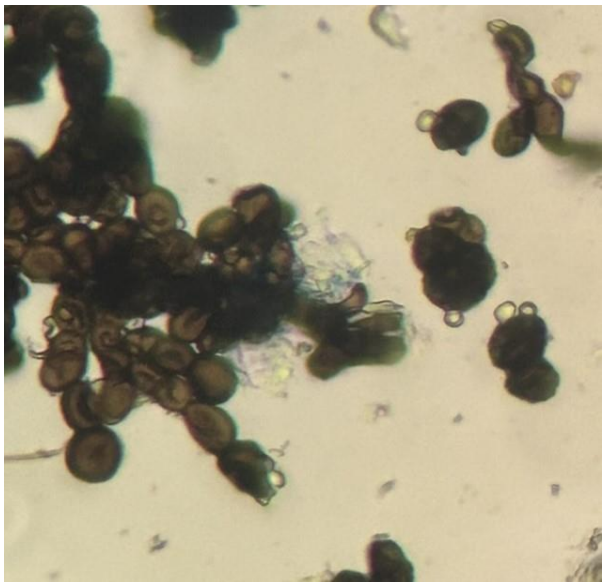


Mold Type:

Cladosporium spp.

Description: Surface sampling from the chronically damp, concrete basement wall revealed pigmented conidia arranged in clusters and short chains, consistent with *Cladosporium*-type mold. The morphology and mineral substrate are not consistent with *Chaetomium*, which produces ascospores within perithecia and is typically associated with cellulose-based building materials.

Upstair Living Room Windowsill

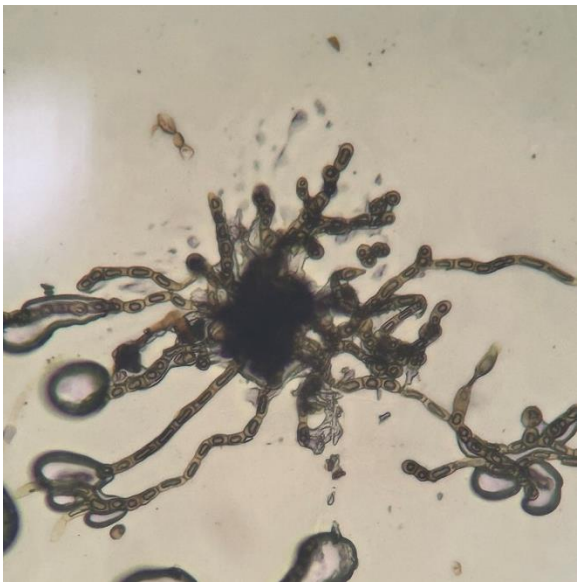


Mold detected:

Chaetomium type

Description: Surface sampling from a chronically damp, cellulose-based building material revealed dark, globose ascospores, morphology consistent with *Chaetomium*-type mold. *Chaetomium* species are commonly associated with persistent moisture conditions and preferentially colonize materials rich in cellulose, such as drywall, paper backing, wood

Basement Storeroom Window

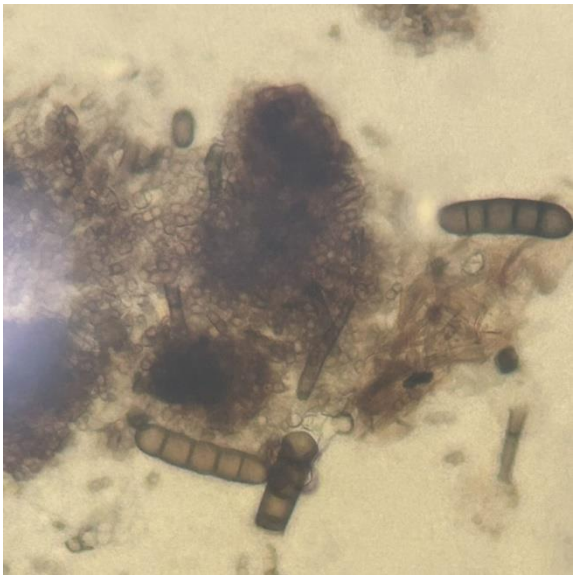


Mold Detected:

Aureobasidium type

Description: Septate Hyphae, dark, irregular hyphal structures consistent with *Aureobasidium*-type mold. *Aureobasidium* is commonly associated with intermittently damp indoor environments and is frequently found on window frames and sills where condensation occurs. This organism readily colonizes smooth or painted surfaces exposed to periodic moisture and temperature fluctuations. Its morphology and growth pattern differ from cellulose-degrading molds

Upstairs Bedroom Window Sill



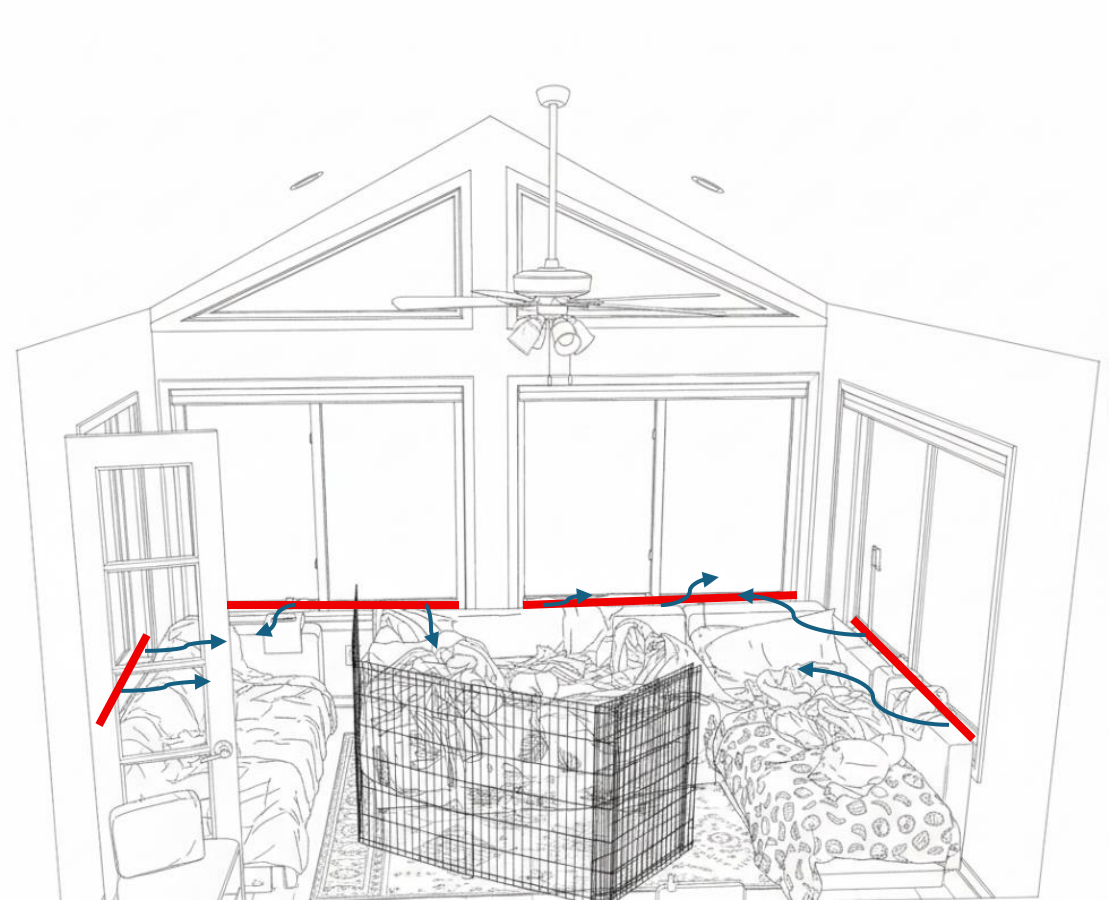
Mold Detected:

Torula & Aspergillus/Penicillium type

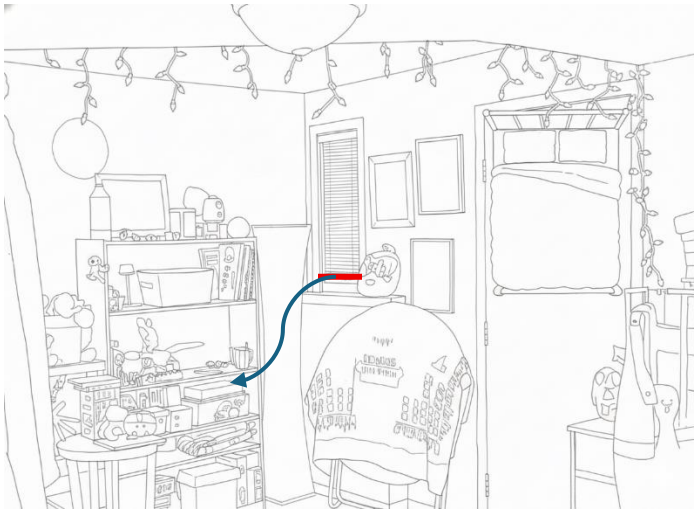
Description: Surface sampling from the window frame revealed dark, pigmented conidia in chains consistent with *Torula* species, along with small hyaline conidia consistent with *Aspergillus/Penicillium*–type molds. *Torula* is commonly associated with intermittently damp conditions, while *Aspergillus/Penicillium*–type molds are ubiquitous and readily grow in the presence of sufficient moisture. Their presence on the window frame is consistent with repeated condensation and elevated localized humidity at the window assembly.

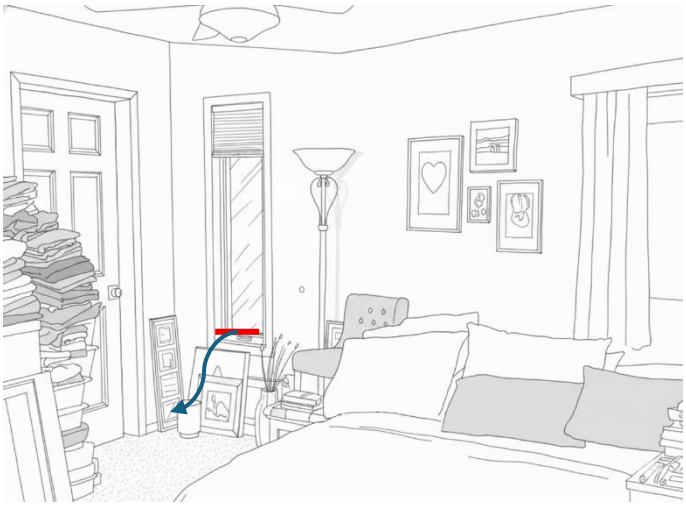
Exposure Modeling: Spore Migration in Occupied Rooms

Though the air samples were negative for elevated spores, this fungal growth shown in red in the picture(s) still is a potent source of mold. Upon the windows drying out the spores will become more prone to aerosolization and become released into the air. We can estimate the amount of mold pores occupants will be exposed to at that time using, Exposure Modeling. **Exposure modeling** is a mathematical method used to calculate the actual "dose" of a contaminant an occupant is breathing by tracking how particles move from a source to a person over time. Rather than relying on a single air test, which only captures a split-second "snapshot" of the room, modeling considers the **size of the growth**, **how much air is moving**, and **how long a person sits near the source**.



Consider these locations at which you spend significant amounts of time in (Living room, bedrooms). The mold, pictured in red in the various rooms represents a continuous source of mold. Though some of these spores travel farther than others proximity to these spaces has a large impact of exposure risk.





1. The Spore Shedding Equation (or Source Generation Rate, G)

Is used to quantify the strength of a mold source. It calculates the total number of spores released into the air from a contaminated surface per unit of time.

The generation rate (G) is the product of the colonized surface area and the spore flux:

$$G = A \times J$$

Where:

- G = Source Generation Rate (spores per second, spores/s)
- A = Total Surface Area of the mold growth (m^2)
- J = Spore Flux (the number of spores released per square meter per second, $\text{spores/m}^2\text{/s}$)

For the area within the living room the total spore exposure is:

Final Generation Rate (G):

$$G = 0.0387\ \text{m}^2 \times 1,000\ \text{spores/m}^2\text{/s}$$

$$G = 38.7\ \text{spores/s}$$

To find the hourly release, we multiply the per-second rate by $3,600$ (the number of seconds in one hour):

- **Low-End Estimate:** $69,840\ \text{spores/hour}$
- **High-End Estimate:** $139,320\ \text{spores/hour}$

Under passive, undisturbed conditions, this strip of growth is releasing approximately $70,000$ **to** $140,000$ **spores every hour** into the surrounding air.

If the area is disturbed by a draft or physical contact, these numbers can increase significantly, as physical disturbance can release the "hourly" volume of spores in a matter of seconds.

To determine whether spores present on the window sill are likely to be released into the occupants' breathing zone, several exposure and transport models are considered to evaluate potential risk. These models account for factors such as spore size and settling velocity, air movement within the room, proximity of the source to occupied areas, and the duration of occupant exposure. This approach helps assess whether spores from localized surface growth could reasonably become airborne and contribute to inhalation exposure.

2. Settling Velocity (V_s)

We determine how long these spores stay airborne. If they stay aloft longer than it takes to travel 5 feet, the occupant is at risk.

Using Stokes' Law:

- V_s **(Settling Velocity)**
- g **(Gravity)**
- d **(Particle Diameter)**
- ρ_p **(Particle Density)**
- ρ_f **(Fluid/Air Density)**
- η **(Air Viscosity)**

$$V_s = \frac{gd^2(\rho_p - \rho_f)}{18\eta}$$

Report Note: Species have e low settling velocities. In an indoor environment with standard air mixing, these spores are considered "neutrally buoyant" and will drift horizontally before they ever hit the floor.

- **Cladosporium:** $V_s \approx 0.0011 \text{ m/s}$
- **Aureobasidium:** $V_s \approx 0.0018 \text{ m/s}$
- **Chaetomium:** $V_s \approx 0.0035 \text{ m/s}$

3. Transport Time to Occupant (*t*)

We calculate the time it takes for a spore to move from the window to the client's breathing zone based on a conservative indoor air velocity of **0.05 m/s** (a very slight, barely perceptible draft).

$$t = \frac{\text{Distance (D)}}{\text{Air Velocity (V)}}$$

- **At 3 feet (0.91m):** $t = \frac{0.91 \text{ m}}{0.05 \text{ m/s}} = \mathbf{18.2}$ seconds
- **At 5 feet (1.52m):** $t = \frac{1.52 \text{ m}}{0.05 \text{ m/s}} = \mathbf{30.4}$ seconds

Conclusion: It takes less than 31 seconds for spores released at the window to reach the client.

4. The Two-Zone (NF/FF) Exposure Model

We use this to show the concentration of spores in the client's "personal bubble" (Near-Field) versus the rest of the room (Far-Field).

The concentration in the client's breathing zone (C_{NF}) is calculated by:

$$C_{NF} = C_{FF} + \frac{G}{\beta}$$

- G **(Generation Rate):** The number of spores shed from the window mold.
- β **(Air Exchange):** The rate at which air moves between the window and the client.

Interpretation for Client:

Because the occupant is sitting within 5 feet of the source, they are effectively inside the **Near-Field**. The (G/β) term shows that the client is breathing a much higher concentration of spores than someone standing on the other side of the room. The air at the window is directly "short-circuiting" into the client's breathing zone.

Exposure Modelling Summary

In the world of indoor air quality, a "high" concentration is generally defined as anything that significantly exceeds the natural levels found outdoors. While outdoor levels vary by season, indoor concentrations over 5,000 to 10,000 spores per cubic meter are typically considered elevated and potentially problematic.

Because the mold growth in this specific room spans a 20-foot perimeter, you are essentially "encased" by the source. This creates a unique hazard: no matter where you sit, you are likely within the **Near-Field** of at least one section of growth. This proximity amplifies the number of spores you encounter because the "plume" doesn't have time to thin out before you breathe it in.

With levels near the window sills reaching approximately **19,000 spores per cubic meter**, the air quality is well within the range that triggers mold allergies, headaches, and respiratory distress. This data aligns directly with the "allergy-like" symptoms reported by the occupants; they are quite literally sitting at the heart of the release zone where the spore count is at its most concentrated. It should be noted that some of these spores tend to be "stickier" and may clump together causing larger masses that have a much lower generation rate.

The bedroom rates are much lower as the distance is greater and the amount of mold growth is much less. Though having these area of mold growth within a structure can raise the overall mold burden within the overall air quality.

Professional Inspection Summary

Based on the recent inspection, the property is in generally good condition regarding overall mold levels; however, specific localized issues—primarily centered around the window units—require strategic attention to maintain a healthy indoor environment.

1. Mold Assessment & Air Quality Analysis

The primary concern at this property is the visible mold growth localized to the window frames. While the air samples returned clean results, these findings require careful interpretation:

- Environmental Factors: At the time of testing, the windows were encased or frozen in ice. When mold is frozen, wet, or "sticky," it does not aerosolize (release particles) into the air, as the organisms typically go dormant in these conditions.
- Exposure Analysis: Our analysis suggests that once these areas dry out or thaw, the capacity for spore release increases significantly. This "theoretical" elevation in the living room aligns with the occupants' reports of allergy-type symptoms in that specific area.
- Microbial Profile: The species identified: *Aureobasidium*, *Chaetomium*, and *Cladosporium*, Torula, and Aspergillus/Penicillium are common indoor molds known to release allergens that can affect sensitive individuals.

  Remediation: Client is having windows cleaned and follow up cleaning will be performed when the windows thaw out. The mold located in the north basement store room floor may be cleaned with detergent while using using PPE. The area is under 10ft^2 and does not meet requirements for professional remediation. This is also the case for the mold present under the toilet reservoir lid in the upstairs ½ bath.

2. Remediation Recommendations: Windows

To resolve the root cause of the moisture buildup and subsequent mold, I recommend the following:

- Replacement: The client's plan to replace the windows within the next two years is the correct long-term solution. In the short term windows should be cleaned and kept as dry as possible.
- Material Selection: I strongly advise against aluminum-cladded units, as they are prone to thermal bridging and condensation. Instead, opt for composite or fiberglass frames. These materials offer superior thermal resistance and durability, significantly reducing the likelihood of future mold growth.

3. Attic & Structural Observations

While the house does not show a "high moldiness" index outside of the window perimeters, the attic space requires professional attention:

- Insulation & Rodent Activity: Evidence of rodent issues was noted. I recommend a pest controller to assess the extent of the activity and the integrity of the insulation.
- Roofing & Attic Components:
    - Saturated Board: A saturated board was identified in the attic; this must be addressed concurrently with the upcoming roof replacement.
    - Cardboard Baffles: The current cardboard baffles are susceptible to degradation and mold. It is highly recommended to replace these with more durable materials (such as plastic or foam) when the roof is serviced to ensure proper ventilation and prevent future microbial growth.

Conclusion

Overall, the localized window issues are the most concerning for addressing overall moldiness in the environment. Addressing the attic contaminants during the next phases of home maintenance will also be useful to maintaining normal conditions.

David Meier
MD Mold

Exterior Inspection Protocol

Roof and Drainage Components • Roof surface condition • Flashing at roof penetrations, chimneys, and sidewalls • Valley flashing and roof-to-wall transitions • Gutter and downspout condition and discharge direction	**Walls and Building Envelope** • Siding condition and penetrations • Holes, gaps, or deteriorated siding materials • Window and door flashing and sealant integrity • Caulking failures or open joints
Foundation and Grade • Proper grading away from the foundation • Foundation cracks or moisture staining • Exterior water pooling or poor drainage conditions	**Other Exterior Observations** • Hose bibs and exterior plumbing penetrations • Vent terminations (bath, kitchen, dryer) • Deck attachments and ledger board flashing • Evidence of exterior water intrusion pathways

Interior Inspection Protocol

Bathrooms • Sink cabinetry and plumbing connections (supply lines, drain, P-trap) • Shower and tub enclosures, surrounds, and caulking • Shower valves, fixtures, and drain areas • Toilet base, supply line, tank, and surrounding flooring • Bathroom ceilings, walls, and corners • Window frames and sills (if present) • Bathroom ventilation fans and discharge adequacy	**Kitchen** • Sink base cabinet and plumbing connections • Dishwasher supply line, drain line, and surrounding cabinetry • Refrigerator water line (if applicable) • Range hood, microwave hood, and exhaust pathway • Walls and flooring adjacent to sinks and appliances • Cabinet interiors and toe-kick areas
Windows and Doors • All interior window frames, sills, and stools • Wall surfaces directly below windows • Exterior wall penetrations visible from interior • Door thresholds and adjacent flooring	**HVAC System and Mechanical Areas** • Air handler cabinet and interior components • Evaporator coil area and condensate pan • Condensate drain lines and discharge points • Supply and return plenum interiors (where visible) • Visible ductwork and insulation
Living Areas, Bedrooms, and Common Spaces • Exterior perimeter walls • Ceilings below bathrooms, kitchens, or roof assemblies • Floor surfaces adjacent to exterior walls • Carpeted areas with staining or odor concerns • Baseboards and wall-to-floor transitions	**Basement, Crawlspace, and Slab-On-Grade Areas (if applicable)** • Foundation walls and slab surfaces • Sill plates and rim joists • Exposed framing and sheathing • Lumber in direct contact with concrete or masonry • Insulation and vapor barriers • Sump pump areas and floor drains
Other Interior Locations • Laundry areas and washing machine connections • Utility rooms and water heater locations • Attic access points and scuttle openings	• Behind accessible drop ceilings or false ceilings • Storage areas and closets • Visible plumbing penetrations and supply/return lines

Common Indoor Molds: Identification & Characteristics

Indoor mold contamination is a widespread issue affecting residential and commercial buildings worldwide. Understanding the most commonly encountered species is essential for proper remediation and health risk assessment.

Rank	Mold Type	Percentage In Homes	Characteristics
1	Cladosporium spp.	70%–90%	Olive-green to black colonies; commonly found both indoors and outdoors
2	Penicillium spp.	60%–90	Blue-green colonies; produces musty odors; rapid growth on organic materials
3	Aspergillus spp.	50%–70%	Variable colors; some species produce mycotoxins; opportunistic pathogen
4	Alternaria spp.	30%–40%	Dark brown to black; chain-like spore formation; strong allergen
5	Stachybotrys chartarum	20%–40%	Black, slimy texture; produces mycotoxins; requires sustained moisture
6	Chaetomium spp.	5%–17%	Cotton-like white growth turning gray-brown; cellulose degrader
7	Aureobasidium pullulans	3%–13%	Pink to black colonies; common on painted surfaces and window frames
8	Fusarium spp.	5%–15%	Pink, white, or red colonies; grows in very wet conditions
9	Trichoderma spp.	~5%	Green-white colonies; fast-growing; enzyme producer
10	Mucor spp.	5%–10%	White to gray fluffy growth; fast-growing; prefers high moisture

The 5 Most Allergenic Common Indoor Molds

Allergenic molds trigger immune responses in sensitive individuals, ranging from mild respiratory irritation to severe asthmatic reactions. These species are recognized as significant indoor allergens:

Species	Allergen Type	Allergic Manifestations	Prevalence
Alternaria alternata	Alt a 1 (major allergen)	Asthma attacks, allergic rhinitis, hypersensitivity pneumonitis, severe respiratory distress	Very High
Cladosporium herbarum	Cla h allergen series	Allergic rhinitis, asthma exacerbation, chronic sinusitis, conjunctivitis	Very High
Aspergillus fumigatus	Asp f allergen series	Allergic bronchopulmonary aspergillosis (ABPA), asthma, allergic sinusitis	High
Penicillium chrysogenum	Pen ch allergen series	Respiratory allergies, occupational asthma, hypersensitivity reactions	High
Epicoccum nigrum	Epi n allergen proteins	Hay fever, asthma, allergic conjunctivitis, dermatitis	Moderate-High

Allergic Sensitivity Note: Individual sensitivity to mold allergens varies greatly. Approximately 10-20% of the general population exhibits some degree of mold sensitivity, with higher rates among individuals with asthma or other allergic conditions. Children, elderly individuals, and immunocompromised persons are at elevated risk.

The 5 Most Common Indoor Mycotoxin Molds

While many indoor molds are primarily known for triggering hay fever or asthma, certain "toxigenic" species pose a more significant threat by producing mycotoxins. These secondary metabolites are toxic chemical compounds released by the fungi into the air via spores onto surfaces. Often as a defense mechanism or a byproduct of growth on water-damaged building materials like drywall and insulation. Unlike simple allergens, mycotoxins can cause systemic health issues through inhalation or skin contact, ranging from chronic fatigue and "brain fog" to severe respiratory distress and even long-term organ damage.

Species	Primary Mycotoxins	Health Effects	Risk Level
Stachybotrys chartarum	Satratoxins, trichothecenes	Respiratory distress, immune suppression, neurological effects, pulmonary hemorrhage in infants	HIGH
Aspergillus flavus	Aflatoxins	Liver damage, carcinogenic, immunosuppressive; aflatoxins are potent hepatotoxins	HIGH
Aspergillus fumigatus	Gliotoxin, fumitoxins	Invasive aspergillosis in immunocompromised individuals, allergic reactions, asthma exacerbation	HIGH
Fusarium spp.	Fumonisins, trichothecenes	Gastrointestinal distress, dermal infections, immune dysfunction, neural tube defects	HIGH
Penicillium crustosum	Penitrem A, roquefortine	Neurotoxic effects, tremors, kidney damage, potential carcinogenicity	MODERATE-HIGH

Important Health Advisory: Mycotoxin exposure typically requires direct contact, ingestion, or prolonged exposure to high concentrations. While these species can produce mycotoxins, their presence does not automatically indicate toxic exposure. Professional assessment and remediation are recommended when these species are detected in significant quantities.

Reputable Authorities on Mold

Mold and Your Health

Institute of Medicine (National Academies) - Damp Indoor Spaces and Health This comprehensive 2004 report from the National Academies reviewed extensive scientific literature linking indoor dampness and mold to respiratory health effects. The National Academies are independent advisors to the nation on science and medicine. https://nap.nationalacademies.org/catalog/11011/damp-indoor-spaces-and-health

American Academy of Allergy, Asthma & Immunology (AAAAI) - Mold Allergy Information The AAAAI is the largest professional medical organization dedicated to allergy and immunology. Their resources explain how mold affects individuals with allergies and respiratory conditions. https://www.aaaai.org/conditions-treatments/allergies/mold-allergy

National Institute for Occupational Safety and Health (NIOSH) - Preventing Occupational Respiratory Disease from Exposures Caused by Dampness in Office Buildings NIOSH is the U.S. federal agency responsible for research on workplace health and safety. Their guidance addresses mold-related health issues in occupational settings. https://www.epa.gov/mold/niosh-guidance-preventing-occupational-respiratory-disease-exposures-caused-dampness-office

Indoor Mold

World Health Organization (WHO) - Guidelines for Indoor Air Quality: Dampness and Mould The WHO provides comprehensive international guidelines on the health risks of dampness and mold in buildings. This organization sets global public health standards based on systematic reviews of scientific evidence. https://www.who.int/publications/i/item/9789289041683

U.S. Environmental Protection Agency (EPA) - A Brief Guide to Mold, Moisture, and Your Home The EPA is the primary U.S. federal agency responsible for environmental health protection. Their mold guidance covers identification, prevention, and remediation in residential settings. https://www.epa.gov/mold

Centers for Disease Control and Prevention (CDC) - Basic Facts about Mold and Dampness The CDC is the leading U.S. public health institute. Their mold resources provide evidence-based information on exposure risks and protective measures for the general public. https://www.cdc.gov/mold-health/about/index.html

The Science of Mold

American Industrial Hygiene Association (AIHA) - Recognition, Evaluation, and Control of Indoor Mold The AIHA is the premier professional association for industrial hygienists and environmental health scientists. They publish technical guidance on mold assessment methodologies. https://www.aiha.org/

Journal of Allergy and Clinical Immunology - Multiple peer-reviewed studies on fungal allergens This is the leading academic journal in allergy research, published by the American Academy of Allergy, Asthma & Immunology. It contains rigorous scientific studies on mold immunology and health effects. https://www.jacionline.org/

Indoor Air (Journal) - International peer-reviewed research on indoor air quality This scientific journal publishes research specifically focused on indoor environmental quality, including extensive studies on mold ecology, exposure assessment, and health impacts. https://onlinelibrary.wiley.com/journal/16000668

American Society of Microbiology (ASM) - Fungal biology and mycology resources The ASM is the oldest and largest life science membership organization. Their mycology division provides scientific resources on mold biology, growth mechanisms, and environmental factors. https://asm.org/

Disclaimer

The results reported herein pertain only to the samples received and analyzed by the laboratory and are representative solely of conditions at the time and locations of sample collection. Sample results shall not be construed to represent conditions at other locations or times.

This report is intended for environmental assessment and informational purposes only. The laboratory does not make determinations regarding habitability, building safety, regulatory compliance, or health risk, nor does this report constitute a medical evaluation or diagnosis. No federal or State of Wisconsin exposure or action limits have been established for mold or mold spores.

Analytical results are dependent upon the integrity of the samples as received and the information provided on the associated chain of custody. The laboratory assumes no responsibility for sampling methods, sample representativeness, or interpretations made by others based on these data.

Interpretation of these results should be performed by qualified professionals experienced in indoor air quality, microbiology, and building science. This report does not constitute remediation verification, clearance testing, or confirmation of mold absence unless explicitly stated.

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More Information on Cladosporium Molds

Cladosporium is a large genus of dematiaceous (darkly pigmented) filamentous fungi within the phylum *Ascomycota* and is one of the most frequently detected molds in both outdoor and indoor air worldwide. The dark pigmentation of *Cladosporium* spores is due to melanin in the cell walls, which provides increased resistance to ultraviolet radiation, temperature fluctuations, and desiccation. As a result, *Cladosporium* spores are ubiquitous in outdoor air and commonly infiltrate indoor environments through normal air exchange, making them a frequent component of background indoor air samples.

From a building science perspective, *Cladosporium* species are considered moderately hydrophilic but highly tolerant of fluctuating moisture conditions, particularly condensation and intermittent wetting. They readily colonize surfaces such as concrete, masonry, painted and unpainted surfaces, window frames, insulation facings, HVAC components, and other areas prone to surface moisture accumulation. Unlike molds that require sustained saturation, *Cladosporium* can grow under conditions of elevated relative humidity and repeated condensation cycles, which makes it common in basements, along exterior walls, and near thermal bridges. Growth often occurs directly on mineral substrates or on minimal organic residues such as settled dust and biofilms.

Health effects associated with *Cladosporium* exposure are primarily allergenic and inflammatory in nature. *Cladosporium* is a well-recognized source of airborne allergens and has been strongly associated with allergic rhinitis, asthma symptoms, wheezing, and hypersensitivity reactions in sensitized individuals. Epidemiological studies have shown correlations between elevated *Cladosporium* spore levels and increased asthma severity and frequency of respiratory symptoms, particularly in children and individuals with pre-existing respiratory conditions. Due to its widespread presence and high spore production, *Cladosporium* is often considered a clinically relevant aeroallergen.

While *Cladosporium* species are capable of producing secondary metabolites, they are not generally regarded as major mycotoxin producers in residential indoor environments when compared to certain other mold genera. Health impacts attributed to *Cladosporium* exposure are therefore primarily related to allergenic, irritant, and inflammatory pathways, rather than toxigenic mechanisms. Opportunistic infections involving *Cladosporium* are rare and typically limited to individuals with severe immune compromise or traumatic implantation, and are not considered a common residential exposure concern.

In indoor air quality assessments, *Cladosporium* is often used as a baseline comparison mold due to its strong outdoor association. Indoor concentrations are typically expected to be similar to or lower than outdoor levels. When elevated indoor levels are observed, or when surface growth is documented indoors, this is commonly interpreted as an indicator of moisture-related conditions or condensation issues, rather than extensive hidden fungal amplification. Scientific consensus emphasizes that controlling moisture sources and correcting condensation conditions are the primary measures for preventing *Cladosporium* growth, with remediation efforts focused on surface cleaning and long-term moisture management.

More Information on Chaetomium Molds

Chaetomium is a common genus of filamentous fungi in the phylum Ascomycota. While ubiquitous in nature as a soil-dwelling fungus, its presence in the indoor environment is highly significant. *Chaetomium* is a dematiaceous (darkly pigmented) fungus, often appearing olive, brown, or black, and is renowned in building science as a primary indicator of **chronic water damage** and cellulose degradation.

From a building science perspective, *Chaetomium* species are considered **strongly hydrophilic**, meaning they require high water activity ($a_w > 0.90$) to germinate and grow. Unlike molds that can survive on mere humidity, *Chaetomium* typically requires liquid water or material saturation. It is a cellulolytic fungus, meaning it specializes in breaking down cellulose-rich materials. It is most frequently found colonizing water-saturated drywall (paper facing), wood, wallpaper, and particularly **cardboard baffles** or organic insulation components in attics. Due to its "sticky" spore characteristics and relatively large size, *Chaetomium* spores do not remain airborne as easily as *Cladosporium*. Therefore, their detection in indoor air samples even at low concentrations is often interpreted as an indicator of a nearby, active, or disturbed fungal reservoir resulting from long-term moisture intrusion.

Health effects associated with *Chaetomium* exposure are largely centered on allergenic and inflammatory responses. It is a recognized allergen that can provoke symptoms of allergic rhinitis, asthma, and sneezing. Because the spores are relatively large and often coated in a mucosal substance, they can be particularly irritating to the upper respiratory tract. While most residents experience standard allergy-type symptoms, individuals with heightened sensitivity or compromised respiratory systems may experience more pronounced distress when *Chaetomium* colonies are disturbed and spores become airborne.

In terms of toxigenic potential, *Chaetomium* is known to produce secondary metabolites, including **chaetoglobosins**. While these are potent mycotoxins in a laboratory setting, the primary health concern in residential environments remains the allergenic and irritant pathways. Similar to *Cladosporium*, opportunistic infections (phaeohyphomycosis) are extremely rare and generally limited to severely immunocompromised individuals, rather than the average occupant.

In indoor air quality assessments, the presence of *Chaetomium* is never considered "normal" background flora in the same way *Cladosporium* might be. It serves as a diagnostic "red flag" for **material saturation**. Scientific consensus emphasizes that because *Chaetomium* aggressively digests the substrate it grows on, remediation usually requires more than just surface cleaning; it typically necessitates the removal and replacement of the affected porous materials (such as the saturated boards and cardboard baffles found in your attic) and the absolute correction of the moisture source.