Best Practices of Microbial Growth (commonly referred to as mold) Response in a University Setting

Mary Beth Koza, MBA

Kim Haley, MS, CIH

Dave Catalano

Taylor J Moore, MPH

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Purpose

To provide the University of North Carolina at Chapel Hill a literature review of the best practices of microbial growth [1](commonly referred to as mold) identification and response as of summer 2019. In 2018, a graduate student from the UNC School of Public Health conducted a review of UNC EHS's mold response and comparing the practices to those of other institutions and government recommendations. See Appendix 1. This report reviews that work and demonstrates the implementations of the recommendations.

[1]The term "microbial growth" can refer to growth from bacteria, fungi (mold), algae, protozoa, or virus. We use this term for mold since in a university setting microbial growth often presents in the form of mold.

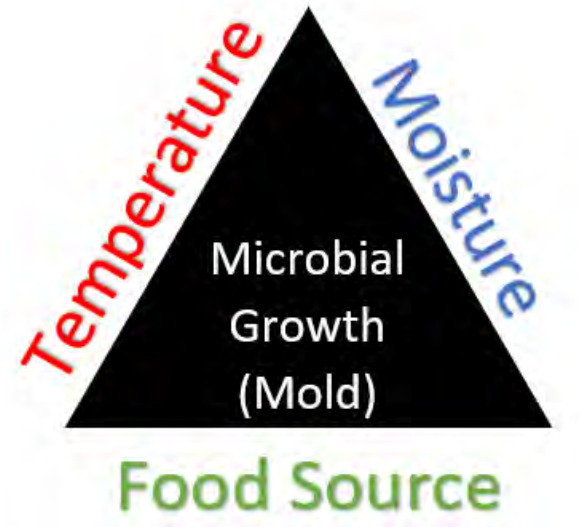
Introduction

What is microbial growth (commonly referred to as mold)?

Microbial growth can present in the form of a fungus, these can be found all year round, both indoors and outdoors. Mold spores live in soil, on plants, and on dead or decaying matter. Microbial growth indoors occurs when there is high humidity or moisture, low sunlight, oxygen, the right temperature, and organic matter present. Similar to a fire triangle, when you eliminate one or more of these conditions it can be difficult or impossible for growth to occur. Most fungi reproduce by releasing spores that can easily spread through the air. If these spores land on a suitable growth surface (e.g. wood, porous material, or another medium) a colony can grow.

Aspergillus parasiticus a common mold found indoors and outdoors

Molds reproduce by creating spores that travel through the air and land on substances to grow. Since microbial growth can be found everywhere, and it is constantly reproducing, all of us are exposed from the air we breathe, both indoors and outdoors, daily. Microbial growth is ubiquitous in our environment. Depending on a building's age, size, construction, design, and condition it could be more prone to microbial growth than another building. Growth can occur on building material in as little as 24 to 48 hours.



Microbial Growth Triangle

Spores in the air cannot be seen by the naked eye but when colonies begin to grow, they can become visible and can exhibit a wide variety of characteristics and colors. Microbial Growth can be seen as green, black, yellow, orange, brown, or other variations of colors and can often be found growing on the underside of areas that have been infiltrated.

Why is this a problem?

Microbial growth can adversely affect humans in three ways:

1. As an allergen
2. An infection
3. Toxic reactions

Even though microbial growth is a natural part of the environment some people can be allergic. Individuals can be allergic to one type of microbial growth and not allergic to another, and those who are asthmatic can have symptoms aggravated with elevated exposure to microbial growth.

Disease related symptoms can present in the form of a fungal infection. Generally, the people most susceptible to these types of infections are those who have an underlying condition, are immunocompromised, elderly, young, or are pregnant.

Microbial growths/molds also produce mycotoxins which may be dangerous to human health and cause disease. In OSHA's Preventing Mold-Related Problems in the Indoor Workplace (2006) they describe mycotoxins as metabolic by-products produced by some molds that can cause toxic reactions in humans or animals. Although the relationship is controversial, some news outlets and the media may incorrectly use the terms "toxic mold" or "black mold" implying these molds are more dangerous than others.[2] Several types of microbial growths/mold can produce mycotoxins although the specificity in the literature is minimal, and epidemiological studies intended to determine causation are limited.[3] However, with the limited science available it is expected that microbial growths have the ability to produce mycotoxins that could cause both acute and chronic symptoms.

Issues facing the response to microbial growth

There are several concerns when tackling how to respond to microbial growth. The three main concerns are:

- There are no regulatory standards from EPA, OSHA or CDC when responding to microbial growth/mold. OSHA does state[4] that "All places of employment shall be kept clean to the extent that the nature of the work allows."
- There is high variability on responses taken to address microbial growth concerns and there is no standardized approach.
- As buildings get older microbial growth may find it easier to grow, due to deteriorating HVAC equipment and structural systems such as roofing materials, foundations building envelope failures. Areas with high humidity are at even higher susceptibility because having increased moisture in the air provides a more suitable environment for growth.

Old East built in 1793 the first state university building

[2] (OSHA, 2006)
[3] (Bennett, W., & Klich, 2003)
[4] 29 CFR 1910.141(a)(3)(i)

Best Practices

There are several guidance documents, microbial growth/mold response procedures, and journals that are available to address response. The guidance documents evaluated are listed below.

1. AIHA – Facts About Mold (2001)
2. OSHA – Preventing Mold-Related Problems in the Indoor Workplace (2006)
3. AIHA – "Green Book" Recognition Evaluation, and Control of Indoor Mold (2008)
4. EPA – Mold Remediation in Schools and Commercial Buildings (2008)
5. NYC DOHMH – Guidelines on assessment and remediation of fungi in indoor environments (2008)
6. WHO – Guidelines for Responding to Indoor Air Quality: Dampness and Mold (2009)
7. ANSI/IICRC – S520 Standard for Professional Mold Remediation (2015)
8. ASHRAE – Position Document on Limiting Indoor Mold and Dampness in Buildings (2018)
9. CDC/NIOSH – Dampness and Mold Assessment Tool for School Buildings (2018)

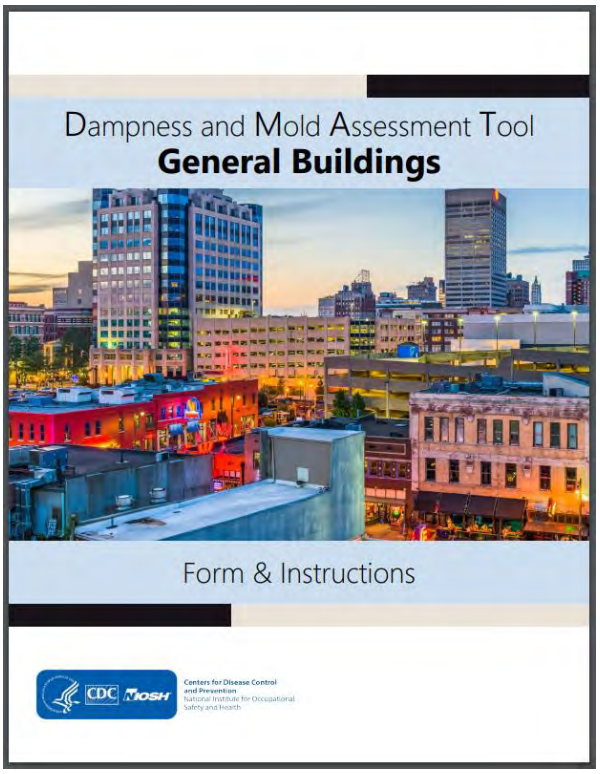
The best practice section will pull areas of consensus from these documents.

Recognition and Evaluation

Before making decisions on how to treat microbial growth/mold within a building you first need to determine the extent of the infiltration. This is accomplished through visual inspection, identification of the cause, correction of the cause and then, if needed, sampling as a last resort.

Visual inspection process

A walkthrough of a suspected area is the first step in evaluation and recognition of the cause. During this process an evaluator will look for sources of biological agents, assess dampness of the area(s), and physical growth. A flashlight and a mirror can be essential to the evaluation of these areas especially ones that have low light



and are hard to see. It is suggested to use a moisture meter, infrared camera, a borescope, or other investigative tools to assist in the walkthrough.

CDC/NIOSH has developed a "Dampness and Mold Assessment Tool"[5] for school buildings and general buildings. This tool was created in 2018 and was developed to help prioritize remediation of problem areas. The tool uses a scoring index for assessment based on visual identification, subjective smell of microbial growth and dampness, and gives guidelines on when to initiate repairs and remediation. Since the tool is so new it is not referenced in older publications but it provides clear guidance as well as the best responses building owners can provide to address issues.

[5] (NIOSH, 2018)

If to Sample

Federal, state, and local agencies as well as AIHA indicate sampling for microbial growth/ mold is not recommended when responding to complaints from building occupants. Specifically, Prezant says in the AIHA Green Book: "*Existing guidance documents do not endorse routine sampling during assessment to comprehensively determine mold types present, as this might exhaust resources that could be more effectively used to remediate the problem.*"[6]

If visible microbial growth/mold is found, the recommendation is to remediate it; further characterization of the mold is not necessary to initiate a remediation plan.

OSHA and EPA have no regulations for the level of microbial growth/mold, which is allowed in the air, so air sampling alone does not provide the data to make an informed decision. The closest thing to a regulation falls under 29 CFR 1910.141(a)(3)(i) which states "All places of employment shall be kept clean to the extent that the nature of the work allows." The ambiguity of this allows for judgement from institutions but also from OSHA when addressing concerns.

Air sampling is also costly, samples run between $30-150 each, plus there is a requirement for field blanks, lab blanks, and indoor and outdoor controls. Sampling also only provides a snapshot in time and may not accurately represent microbial growth. Even with a good sampling plan, results can be difficult to interpret for non-professionals. Virtually all sampling will reveal microbial growth even if there is not active growth in an area since it is ubiquitous in our environment.

When to sample\who can sample

There are instances where sampling may be used during a mold response to identify a hidden mold source within walls or HVAC systems.

If a decision is made to sample, a sampling plan, with clear goals, to be carried out by a trained professional working with a microbiology lab is essential. There is no current certification or credentials that are specific for inspecting microbial growth/mold, however, OSHA states that occupational safety and health professionals are typically able to. Eliot Horner describes that microbial growth/mold inspectors should "*recognize the boundary between the environmental assessment of a building and medical diagnosis; that is, the discovery of mold growth in a building does not always explain occupants' symptoms.*"[7] Pre-existing conditions, high ultrafine particles, and many various other factors can contribute or be the primary reason for symptomatic occupants.

What to sample, Air Sampling vs Surface Sampling

In scenarios where sampling was deemed necessary, there are two ways to proceed. Air samples or surface sampling can be taken of building material and building contents.

When choosing to air sample, samples are taken from the problem area, from a known "clean area," as well as at least two and up to 10% of total samples from outside the building. At each location it is recommended to take two culture based and two spore trap samples simultaneously. Because results are highly susceptible to variability, ideal conditions are those which are closed off from the outside air and have not been unusually cleaned recently (especially in the last 24 hours).

Surface sampling can be used to determine the presence of microbial growth/molds on contents

[6] (Prezant, 2008)

[7] (Horner, Barnes, Codina, & Levetin, 2008)

that are not visible to the naked eye. When sampling a surface, it is recommended to perform (1) control sampling of similar materials, (2) collection of a "sufficient number" of surface samples of the same kind of item, (3) sample items after they have been cleaned.

Control

Once you have identified that microbial growth/mold exists in an area there are recommended ways to control the growth.

Decision processes

Categorizing and evaluating the contents of the contaminated material is the first step in remediation. Depending on the type of the material different cleaning methods can apply. For example, if building material in need of remediation is identified as having a regulated material, like lead or asbestos, specific regulations need to be followed and will take priority. If the material is porous and the microbial growth/mold has penetrated beyond the ability to be remediated, then the material will need to be replaced so further deterioration does not occur.

The extent to which the area has been contaminated, as well as the size of the area, are factors in remediation strategies.

OSHA splits remediation strategies into three size categories:

1. <30 ft.^{2} (Small areas)
2. 30-100 ft.^{2} (Large areas)
3. >100 ft.^{2} (Extensive and visible mold contamination)

Other publications have similar guidelines that categorize the extent of the contamination based off its square footage, as well as, growth conditions of (1) normal fungal growth (2) settle spores or fungal fragments and (3) actual growth.

Workers Dressed in PPE

Using the size categories and the growth conditions as determining factors, critical barriers and engineering controls including decontamination chambers, negative pressure encapsulations, and air filtration devices can be recommended.

Occupant relocation

Determining if an occupant needs to be relocated is a decision that could have ripple effects and needs to be evaluated carefully. It is recommended that, occupants are moved while remediation occurs, and surrounding occupants are moved for larger areas needing clean up. In terms of whether to move an occupant from an area that requires remediation, before remediation has yet to begin, guidance is a bit unclear. However, the CDC does suggest following health care provider recommendations when deciding to relocate an occupant that has been diagnosed with a sensitivity. OSHA and EPA only mention relocation of occupants during the remediation process and suggests scheduling work during off hours.

PPE to wear

In the guidance documentation[8,9,10,11] workers, who are responsible for remediation or clean up, are recommended to wear personal protective equipment that can include respiratory protection, eye protection, gloves, coveralls, foot protection, head protection, and hearing protection. Workers should also have training related to the size and scale of the cleanup. ANSI/IICRC S520: Standard for Professional Mold Remediation suggests anything from N-95 filtering face piece to SCBA's, all depending on the need to protect against fungal spores, bacterial spores, or chemicals used during clean up. SCBAs are suggested for clean ups that would commence in oxygen deficient environments.

How to remediate

Surface cleaning and demolition are the two primary recommended practices for remediation. Any material that has been penetrated by contamination (e.g. wood or dry wall that has microbial/mold growing throughout) should be discarded or replaced. Any porous material that has a surface where growth can be mechanically stripped or restored using HEPA vacuuming and wiping. ANSI/IICRC S520 goes over specific techniques and methods to minimize aerosolization and maximize cleaning efforts. One method includes ensuring not to spray the surface. If surface cleaning or demolition is not feasible, encapsulation, sealing, or long-term engineering controls are possible but not advised. Material that is non-porous can be restored or cleaned using standard housekeeping products and methods along with the combination of HEPA vacuuming.

Waste from remediation projects can be treated as construction waste assuming it does not contain any other regulated materials (e.g. asbestos, lead, etc.). The use of biocides or antimicrobials are not considered to be an effective form of remediation and can interfere with post remediation surface sampling if applicable. IICRC does note that professional judgement can be used when deciding if to use these products as there may be specific or special circumstances where they can be utilized.

The US EPA identifies 4 methods to remediate mold

Cleanup Methods

- ***Method 1:*** *Wet vacuum (in the case of porous materials, some mold spores/fragments will remain in the material but will not grow if the material is completely dried). Steam cleaning may be an alternative for carpets and some upholstered furniture.*
- ***Method 2:*** *Damp-wipe surfaces with plain water or with water and detergent solution (except wood —use wood floor cleaner); scrub as needed.*
- ***Method 3:*** *High-efficiency particulate air (HEPA) vacuum after the material has been thoroughly dried. Dispose of the contents of the HEPA vacuum in well-sealed plastic bags.*
- ***Method 4:*** *Discard - remove water-damaged materials and seal in plastic bags while inside of containment, if present. Dispose of as normal waste. HEPA vacuum area after it is dried.*

Ideally this should occur within the 24-48 hours after a moisture event.

[8] (OSHA, 2006)
[9] (Prezant, 2008)
[10] (USEPA, 2008)
[11] (IICRC, 2015)

Recent events at other universities surrounding mold response

Other universities across the country have struggled with the issues of microbial growth/mold. These problems have resulted in media and litigation issues. The University of Maryland, Indiana University, and St. Augustine University in North Carolina have had problems during the 2018-2019 school year.

University of Maryland

In the fall of 2018 University of Maryland (UMD) students complained about mold in their dormitories, specifically in Elkton Hall. The school stated that mold issues were exacerbated because of significant rain and humidity in the area. UMD's response to the issue was to temporarily relocate the students in the hall to hotels while the rooms were cleaned. Sandow Construction Inc. (Sandow) and Infinity Restoration Inc. (Infinity) were used as remediation contractors for the building and WL Gary Companies, Inc. was used to assess the cleaning of the fan coil units in the building.

Elkton Hall is eight stories and houses approximately 555 residents, most of which are freshmen. The students stayed in the Cambria Hotel, The Hotel at the University of Maryland, and the College Park Marriott from Sunday, September 23rd to Wednesday October 10th, a total of two and a half weeks.

Elkton Hall 1

While the incident was occurring UMD provided a FAQ to students explaining the issues and what the University was doing to remediate the situation. The FAQ states: [12]

Once students temporarily vacate each floor, remediation will be completed by mold remediation specialists contracted by the University. Actions will include:

- *Inspection and review of building mechanical systems*
- *Cleaning all room surfaces including walls, floors, doors, and closets, and HEPA vacuuming carpets*
- *Servicing and cleaning the fan coil unit (air conditioning unit) in the room, including removing and cleaning the cover, cleaning coils, and changing filters*
- *Cleaning all furniture surfaces, including inside and underneath drawers*
- *Cleaning all surfaces in the hallways and bathrooms, other public areas*
- *Dehumidifiers and additional air filtration will be in place during this process*

To evaluate the incident, determine the root cause, and to determine the effectiveness of the response, the university partnered with two third-party consulting firms Vertex Companies, Inc (VERTEX), and Building Dynamics (BDL), to serve as consultants during the Elkton Hall remediation project. BDL also conducted an engineering study and recommend the best strategy for preventing a future reoccurrence.

VERTEX did a visual inspection of the work being done on floors 1-5 to confirm it was cleaned properly. Floors 6-8 were not observed because

[12] (University of Maryland, 2018)

the cleaning had taken place prior VERTEX being contracted.

If any areas were deemed unsatisfactory VERTEX was responsible to inform the cleaning contractor to re-clean. Once the re-cleaning was done VERTEX would then inspect again until the area was deemed to have been satisfactory. When an area was deemed satisfactory it was certified by an assessor, and this was done for every dormitory on the floors inspected. VERTEX recommended finding the source of the mold and to stop it from growing.

BDL determined[13] *Root cause of mold growth at Elkton is the air-conditioning system's (HVAC) limited capability to control humidity. Because the system was designed to control temperature, but not humidity, indoor RH rose during humid weather to levels exceeding the threshold for growing mold.* Additionally, the building was under negative pressure and unconditioned humid air was pulled into the building further causing the growth. Their most cost-effective recommend solution was to install small dehumidifiers in each room.

In November after the incident a freshman student, Olivia Paregol, passed away when she contracted adenovirus. The news and the parents of Olivia believed the mold outbreak contributed to the student contracting the disease. The CDC, however, indicated that there is no connection between mold exposure and adenovirus.

[13] (BUILDING DYNAMICS, LLC, 2018)

Indiana University

During the fall 2018 semester at Indiana University students within two dormitories, Foster and McNutt, were met with mold throughout their rooms. There were also some mold complaints coming from a third dorm, Teter, but not on the same scale as the other two. Students concerned with their living situation filed 725 requests to inspect rooms for mold leading to 746 areas being remediated.

Student Picture from IU

On October 17th, of the same year, a group of freshman students filed a class action lawsuit against the university stating that the university was not transparent and did not respond to requests addressing mold issues in the dormitories. The lawsuit also alleges the university did not use proper methods to remediate the mold.

To help characterize the extent of growth, IU hired two outside consultants, Safety Management Group and ATC Environmental. Each company used Certified Industrial Hygienists to conducted mold spore sampling in the dormitories. They also utilized EMLab to provide MoldSCOREs to indicate which rooms were considered to have normal levels of mold, the reports were made available to students. Scores ranged from 100-300 and were a summarized report intended to make the mold reports easier to read. A score of 100-150 indicated low probability of indoor mold growth,

151-250 moderate probability, and 251-300 high probability. Throughout the whole process, the University provided frequent updates on their website, multiple times per day in the early stages of the incident, and weekly throughout the rest of the semester.

During remediation efforts several hundred students who complained of symptoms or who reported mold were offered relocation with 82 accepting. All rooms with mold reports were scheduled to be remediated.

The remediation process[14] consisted of Indiana University Facilities Operations or Environmental Health and Safety entering the room allowing crews to prep with partial plastic encapsulations. Then crews would HEPA vacuum exposed areas, including walls, window frames, and piping insulation. The HVAC unit would be cleaned and sanitized. Any items that needed to be replaced because of extensive mold activity, were. The partial encapsulation was then removed, and the room's items were placed back to their original location. If additional items, like the closet or clothing, were found to have mold growth a separate remediation process would commence.

All of the students living in the two dorms were given a $3,000 bursar credit. Additionally, IU offered reimbursement for students' items that were visibly moldy and could not be cleaned or washed.

3,223 Honeywell True HEPA Air Purifiers were installed in Foster and McNutt dorms as well as additional dorms on campus, and each purifier cost about $200. These machines are stated to capture airborne particles .3 microns and larger, including mold spores, pollen and dust, and clean the air in the room up to 12 times per hour. In June 2019 The Chronicle of Higher Education

Honeywell Air Purifier

reported that student indicated shutting off the machines because they were too loud.

The two buildings had been scheduled to be renovated in the coming years however, the mold problems accelerated renovation and is estimated to cost $56 million.

[14] (Indiana University, 2019)

St. Augustine's University

After Hurricane Florence, in the fall of 2018, mold was found at St. Augustine University in the stairwells of Latham Hall. When the University did not respond to the issues, the media got involved. Students submitted pictures and their medical evaluations to the media, evaluations stated symptoms could be as a result of allergies from mold in the dorm rooms.

Stairwell at St. Augustine's University

During the Christmas break the University hired Raleigh Mold Inspection and Remediation to remove the microbial growth off the walls and steps. Students returned to the dorms starting January 4th however, the contractor did not start work until January 11th. The contractor service also used a product called "Bio Barrier" and painted the stairwell in hopes of preventing reoccurrence of the issue.

The University issued a press release in February, weeks after the news reported on the issue several times.

Conclusion and Recommendations

UNC has maintained that it does not sample for mold during building inspections, and will continue to do so, mainly for the following reasons:

1. Governing agencies do not recommend it
2. There are no regulations for acceptable levels in the air
3. Sampling is a snapshot in time and my not accurately represent mold growth
4. Sampling almost always revels mold regardless of surface growth since ubiquitous in our environment.
5. Even with a good sampling plan results can be difficult to interpret for non-professionals

A visual inspection followed by prompt remediation of growth sources seem to be the most effective way to address most situations. Additionally, sampling is not a necessary step to initiate remediation if it is only being used to confirm visible microbial growth/mold.

If sampling is deemed necessary, an experienced professional is needed for interpretation of the results. The evaluator should be able to answer how much, what type of mold, and what to compare it to (e.g. time of day, date, outdoor vs. indoor, etc.).

Response to concerns

UNC will respond to all reports of microbial growth and follow set procedures based off the below chart. JSAs have been created for each level of contamination and are available on the [EHS JSA webpage.]

Level	Remediation Size	Work Area Relocation Required	Adjacent Area Relocation Required
0: Minor Isolated Areas	<5 ft^2	No	No
I: Small Isolated Areas	5-10 ft^2	No*	No*
II: Mid-sized Isolated Areas	10-30 ft^2	Yes	No*
III: Large Isolated Areas	30-100 ft^2	Yes	Yes
IV: Extensive Contamination	100+ ft^2	Yes	No* (work area under full containment)

*Relocation recommended for 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).

Define the mold inspection and evaluation process

When responding to mold complaints at the UNC Chapel Hill an Environment Health and Safety Industrial Hygienist performs a visual inspection as well as assesses dampness of areas using a moisture meter if needed. In summer of 2019 UNC-CH will begin to pilot the "Dampness and Mold Assessment Tool" for school buildings and general buildings from NIOSH to assist with decision making. UNC is developing a Standard

Operating Procedure for Microbial Growth Evaluation and Remediation.

Transparency

UNC-CH strives to be proactive and informative. Complaints of microbial growth from building occupants are taken seriously, and a swift response with open communication is required.

Relocation of occupants

If remediation is going to occur, occupants should be removed and relocated away from the remediation. University Employees & Students who have sensitives or preexisting conditions should seek medical attention from the University Employees Occupational Health Clinic or Campus Health Services. Additionally, individuals can receive reasonable accommodations from the university per UNC's ADA Reasonable Accommodations for Employees, Applicants and Visitors Policy.

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APPENDIX 1 - UNC Mold Response Review

5/2/2018

UNC Mold Response Review

Blake Tyler Fulton

Evaluation Statement of Purpose

I will be evaluating the UNC EHS mold response and comparing the practices to those of other institutions and government recommendations. Upon completion of this review I will recommend a course of action to determine whether or not the procedure is maintained or modified to better reflect best practices.

Introduction to Mold exposure

Discussion on the importance of mold prevention and remediation

The group of fungi known as mold is a diverse group of organisms that grow both indoors and outdoors. These molds release spores as their form of reproduction, and these spores make up part of the common indoor air pollution profile. Often these spores are associated with a few different adverse health effects, including allergic reactions, asthma, infections, and toxin-mediated conditions, especially for sensitive populations[15]. Several of these molds have been known to cause infection in immunocompromised hosts when inhaled or inoculated subcutaneously from environmental sources[16]. On the other hand, there are many individuals that have no response to mold spore exposure, so it becomes difficult to set standards of exposure, as protecting sensitive populations would involve stringent regulations.

As a result, there are different recommended steps to prevent and eliminate mold depending on the location, building owner, institution, etc. but no regulations to enforce. Consequently, many institutions follow a set of guidelines to determine how they deal with mold, and it is in our best interest as a prominent institution of higher learning, to be aligned with other entities in having the most effective and reasonable procedures. It's vital to perform best practices in the most efficient way possible, as sampling and analysis of mold can be costly, and a careless procedure can lead to alarm among the general public. The lack of numerical standards, dose response relationships, and understanding on health effects prevent the creation of quantitative guidelines.

This lack of knowledge combined with the knowledge of health effects often results in concern from the public, which can lead to unnecessary action and waste of resources[17]. Additionally, there is no way to completely eliminate mold, so there will always be discontent if and when mold does grow, especially on college campuses. Regardless, it is the mission of the University of North Carolina at Chapel Hill's Department of Environment, Health & Safety to protect the health of its students and employees to the best of its abilities with a comprehensive program.

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[15] OSHA. (2006). *Preventing Mold Related Problems in the Indoor Workplace A Guide for Building Owners, Managers and Occupants* [PDF]. Retrieved from https://www.osha.gov/Publications/preventing_mold.pdf

[16] US EPA. (2008, September). *Mold Remediation in Schools and Commercial Buildings* (Publication No. EPA 402-K-01-001). Retrieved https://www.epa.gov/sites/production/files/2014-08/documents/moldremediation.pdf

Outline of the current UNC mold response standard operating procedure

The University of North Carolina at Chapel Hill department of Environment, Health & Safety (UNC EHS) provides environmental, health, and safety services to the university community through education, training, and controlling health hazards. The EHS department has provided a document that thoroughly defines the department's approach to monitoring and maintaining healthy indoor air quality available on the department's website under indoor air quality[18]. Currently, mold response, as well as broader indoor air quality, procedure includes interviewing the complainant to determine the nature of their symptoms, and given appropriate cause, a multi-phase investigation of the complaint site. An EHS industrial Hygienist will conduct the investigation via several metrics including ventilation rate, relative humidity, temperature, signs of water intrusion, and more. The program mentions the limitations of air sampling for mold as well as the lack of standards to regulate but doesn't state that this leads to an ineffective or unnecessary technique. After a completed investigation, a report is filed detailing the results and any recommended remedial action to be performed either by the complainant's supervisor or facilities services. A separate internal document provides details on the necessary steps involved in responding to water and moisture intrusion, and this includes moisture monitoring and water cleanup. UNC EHS will work with facilities services to monitor for mold and moisture, as well as communicate and collaborate on remediation processes[19]. Additionally, UNC EHS has an internal document that outlines the responsibilities of residents and staff in preventing mold. This document denotes the "Three C's" as cleaning, climate, and communication with descriptions of how residents should practice preventative measures against mold[20]. An important note is that EHS will follow up after remediation to ensure the effectiveness of the changes, and that given continued difficulty, students are recommended to seek out campus health services for medical evaluation and staff visit the university occupational clinic.

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[17] Arora, A.S. 2003. "Understanding the Health Effects of Mold." Guest Column. The AIH Diplomate, Fall 2003, Issue #03-3, pp. vi – vii Retrieved from https://deepblue.lib.umich.edu/bitstream/handle/2027.42/91924/Paik02.pdf?sequence=1&isAllowed=y

[18] UNC Environment, Health and Safety. (2018). *Indoor Air Quality*. Retrieved from https://ehs.unc.edu/oeh/iaq/

[19] UNC Environment, Health and Safety. (n.d.). *EHS Policy for Moisture Intrusion and Mold Events*. Internal UNC EHS document. Unpublished

[20] UNC Environment, Health and Safety. (n.d.). *Indoor Air Quality and Promoting Healthy Living Conditions in Residence Halls*. Internal UNC EHS document. Unpublished

Environmental Assessment Procedures

Environmental assessment

Environmental assessment involves monitoring the immediate environment for health hazards. These sampling measures can involve visual inspection, air sampling, and surface sampling.

Visual Inspection

This is the most common method of identification of mold growth, and often the most appropriate. Vigilance of areas commonly vulnerable to mold growth with immediate reporting of suspected spots will yield the most effective use of monitoring[21]. It would be most effective to provide training on identifying common forms of mold in order to ensure that employees are not missing obvious sign of mold growth. To have the best chances of catching mold development, it would be useful to specifically encourage or require routine inspection of areas that have either been damaged by water in the past, or can be determined to have a reasonable chance of water damage. Inspecting potentially vulnerable areas after heavy rains, floods, or hurricanes for a few weeks following the events could help to increase the chance of detecting mold growth before it becomes a nuisance to deal with, and before alarming the public.

Environmental Sampling

This is a lesser used option for detecting mold in the workplace, as it requires more analytical power and resources. Though visual analysis is often sufficient, you can do sampling to search for more mold spores if there is concern. This can consist of surface sampling, bulk air sampling, moisture readings, and water condensate sampling to see what the mold proportion is in the air and environment indoors, especially compared to the outdoor environment to test for consistency with normal mold levels[22]. Sampling can be done if there is a reason to be concerned about exposure, for example if people are displaying reactions to mold, or if it's suspected that there is a hidden growth of mold behind

[21] US EPA. (2008, September). Mold Remediation in Schools and Commercial Buildings
[22] US EPA. (2008, September). Mold Remediation in Schools and Commercial Buildings

a wall. However, sampling without a specific purpose greatly increases the chances of generating useless data and wasting time and resources[23].

Remediation

Moisture Control

Once mold has been identified indoors, steps must be taken to begin eliminating the mold growth and eliminating conditions under which the mold was able to proliferate. One of the most influential aspects of mold is the moisture level indoors, as most species of mold flourish when moisture levels are high. This is due to the fact that mold requires a certain level of moisture activity to grow, which can be correlated to relative humidity. In addition to water, mold species also need nutrient sources, and given that they can gain nutrients from a large variety of sources, water availability is the limiting growth factor. To control moisture levels indoors, first and foremost is to remove the water source if possible. This should be fairly easy depending on the source of water, with common solutions including fixing leaky water fixtures or diverting nearby sources of water. To get rid of high moisture levels, you can remove water with water extraction vacuums, use dehumidifiers, increase ventilation (if outside is cold and dry), or use fans. If there are materials with significant water damage, then those damaged materials should also be removed and replaced, ideally with water resistant materials[24]. One possibility is to use moisture as a metric for likelihood of mold growth, specifically if there are complaints or suspicion but no visible mold. If people are having serious reactions then air sampling might be a more appropriate step, but if not, then using moisture meters, humidity gauges, or humidistats to monitor the humidity levels can be an effective tool for regular surveillance.

Ventilation

It's important to keep ventilation in mind when dealing with mold for two reasons. One reason is to ensure that you have proper ventilation in enclosed spaces to prevent humidity from building up. The second reason is that if you have a mold outbreak that might spread to the ventilation, then you need to remediate the ventilation specifically and check other parts of the building to make sure that

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[23] AIHA. (December 2011). Facts about Mold [PDF]. Retrieved from https://www.aiha.org/publications-and-resources/TopicsofInterest/Hazards/Pages/Facts-About-Mold.aspx

[24] US EPA. (2008, September). Mold Remediation in Schools and Commercial Buildings

the growth hasn't spread. Additionally, temporarily limiting or quarantining the contaminated ventilation might be a reasonable control measure. This is especially important in a living space with potentially sensitive populations.

Cleaning Mold

There are several methods of cleaning mold, and each method is used to deal with a different scale and intensity of mold growth. Four cleaning methods that the EPA recommends for dealing with mold include wet vacuums, damp wipes, HEPA vacuums, and total discarding of materials in sealed containers/bags. These steps can be done together or in sequence depending on the situation. Wet vacuums can be used to remove water from floors, carpets, and hard surfaces, but not porous materials, and should be used to remove spores with sufficient liquid present. Damp wipes are useful when dealing with hard surfaces and any presence of mold, dead or alive. This is an appropriate method for small scale mold growth or if a layperson is dealing with the outbreak. HEPA vacuums can be helpful in removing any dust or spores that have built up during the cleaning and remediation process. For most porous materials, and for materials that are irredeemable, disposal is likely necessary, and should be done carefully in sealed containers or bags to prevent spores from spreading as the material is removed from the building[25].

Building repair

Once a mold outbreak has occurred, and the cleaning of mold is taking or has taken place, one must consider the repair of the damaged materials. If the damaged materials can be reasonably repaired/dried, then depending on the material, it can be put back into the area. However, materials that lose structural integrity like wood or dry wall should be replaced entirely with new, possibly water resistant material.

Safety

During the entire remediation process, participants need to be equipped with the proper protective gear, including efficient and adequately protective respirators, coveralls, appropriate gloves, and eye protection. Typically, these higher levels of personal protective equipment (PPE) are only necessary with larger and wider scale outbreaks, but caution should always be exercised. Respirators are

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[25] US EPA. (2008, September). Mold Remediation in Schools and Commercial Buildings

important in preventing the inhalation of mold spores, especially the more toxic varieties that create mycotoxins and microbial volatile organic compounds. Typically N-95 respirators are sufficient to protect against most if not all mold air contaminants. Depending on the intensity of the outbreak, it might be more effective and safe to implement the use of full-body disposable coveralls to prevent the spread of mold and protect from harsh cleaning chemicals. Beyond PPE, some outbreaks might require a containment area via a layer (or layers) of polyethylene sheet barriers to prevent the spread of mold spores. In these containment areas, there needs to be negative pressure to limit mold movement. During this whole process, occupants of the buildings, especially those that are sensitive to mold allergens or are immunocompromised, need to be alerted of the process and kept in the communication loop.

Scenarios that require specific steps

If flooding has occurred, there is a possibility for contaminated waters to have infiltrated and damaged building materials. Contaminated waters can contain a wide array of hazardous chemicals and biological agents, and this degree of material damage should default to disposal of all affected material. Additionally, a higher degree of PPE might be required by default in this situation given the unknowns of flood water contaminants. Mold growth in hidden areas should also be approached with an increased level of caution given the inability to gauge hazard level via visual inspection.

COMMUNICATION

Once a mold outbreak has occurred, communication methods need to be determined between those involved in the remediation, building owners/managers, and occupants. Throughout the entire process, building owners and managers should serve as the communication bridge between those in charge of remediation and the denizens of the building. Bearing this in mind, it is up to the industrial hygienist or mold remediation specialist to only give necessary information and to avoid spreading unnecessary alarm to the occupants. Especially for smaller mold instances, this could potentially lead to more panic, and consequently more frequent reporting and misreporting of mold. Further sections will detail educating building managers or employees in resident halls on campus.

Examples of relevant mold procedures from other entities

As mentioned earlier in this report, it is important that the University inspects other mold sampling and remediation processes to be sure that there we are practicing the most agreed upon,

scientifically validated, and up-to-date procedures. This section will detail the processes of other institutions and entities to which the department can compare practices.

University mold assessment procedures in North Carolina

In the state of North Carolina, there are several other universities that share our typically humid climate, and it's relevant to examine how they handle mold outbreaks given similar environmental contexts.

North Carolina State University

North Carolina State University is just 30 minutes down the road, and experiences much of the water intensive events that might make our campuses vulnerable to mold. Inspecting their publicly available page on mold, we find quite an extensive set of mold remediation guidelines[26]. The page mentions that the discussion on mold is due in part to the rise in awareness of the potential health effects of mold, and explains that though it is impossible to entirely eliminate, people at the university can request an "indoor air quality assessment". This is hyperlinked to a relevant email address that would inform the EHS department of the inquiry. The rest of the page lists information on mold and the relevant prevention and remediation steps, with much of the information directly from the EPAs Mold remediation in Schools and Commercial Buildings guideline document.

Duke University

Duke University, much like North Carolina State University, is very close to the University of North Carolina at Chapel Hill, and consequently shares our vulnerability to mold, thanks to our moderately humid climate and proximity to bodies of water. Duke's Occupational & Environmental Safety office has a page dedicated to indoor air quality with a large amount of the information focusing directly on mold[27]. This details mostly how building occupants can take steps to prevent the growth of mold and deterioration of air quality, which includes notifying maintenance of water leaks, not blocking air vents, contacting housekeeping to clean wet carpets, and calling maintenance to clean up any visible mold. It then says that if there are still concerns about mold after contacting maintenance and having

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[26] North Carolina State University. (n.d.). Mold Remediation Guidelines. Retrieved 01 April 2018 from https://ehs.ncsu.edu/health-safety/occupational-health/indoor-air-quality/mold-remediation-guidelines/

[27] Duke University Occupational and Environmental Safety Office. (n.d.). Maintaining Good Indoor Air Quality. Retrieved on 01 April 2018 from https://www.safety.duke.edu/occupational-hygiene-safety/indoor-air-quality

them check ventilation and plumbing, then "you may request that Occupational Hygiene and Safety perform an Indoor Air Quality Investigation". The page points out that they will do preliminary testing and talk to maintenance, and if there are signs that could mean potential mold, then they will perform sampling and if necessary, appropriate remediation.

Wake Forest University

Wake forest has two main resources publically available on mold management. Firstly, is the page on mold and mildew prevention housed under the current students, policies and procedures page. The information displayed under this page is provided by the Office of Residence Life and Housing and details the different health effects that might occur, as well as information to contact campus health services if students are concerned about symptoms and exposure[28]. The page provides a link to the EPAs page on mold information and mentions the availability of the University's mold management plant to deal with mold growth and outbreaks. Following this are tips for students to help prevent the growth of mold and mildews in the residence halls and dormitories, with a thorough frequently asked questions section addressing relevant queries including "How does Wake Forest respond to a mold report?", "Has Wake Forest taken a look at how other schools address mold?", and "are there government regulations governing how the University must treat mold?". These are typical questions that students and concerned members of campus might ask, so inclusion of a FAQ section seems like an effective method to answer questions and concerns without having to respond to each individual. Additionally, the environmental health and safety department has a page identifying the same information available on the housing mold page in slightly less detail with links to the American College of Occupational and Environmental Medicine the EPA, and links to a fact sheet on mold as well as the previously mentioned mold management plan[29]. This management plan is a document seemingly modeled after the EPAs Mold remediation in Schools and Commercial Buildings but more focused on how the steps and procedures involve faculty and students on campus, listing responsibilities to prevent mold and required mold trainings. Wake Forest's approach seems to be full transparency into the mold remediation process, making the University's approach to mold easily accessible and built to respond directly to concerns.

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[28] Wake Forest University Office of Residence Life and Housing. Retrieved April 20 2018. *Mold & Mildew Prevention.* Retrieved from Wake Forest University website: https://rlh.wfu.edu/students/current-students/policies-procedures/mold-mildew-prevention/

[29] Wake Forest University Office of Environmental Health and Safety. Retrieved April 20 2018. *Important Information on Molds.* Retrieved from Wake Forest University website: https://ehs.wfu.edu/health-safety/important-information-mold/

Wake Forest University's steps to respond to mold reports is reported to include mold identification from EHS staff, cleaning of mold-positive areas with mold inhibiting products, and inclusion of "third-party abatement contractors" for large areas of mold growth, specified to be contaminated areas "greater than 10 sq ft." in size[30].

East Carolina University

Upon searching ECU's school website and EHS department page, searches lead to their page on indoor air quality, which leads to a document called the indoor air quality program guide, an all-inclusive document detailing what makes up indoor air quality, how to monitor it, and basic remediation procedures[31]. The document details basic information, and when discussing response to indoor air quality complaints, the department recommends that employees contact EHS so that EHS can visually inspect physical space and collect measurements of temperature and relative humidity to determine if further sampling is necessary. Following this, they will coordinate with facilities to ensure that the situation has been dealt with appropriately. The document mentions mold a few times, but makes no mention of health information or mold specific precautions, and speaks more broadly and generally about investigating mold in indoor air quality[32].

University of North Carolina – Wilmington

UNC-Wilmington does not have much readily available information on mold. Their environmental health and safety department has a page on general indoor air quality without links to other information and discusses the responsibilities of the department which include consistent evaluation of indoor air quality complaints; addressing remediation of recognized problems; and routine reviews of conditions. Besides this there is an available allergens information sheet through their student health center that mentions mold, but other than this, any information on mold doesn't seem to publically available[33].

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[30] Wake Forest University Office of Environmental Health and Safety. Retrieved April 20 2018. *Information on Molds.* Retrieved from Wake Forest University website: https://prod.wp.cdn.aws.wfu.edu/sites/208/2017/07/Moldy-Bullets.pdf

[31] East Carolina University Office of Environmental Health and Safety. Indoor Air Quality. (n.d.). Retrieved April 20, 2018, from http://www.ecu.edu/cs-admin/oehs/ih/Indoor-Air-Quality.cfm

[32] East Carolina University Office of Environmental Health and Safety. June 2016. *Indoor Air Quality Program Guide.* Retrieved from East Carolina University website: http://www.ecu.edu/cs-admin/oehs/ih/upload/Indoor-Air-Quality-Program-2.pdf

[33] University of North Carolina at Wilmington .(n.d.). Indoor Air Quality. Retrieved April 04, 2018, from https://uncw.edu/ehs/indoorquality.html

Nation-wide University Assessment procedures

The following section details the programs and standard procedures that prominent universities utilize in responding to mold outbreaks.

Yale University

Yale University does not have a specific page detailing mold prevention and response, but through their Office of Environmental Health and Safety, they make available a list of programs, which includes a management plan for flood response and mold prevention. The document is meant to be a reference document for employees of the university, with responsibilities to respond to and prevent mold, and to recall in dealing with mold and flooding events. This is an example of equipping university employees with the tools and knowledge to respond to mold in smaller instances and proliferate relevant information. There is a section that defines the roles of different members of the University in dealing with mold, and the office of environmental health and safety is expected to provide training, direct emergency response to campus floods and other water intrusion events, and perform post-flood monitoring and evaluation to prevent long term negative consequences which includes mold. There is a section describing how to respond to mold impacted areas, and recommends similar steps to the EPAs Mold remediation in Schools and Commercial Buildings guideline, noting that EHS and facilities should be contacted for larger mold outbreaks, i.e. larger than 10 square feet[34]. On the note of preventative maintenance, there is a section that details how this is carried out, and lists no sampling of mold but does talk about routinely drain purging on AC condensate pans and cleaning of slime accumulations on pans, filter replacement on all HVAC systems, and cleaning of areas of regularly elevated humidity to help prevent the growth of mold. There is no mention of air sampling for mold.

University of Virginia at Charlottesville

The University of Virginia's Office of Environmental Health and Safety has a page for air and noise monitoring, a category within which they include mold. Answering a set of frequently asked questions, the page details how the department responds to complaints of air quality by investigating them via a walk-through survey, interviews with occupants and consultation with facilities management

[34] Yale University's Offices of Environmental Health and Safetey. (December 2009). Flood Response and Mold Prevention Program [PDF file]. Retrieved from https://ehs.yale.edu/sites/default/files/files/flood-response-mold-prevention.pdf

on the operation of the HVAC (heating, ventilation and air conditioning) system. This page also contains a link to the university mold policy document, a comprehensive document with a main policy statement that wet and water-damaged materials resulting from floods or leaks will be dried in 48 hours. Recommended steps are listed with basic outline of the remediation procedure, but only mentions what should be done given a mold growth of greater than 10 square feet with no mention of air sampling[35].

Stanford University

Stanford's department of Environmental Health & Safety provides a mold prevention and water damage response guideline "to help facility zone and building managers take proper action when addressing facility water damage incidents". This document is designed to address mold prevention strategies through remediation of water damaged materials, and does not focus extensively on the nature of mold, its health impacts, or its growth factors[36]. At the end of the document, they discuss requests for mold sampling, denoting that often this request is misinformed, and that people should really be evaluating moisture problems and damage. They then provide a link to the State of Minnesota Department of Health's page on mold testing, which explores the limitations and misunderstandings of mold sampling with a high degree of depth.

Harvard University

Harvard's department of Environmental Health & Safety provides a program for indoor air quality for building managers and facilities[37], but does not have specific information on mold, nor does it mention information relevant to the layperson. Under the recommended guidelines, if mold is found, then building managers are to reach out for assistance (EHS staff) and to properly control moisture to prevent this in the future. No discussion of sampling is apparent, and the procedure seems to rely solely on visual inspection[38].

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[35] University of Virginia Office of Environmental Health and Safetey. (16 June 2015). SEC-023: Mold Management. Retrieved from http://uvapolicy.virginia.edu/policy/SEC-023

[36] Stanford University Environmental Health & Safety. (n.d.). *Mold Prevention and Water Damage Response*. Retrieved 06 April 2018 from https://ehs.stanford.edu/topic/construction-maintenance/mold-prevention-and-testing

[37] Harvard Campus Services Environmental Health & Safety. (19 December 2017). *FACT SHEET Program: Indoor Air Quality; Building/Facility Manager: Indoor Air Quality.* Retrieved from https://www.ehs.harvard.edu/sites/ehs.harvard.edu/files/building_facility_manager_iaq_fact_sheet_0.pdf

[38] Harvard Campus Services Environmental Health & Safety. (19 December 2017). *Building/Facility Manager: Protocol for Responding to Indoor; Air Quality Complaints or Concerns*. Retrieved from https://www.ehs.harvard.edu/sites/ehs.harvard.edu/files/building_facility_manager_protocol_responding_iaq_complaints_concerns_0.pdf

University of Michigan

The university's EHS department outlines basic information about mold and provides a copy of their flood damage remediation guidelines, which includes preventing mold growth, but does not specifically address mold growth response. The university seems to designate that the EHS department and housing facilities be contacted to inspect for and clean mold[39].

Findings

The level of availability of mold information is highly variable between universities, but the typical structure for mold procedure is similar. Many institutions simply link the EPAs documentation to allow those seeking information to read about it there, but some still provide an abbreviated amount of information on their own EHS department web pages. Two points of interest are Wake Forest University and Yale University. Wake Forest's use of a frequently asked questions on mold and two webpages for their EHS and housing sites seem to be effective ways to address resident concerns. Yale's focus on flooding leaves something to be desired on mold information, but does also include a requirement for post-flood testing, a potentially effective way to mitigate mold growth before it becomes a larger issue.

Governmental mold procedures

City/Municipal Mold Recommendations

Wake County Environmental Health and Safety

Wake County encompasses the cities of Raleigh and Durham, two of the most populous cities in the state, and the web page on environmental health and safety touches briefly on indoor air quality and, specifically, mold. The most relevant information on this page is summed up in this statement: "Wake County Environmental Services does not inspect private residences, apartments or places of business for mold. Right now, there are no laws regulating mold levels in private homes in Wake County

[39] University of Michigan Environment, Health & Safety. (2018). *Mold*. Retrieved from https://ehs.umich.edu/living-safely/building-environment-issues/mold/

or in North Carolina"[40]. They explain that professionals should be contacted in the event that mold is noticed and do not mention much about the effects or causes of mold outbreaks besides linking to other federal organization pages.

Orange county Environmental Health

The University of North Carolina at Chapel Hill is in Orange County, and as such, should be included in this section. The Environmental health page has links to other pages on different environmental health hazards, but has a specific section in which it provides referrals to other agencies, this is the case for indoor air quality[41]. The link simply redirects site visitors to the EPAs website, and does not seem to say anything more on the topic of mold or indoor air quality.

New York City Department of Health and Mental Hygiene

New York City's department of health and mental hygiene (DOHMH) has created a set of guidelines intended for building owners and managers, environmental contractors and environmental consultants to refer to when evaluating plans of action to respond to and deal with mold growth in city buildings. This document gives step by step analysis of mold inspection, cleaning procedures, and building remediation to protect residents and remediation personnel. The department is in agreement with the EPA that sampling is often unnecessary and likely to be a cost and time-inefficient process[42]. This document would serve the target demographics well, but might be daunting to the average citizen.

State Government Mold Recommendations

North Carolina Department of Health and Human Services

As an agency devoted to promoting the improvement of health, safety and well-being of all North Carolinians, the NC DHHS provide a thorough explanation of mold, prevention tips, cleaning methods, health information, and consultation. Specifically, the occupational and environmental epidemiology branch has a central document that reviews all of this information, as well as several easy

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[40] Walston, Stephen R. (May 09, 2016). *Mold*. Retrieved from Wake County Environmental Services. http://www.wakegov.com/envirohealth/air/pages/mold.aspx

[41] Orange County Environmental Health Division. (2015). *Environmental Health Division*. Retrieved from http://www.orangecountync.gov/departments/health/environmental_health.php

[42] New York City Department of Health and Mental Hygiene. (November 2008). *Guidelines On Assessment and Remediation of Fungi in Indoor Environments*. Retrieved from https://www1.nyc.gov/assets/doh/downloads/pdf/epi/epi-mold-guidelines.pdf

to navigate pages giving all the information a concerned citizen would need to understand what they can do to protect themselves against mold. An intriguing document available is a presentation on "Managing Citizen Inquiries about dampness and mold growth". This is an interesting document because it addresses the important topic of involving local community partners in the remediation and prevention of mold. They assert that these problems are best solved at the local levels, and that those involved need to be best equipped to prevent frustration as residents are moved between agencies and groups without resolution[43]. Besides the EPAs own Mold remediation in Schools and Commercial Buildings guideline, this provides one of the most comprehensive assessments of mold available, and states that "Alone, mold testing results cannot determine that mold is the cause of symptoms and should never be used to dismiss complaints or defend inadequate efforts to investigate and solve potential problems"[44]. They also list the limitations that sampling cannot account for variability in spore count, is unnecessary given that visible mold should be removed regardless, and detracts from the underlying moisture problem.

Minnesota Department of Health

This department of health is often referred to for more information from other agency websites, and rightfully so, as they have crafted a series of webpages with a plethora of mold information, as well as a page specifically addressing the topic of mold sampling. The department itself states that it does not usually support mold testing and notes that it is often an inappropriate response to inquiries from concerned parties[45]. Testing as a response to concerns is limited to a snapshot of an exposure profile, and with many testing methods for specific molds comes the risk of missing certain species and misidentifying others. Additionally, there is high cost associated with sample testing, and it is best used sparingly in situations where cost of remediation requires proof or is growing in a hidden area. In depth debunking of common justification of mold sampling is given, and the department advises that sampling not be used in many situations in agreement with the EPA. The Seven reasons listed as justification for not sampling for mold are listed below

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[43] Lipton, David. (n.d.). *Managing Inquiries about Dampness and Mold Growth*. Retrieved from Occupational and Environmental Epidemiology NC Division of Public Health website http://epi.publichealth.nc.gov/oee/mold/docs/Mold_Moisture_Presentation_long.pdf

[44] North Carolina Department of Health and Human Services, Division of Public Health, Occupational and Environmental Epidemiology. (August 2005). *Mold and Human Health*. Retrieved from http://epi.publichealth.nc.gov/oii/pdf/Mold%20and%20Human%20Health%208-18-05.pdf

[45] Minnesota Department Health. (n.d.). *Testing For Mold*. Retrieved from http://www.health.state.mn.us/divs/eh/indoorair/mold/moldtest.html

1. Unable to distinguish between “normal” and “problem” conditions.
2. Typically unnecessary to know what types of mold are present if it’s already visible.
3. The desire to know if it is toxic mold is countered by the idea that testing for mold is not the same as testing for mycotoxins, and sampling might not reliably provide that information
4. Though people are often interested in sampling for mold to determine if it is the cause of health problems, “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.”
5. Sampling cannot determine if the environment is safe as there is no known “safe” level of mold.
6. Testing to determine the correct remediation process is unnecessary, as all mold can be approached similarly.
7. Trying to gain a response from responsible parties is ineffective, as there is no legal requirement. [46]

Federal Government Mold Recommendations

Environmental Protection Agency

The Environmental Protection Agency (EPA) is a leading authority on Mold, and has the most comprehensive documentation on mold and the necessary steps for remediation among the federal agencies. In a broader discussion of indoor air quality the EPA Identifies biological contaminants, including mold and mildew and explains associated health outcomes and lightly details exposure reduction methods. Additionally, the EPA has two distinct publications detailing guidelines for mold prevention and remediation, one for the residential home (Publication No. 402-K-02-003, (September 2010)), and another for schools and commercial buildings (Publication No. 402-K-01-001, (September 2008))[47]. A number of universities reference and provide links to the latter, as it denotes that sampling is not encouraged as a frequent primary response to mold presence. The agency’s website also provides easily accessible basic information on mold with relevant links.

Occupational Safety and Health Administration

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[46] Minnesota Department Health. (n.d.). *Testing For Mold*. Retrieved from http://www.health.state.mn.us/divs/eh/indoorair/mold/moldtest.html

[47] US EPA. (14 February 2014). *Mold*. Retrieved from https://www.epa.gov/mold

Based on visual and physical inspection, OSHA recommends that you don't need to sample further for other bioaerosols, as cleanup of one visual mold is often enough to account for other molds and fungi present. OSHA also provides a set of conditions in which sampling for molds might be recommended, and they are as follows: (i) when medical diagnosis is consistent with mold-associated illness, (ii) to delimit the outer boundaries of severely contaminated areas before and during a mold cleanup project, and (iii) after a cleanup to show that the types and concentrations of mold in the area are similar to background levels[48]. The agency site provides a plethora of links to other sources of information, providing a useful starting point to find whatever mold information that is being sought.

Centers for Disease Control

The Centers for Disease Control and Prevention (CDC) mostly provide basic facts and information about mold, with more specific information on Stachybotrys chartarum and Other Molds. This secondary elaboration on this specific strain is in response to the increased number of health concerns with Stachybotrys chartarum and other molds that have cropped up over the last two decades.

In one of the agency's Morbidity and Mortality Weekly Reports (MMWR), titled "Mold Prevention Strategies and Possible Health Effects in the Aftermath of Hurricanes and Major Floods", several scientists from several national centers present instruction on limiting mold exposure and identifying mold-related health effects. This 2006 publication was in response to the significantly increased levels of mold found in New Orleans homes after Hurricane Katrina in 2005[49]. This report delineates exposure assessment, health considerations, clean-up work, dealing with contaminated water, and preventing flood damage in the future.

Discussion of findings

Almost all of the institutions that have been reviewed are distinctly against sampling for mold beyond visual inspection or special circumstances. Most sub-federal agencies follow a set of mold guidelines similar to those outlined by the EPA, but more often than not, they simply redirect to the EPA

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[48] OSHA. (n.d.). *Mold*. Retrieved from https://www.osha.gov/SLTC/molds/hazards.html

[49]

Brandt, Mary; Brown, Clive; Burkhart, Joe; Burton, Nancy; Cox-Ganser, Jean; Damon, Scott; Falk, Henry; Fridkin, Scott; Garbe, Paul; McGeehin, Mike; Morgan, Juliette; Page, Elena; Rao, Carol; Redd, Stephen; Sinks, Tom; Trout, Douglas; Wallingford, Kenneth; Warnock, David; Weissman, David. (9 June 2006). MMWR (Rep. No. 55(RR08);1-27). *Mold Prevention Strategies and Possible Health Effects in the Aftermath of Hurricanes and Major Floods* Retrieved from https://www.cdc.gov/mmwr/preview/mmwrhtml/rr5508a1.htm#top

site and provide a variable amount of information on mold. Of note is the CDC MMWR which notes that if made available, flood sampling might be appropriate for public health agencies to consider collecting health outcome information from health-care facilities to monitor the incidence or prevalence of selected conditions.

Analysis of public response to mold

Past public responses to mold and risk value assessment of mold from public perspective

OSHA itself says "Concern about indoor exposure to mold has increased along with public awareness that exposure to mold can cause a variety of adverse health effects", indicating an increase over the past several years in the public's collective knowledge on mold[50]. With this increase in knowledge comes a proportional increase in how likely the public is to report mold and request action to remediate.

In 2016, students on Duke University's campus were reporting poor indoor air quality attributed to mold growth in the facilities[51]. Given the consistent presence of mold for a number of students, there was a perception the university was unprepared and unequipped to handle mold growth. Some students requested mold sampling, and the tests came back with mixed results, demonstrating the ineffectiveness of mold sampling to determine the presence of mold. Even once many of the mold problems were solved, students reported frustration and being portrayed as overreacting, which goes to show that if students are not provided with information on mold and resources are not effectively allocated or are wasted, then this can lead to dissatisfaction among residents and an exacerbated situation.

In a similar situation at North Western University, residents raised concerns over mold being found on mattresses and requested that something be done about this[52]. The university cleaned all of

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[50] OSHA. (2006). *Preventing Mold Related Problems in the Indoor Workplace A Guide for Building Owners, Managers and Occupants* [PDF]. Retrieved from https://www.osha.gov/Publications/preventing_mold.pdf

[51] Beyer, Adam. "Campus Faces 'Gray Fuzzy Dripping Mold.'" Duke Chronicle, 2 Nov. 2016, www.dukechronicle.com/article/2016/11/campus-faces-gray-fuzzy-dripping-mold.

[52] Kim, Yyvone. "Potential mold found on several mattresses in CCI, students say." The Daily Northwestern, 1 Nov. 2016, https://dailynorthwestern.com/2016/11/01/campus/potential-mold-found-on-several-mattresses-in-cci-students-say/

the mattresses with disinfectant and students still expressed dissatisfaction with the response stating "But once we told someone, I don't think it was handled well" and "Mold isn't going to go away if you wipe it off". The director of housing noted that the perceived symptoms could likely be attributed to the natural college setting in which a variety of individuals come in contact with a diverse range of germs, and if students were made a little more aware of the nature of mold, then they might have been more receptive to this idea.

At the University of Louisville, students were reporting general presence of mold in their residence halls and rooms, even with an updated air conditioning system and dehumidifiers, which significantly decrease the likelihood of this occurring. Students were not satisfied with simply cleaning the mold and being told to remove moisture sources, the most typical prescription for eliminating mold[53]. Educating students and residents about mold could prevent this dissatisfaction.

Here in our own University of North Carolina at Chapel Hill, residents in Morrison residence hall had complained about mold coming directly out of the ventilation ducts, and housing responded with a $90,000 repair to the HVAC unit[54]. The associate director of housing was able to allay most concerns with this by explaining exactly why this was occurring, but students still expressed general concern about the situation, one stating "Mold is not a good thing to have in dorms. Sickness can spread very easily on college campuses."

In the town of Chapel Hill, there was an incident involving residents of a condominium and a sewage backup that damaged the carpet and ceiling of the unit. Alongside this problem, the residents reported finding mold, and out of concern, took samples and had them tested in a lab in Texas[55]. The samples reported black mold, but the management did not take the results seriously, as the residents

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[53] Merkel, Ralph. "Mold returns to campus dorms." The Louisville Cardinal, 3 Sep. 2016, http://www.louisvillecardinal.com/2016/09/mold-returns-campus-dorms/

[54] Moir, Colleen. "Mold uncovered in Morrison dormitory." The Daily Tar Heel, 20 Feb. 2015, http://www.dailytarheel.com/article/2015/02/mold-uncovered-in-morrison-dormitory

[55] Jansen, Katie. "Resident Alleges Chapel Hill Condo Contaminated." The Herald Sun, 8 Jan. 2015, http://cms3.revize.com/revize/orangecounty/document_center/Health/Media_Items_BOHmediapacket2_15.pdf

had taken the samples, and even with that information, sample taking only provides a limited snapshot of mold spores exposure profile.

The Minnesota department of health seems to suggest that the best way to combat paranoia on mold is to explain the justification behind not sampling, as well as the likelihood of experiencing negative health outcomes[56]. General public response to mold is one of uncertainty and concern, especially with sensitive populations like asthmatics and children. Considering this fact, one of the best responses might be to preemptively educate residents in areas prone to mold growth, specifically on prevention techniques and the lack of distinct health outcomes in healthy individuals.

Communication with staff and faculty

Most educational institutions provide their staff and faculty with basic information on mold, with some training depending on the role of the employee. Bearing this in mind, the average resident or member of the general public will have very little familiarity with mold and its associated effects, and will rely on information gleaned from media and hearsay. This will likely result in strong reactions to discovery of mold, especially if there is a coinciding health effect, regardless of whether or not it is actually caused by mold. This has been a common theme in university settings, in which mold is discovered, students report a variety of symptoms, students blame these symptoms on mold, and staff attempts to remediate mold while also explaining that it is likely not the cause of their symptoms. Balancing the dispersion of concern while also providing correct information is difficult, and will almost always result in some degree of frustration, especially if the mold persists despite efforts. Without educating every resident on mold, the best we can likely achieve is to preemptively educate on prevention, act with transparency, and highlight the important parts of the body of knowledge on mold.

Housing and Residential Education employees

Training and communication

As mentioned in the previous section, in a university setting, it is common for students to bring up mold related concerns, and often times, it is the resident advisors (RA) employed by Carolina Housing that be “first responders”. Residents are often instructed to contact their RA if they encounter any

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[56] Minnesota Department Health. (n.d.). *Testing For Mold*. Retrieved from http://www.health.state.mn.us/divs/eh/indoorair/mold/moldtest.html

problems, ranging from feeling overwhelmed to finding mold in their room. Consequently it makes sense that RAs could potentially contribute to aiding residents through the process of mold remediation. This could be something as little as providing context for the process and explaining what the UNC EHS staff and facilities personnel will be doing to remediate mold. Providing clarity and helping residents understand the importance of moisture control as well as the holistic cleaning process could help residents to better understand the process and justification. In a more applied approach, RAs might provide a little information on mold prevention at the beginning of the year, or even after severe rains or floods to try to mitigate the number of cases that come up, but this might be overexaggerating the prevalence and likelihood of mold growth and do more harm than good. Most importantly, RAs should be able to recommend that given the finding of possible mold, students contact UNC EHS and facilities to address the problem, and given health symptoms, direct students to campus health services.

As a former RA, I have much experience in redirecting residents to the appropriate resources, and it would be relatively easy to incorporate a mold slide into their training. Additionally, an online resource for resident advisors and residents to access through EHS or Carolina Housing might be a useful way to answer easy questions, similar to the resource provided through Wake Forest University's residence life webpage. A simple informative document or page highlighting the aspects of visual inspection, remediation, moisture control, and sensitive populations could be an insightful tool without causing alarm over black mold and uncertainty of mycotoxins.

DIscussion of modifying the current UNC Mold sampling methods

Though UNC's EHS department provides easy access to a comprehensive and effective mold response protocol, there are ways to potentially improve the procedure as well as the way information is presented.

Pertaining to the procedure itself, UNCs mold guidelines are in line with federal recommendations as well as many university programs, recommending visual inspection of sampling, and following appropriate remediation steps. UNC EHS does not need to update their mold response program, but it is recommended that the information on water intrusion response be made publically available. With an increase in hurricane frequency anticipated with increasing climate variability, we can reasonable anticipate there being more flooding events like those in Texas, Florida, and eastern North Carolina. An increase in flooding events will likely lead to more public concern about mold, so it might be best to anticipate these flooding events when they come and to provide the public with information on mold prevention.

Concerning the way that this information is presented, one of the commonalities between universities examined was the lack of a discrete page about mold. This is likely due to the fact that it does not need its own page and can be adequately covered in a blurb under indoor air quality, but there is a possibility here to educate the general public. Inclusion of a page solely for mold could be appropriate on either the housing or EHS webpage, and could serve as a convenient location for a frequently asked questions section on mold, tips for preventing mold growth, and links to helpful documents similar to Wake Forest University and the NC DHHS. Creation of such a resource could raise more awareness and concern over mold depending on how mold information is displayed, but this cost-benefit dichotomy could be assessed by comparing the number of complaints filed before and after to see if it's effective or a nuisance.

Referring to the section on RAs, EHS could work with the UNC Housing department to develop a small training or pamphlet to aid RAs in communicating with residents about mold. RAs certainly don't need to be experts on mold, but if they could inform residents on general procedures for filing complaints or investigations, then this could raise the level of transparency and increase resident satisfaction with mold response. However, there is the possibility that this increase the amount of miscommunication, but ideally no more than is already present with the lack of general knowledge on the topic. This step is likely only necessary if incidence of mold reports and complaints increase significantly, but could be useful to provide general introductory education on mold. Additionally, the document "Indoor Air Quality and Promoting Healthy Living Conditions in Residence Halls" should be made publically available, especially the information pertaining to the 3 Cs.

Something that the department could consider is the idea presented in the CDC MMWR, which notes that it might be appropriate for public health agencies to collect mold-related health outcome information from health-care facilities. This would aid in monitoring for mold if case incidence increases drastically, and is likely unnecessary at this point.

Final recommendation

The Department of Environment, Health & Safety at UNC-CH and its disinclination to sample for mold is appropriate and aligned with the practices of fellow institutions, consensus of general mold scientific evidence, and the federal recommendations. The department already has an effective water intrusion response document, which includes routine moisture inspection after heavy rain and flooding events. Therefore the actual response protocol does not need any modification, but I would recommend

the creation of a more comprehensive web resource with a FAQ section, the publication of the “Indoor Air Quality and Promoting Healthy Living Conditions in Residence Halls” document, and implementation of small RA training resource are recommended courses of action.

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APPENDIX 2 - NIOSH Dampness and Mold Assessment Tool School Buildings

https://www.cdc.gov/niosh/docs/2019-114/pdfs/2019-114-508.pdf?id=10.26616/NIOSHPUB2019114

Dampness and Mold Assessment Tool
School Buildings

Form & Instructions

Centers for Disease Control
and Prevention
National Institute for Occupational
Safety and Health

Disclaimer

Mention of any company or product does not constitute endorsement by the National Institute for Occupational Safety and Health (NIOSH), Centers for Disease Control and Prevention. In addition, citations to websites external to NIOSH do not constitute NIOSH endorsement of the sponsoring organizations or their programs or products. Furthermore, NIOSH is not responsible for the content of these websites. All web addresses referenced in this document were accessible as of the publication date.

Ordering Information

To receive documents or other information about occupational safety and health topics, contact NIOSH at
Telephone: 1-800-CDC-INFO (1-800-232-4636)
TTY: 1-888-232-6348
CDC INFO: www.cdc.gov/info

Or visit the NIOSH website at www.cdc.gov/niosh.

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Suggested Citation

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Instructions

Dampness and Mold Assessment Tool

Contents

About the Form

Using the Form

Appendix

Background

The health of those who live, attend school, or work in damp buildings has been a growing concern through the years due to a broad range of reported building-related symptoms and illnesses. Research has found that people who spend time in damp buildings are more likely to report health problems such as these:

- Respiratory symptoms (such as in nose, throat, lungs)
- Development or worsening of asthma
- Hypersensitivity pneumonitis (a rare lung disease caused by an immune system response to repeated inhalation of sensitizing substances such as bacteria, fungi, organic dusts, and chemicals)
- Respiratory infections
- Allergic rhinitis (often called “hay fever”)
- Bronchitis
- Eczema

Exposures in damp buildings are complex. They vary from building to building, and in different places within a building. Moisture allows indoor mold to multiply more easily on building materials or other surfaces, and people inside buildings may be exposed to microbes and their structural components, such as spores and fungal fragments. Mold may also produce substances that can cause or worsen health problems, and these substances vary depending on the mold species and on conditions related to the indoor environment. Moisture can also attract cockroaches, rodents, and dust mites. Moisture-damaged building materials can release volatile organic compounds that can cause health problems.

Researchers have not found exactly how much exposure to dampness-related substances it takes to cause health problems. Research studies report that finding and correcting sources of dampness is a more effective way to prevent health problems than counting indoor microbes. Therefore, NIOSH developed a tool to help assess areas of dampness in buildings and to help prioritize remediation of problems areas.

NOTE: NIOSH uses the term “mold” to refer to fungi in the indoor environment, which can include multicellular fungi that produce hyphae, unicellular yeasts, and in some excessively damp environments, mushroom producing basidiomycetes.

Photo by NIOSH

Dampness and Mold Assessment Tool

School Buildings Form
Use one form per area being assessed.

District:_____ School/Site:_____ School Type:_____ Observer:_____
Date: _____ Building:_____ Floor:_____ Room: _____

Room/Area Type: Fill in the bubble for the type of room/area you are assessing.

○ Art Room	○ Cafeteria	○ Crawlspace	○ IT Room	○ Mechanical Room	○ Storage Area
○ Attic	○ Classroom	○ Custodial Closet	○ Kitchen	○ Nurse/Medical	○ Other:
○ Auditorium/Stage	○ Computer Room	○ Entrance/Atrium	○ Library	○ Office Area	_____
○ Bathroom	○ Conference Room	○ Gym	○ Locker Room	○ Pipe Chase	_____
○ Boiler Room	○ Copy Room	○ Hallway	○ Lounge	○ Stairwell	

Mold Odor: Fill in the bubble for mold odor. Be sure to smell for mold odor when you first walk into the room/area.
⓪None ①Mild ②Moderate ③Strong Describe source of mold odor: ○Source Unknown

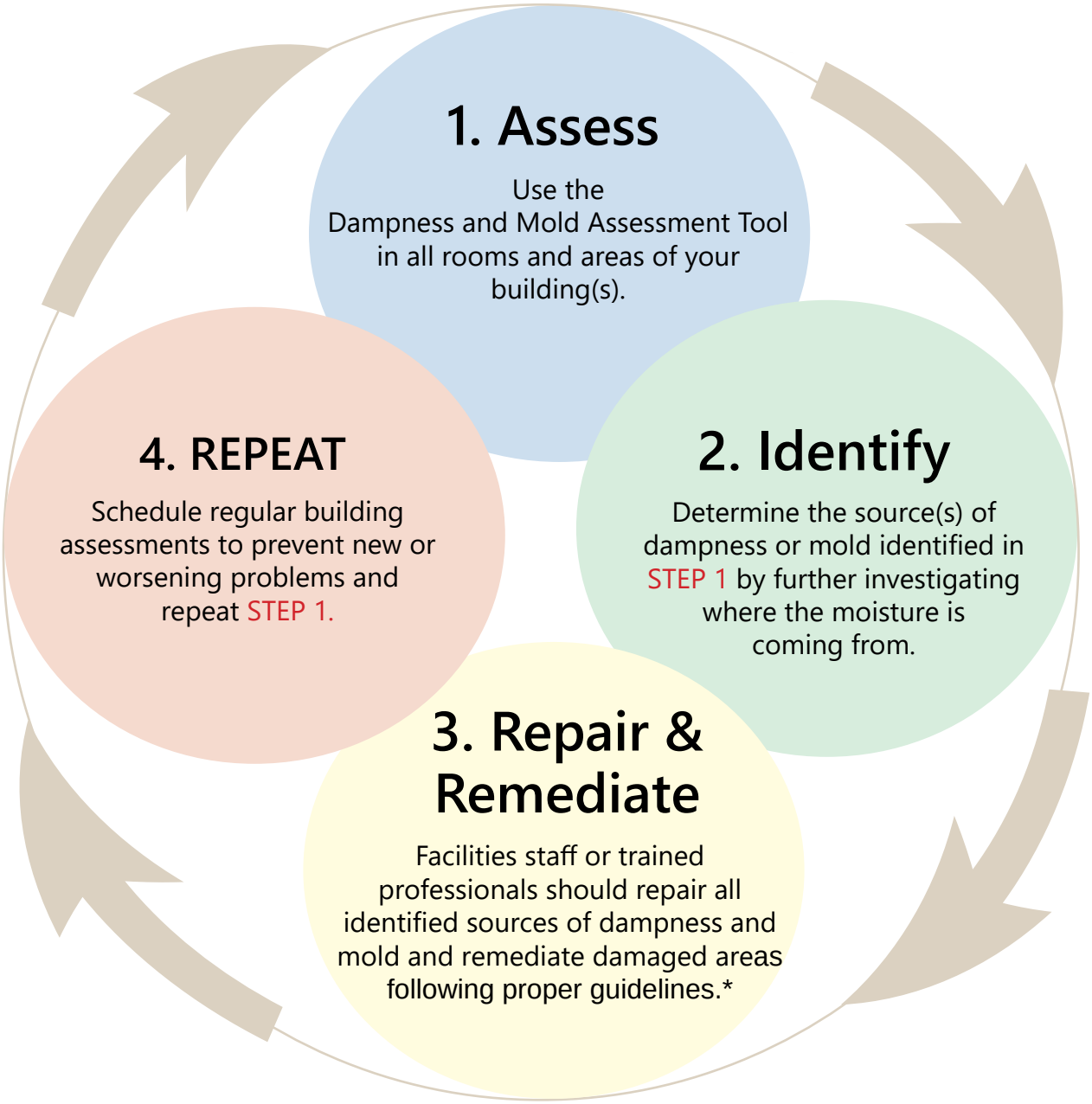
See **scoring** below for ⓪①②③.		Check if nothing found	**Damage or Stains**	Check if near exterior wall*	**Visible Mold**	Check if near exterior wall*	**Wet or Damp**	Check if near exterior wall*	**Component Notes**	**Assessment Notes**
✓	Check if component is in the room/area.	✓	See scoring below	✓	See scoring below	✓	See scoring below	✓	Fill in the bubbles for the type of material that is affected.	Fill in the bubbles for additional detail. Describe if "Other"
✓	**Ceiling**		⓪①②③		⓪①②③		⓪①②③		○Ceiling tile ○Plaster ○Concrete ○Sheet rock ○Metal ○Wood	○Peeling paint ○Rust Other:
✓	**Walls**		⓪①②③		⓪①②③		⓪①②③		○Sheet rock ○Plaster ○Concrete ○Block ○Brick ○Tile ○Wood	○Peeling paint ○Efflorescence Other:
✓	**Floor**		⓪①②③		⓪①②③		⓪①②③		○Wood ○Carpet ○Vinyl ○Ceramic ○Concrete	○Buckling Other:
	Windows		⓪①②③		⓪①②③		⓪①②③		○Exterior ○Interior ○Skylight	○Peeling paint ○Condensation Other:
	Furnishings		⓪①②③		⓪①②③		⓪①②③		○Furniture ○Mechanical ○Sink ○Toilet ○Copier	○Peeling paint ○Rust Other:
	HVAC systems		⓪①②③		⓪①②③		⓪①②③		○Radiator ○Forced-air ○Fan ○Unit ventilator ○Window unit	○Peeling paint ○Rust Other:
	Supplies & Materials		⓪①②③		⓪①②③		⓪①②③		○Books ○Boxes ○Equipment	○Wrinkled pages ○Crumpled boxes Other:
	Pipes		⓪①②③		⓪①②③		⓪①②③		○Plumbing ○Gas	○Peeling paint ○Rust Other:

General Notes

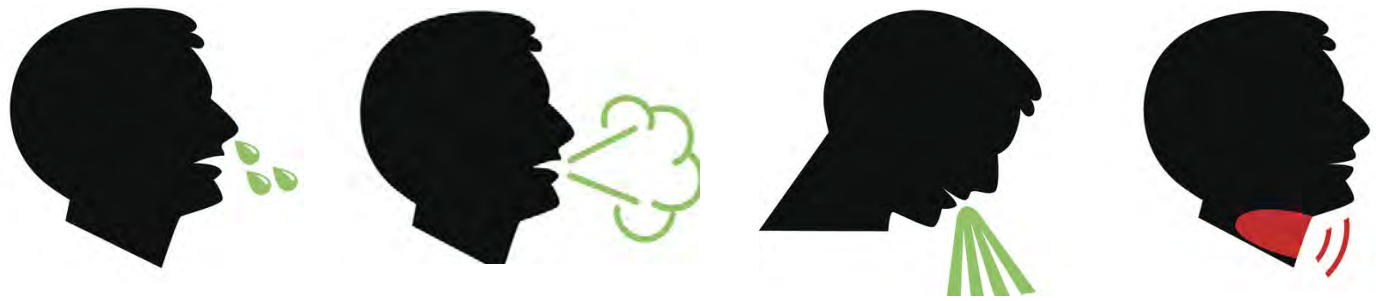
* Within 3 feet of exterior wall.

Scoring: ⓪= none ①< or = the size of a sheet of paper ②> than a sheet of paper to the size of a standard door ③> than the size of a standard door

Assessment Cycle



*Mold Remediation in School and Commercial Buildings—Environmental Protection Agency (EPA)
www.epa.gov/mold/mold-remediation-schools-and-commercial-buildings-guide



NOTICE TO USERS

Building assessments using the Dampness and Mold Assessment Tool will likely be done in areas that may pose health problems for some people. Use caution if you have asthma, allergies, or are having current respiratory health symptoms.

1) General Building Information

Complete the top of the form by entering the following information.

Date:	Month, day, and year of the assessment.
Observer:	Name of the person that is performing the assessment.
Building:	Unique reference of the school (such as main, annex, portable).
Floor:	Floor number or level.
Room:	Room number or name.

2) Room/Area Type

Fill in the bubble that most closely represents the use of the room/area being assessed. Only one room can be selected.

Example:

○	Cafeteria/Dining	○	Custodial Closet
○	Computer Room	○	Daycare
○	Conference Room	●	Entrance/Lobby
○	Copy Room	○	Gym
○	Crawlspace/Pipe Chase	○	Hallway

If the type of room/area you are assessing is not listed, write in the room/area type after **Other.**

Example

○	Nurse/Medical	●	Other:
○	Office Space		*Loading dock*
○	Sleeping Area		
○	Stairwell		
○	Storage Area		

3) Mold Odor

If you detect a mold odor, assess it. Be sure to smell for mold odor when you first walk into each room. Determine subjectively whether a smell is mild, moderate, or strong, and identify the odor's source.

Example:

⓪None ①Mild ●Moderate ③Strong Describe source of mold odor: *flooring* ○Source Unknown

If you cannot determine the source, fill in the Source Unknown bubble.

4) Room Components

Place a check (✓) in the first (green) column for all of the room components found in the room you are assessing. Because all areas must have a ceiling, walls, and a floor, those components are automatically checked. Assess components systematically in the order given from top to bottom.

Example:

Automatically checked

✓	Check if component is in the room/area.
✓	Ceiling
✓	Walls
✓	Floor
	Windows
✓	Furnishings
✓	HVAC systems
✓	Supplies & Materials
	Pipes

- *Windows* includes internal, external, and skylights.
- *Furnishings* includes furniture, sinks, toilets, printers and copiers.
- *HVAC systems* includes all systems used to heat/cool the room or area including unit ventilators, radiators, forced-air systems, window units, and fans.
- *Supplies & Materials* includes books, paper, boxes, gym equipment, kitchen supplies.
- *Pipes* includes any exposed pipes in the room.

5) Nothing Found

Look closely at all components identified in the room for any damage, mold, or wetness. Place a check (✓) in the third (gray) column for all of the room components where no issues are identified.

Example:

		Check if nothing found
✓	Check if component is in the room/area.	✓
✓	Ceiling	
✓	Walls	
✓	Floor	✓
	Windows	
✓	Furnishings	✓
✓	HVAC systems	
✓	Supplies & Materials	✓
	Pipes	

In this example, no damage, mold, or wetness was found on the floor, the furnishings, or supplies & materials.

6) Assessing Damage and Scoring

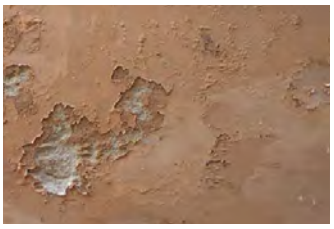
Assessing Damage

Use the three different columns of damage types for the assessment.

1) Damage or Stains

This refers to any water-related damage or stains identified per component.

- Damage could include peeling paint, efflorescence, rust, warping, and deteriorated or crumbling building materials.



Damage to wall caused by flooding.

- Stains could include discoloration caused by possible water leaks, flooding or condensation.


Water stained ceiling panels.

2) Visible Mold

Note if you see visible mold growth or suspect mold growth.

- Mold can include patches or spots that are colored differently than the underlying material (typically gray, brown, or black). Mold can appear fuzzy and can have a musty or earthy odor.


Mold on a wall.

3) Wet or Damp

Note any areas of wetness or dampness that are visible.

- Wet or damp conditions could include visible signs of moisture, such as water beads or condensation, humidity, water leaks, or flooding.


Wet area on floor and side of wall.

Scoring

Scoring is based on the size of all affected areas combined. Individual sizes of each affected area are added together to obtain a combined size. Scoring examples are provided in the Appendix (pages 11–13).

⓪ = No problem areas identified.

① = The combined area of damage is the size of a standard sheet of paper (8½ inches X 11 inches) or smaller.

② = The combined area of damage is greater than the size of a standard sheet of paper (8 1/2″ x 11″) and less than the size of a standard interior door (32″ x 80″).

③ = The combined area of damage is greater than the size of a standard interior door (32″ x 80″).


Interior door

Score each component by filling in the appropriate assessment score in the Damage or Stains, Visible Mold, or Wet and Damp columns. If the affected area is within 3 feet of an exterior wall, place a check (✓) in the yellow column after each scoring column.

Example:

Damage or Stains	Check if near exterior wall*	**Visible Mold**	Check if near exterior wall*	**Wet or Damp**	Check if near exterior wall*
See scoring below	✓	See scoring below	✓	See scoring below	✓
⓪ ● ② ③		⓪ ① ● ③	✓	● ① ② ③	

These evaluations are subjective, so you should try to be consistent in the way you observe the conditions and then score each assessment.

A score of 3 for Damage or Stains, Visible Mold, or Wet or Damp should trigger immediate attention to identify problem sources and to remediate. Likewise, a score of 3 for Mold Odor should trigger attention to identify areas of hidden mold. Scores should also be used for comparison of rooms/areas over time to see if remediation works or if problems get worse.

7) Component & Assessment Notes

This section collects more information that you observe for each of the room components:

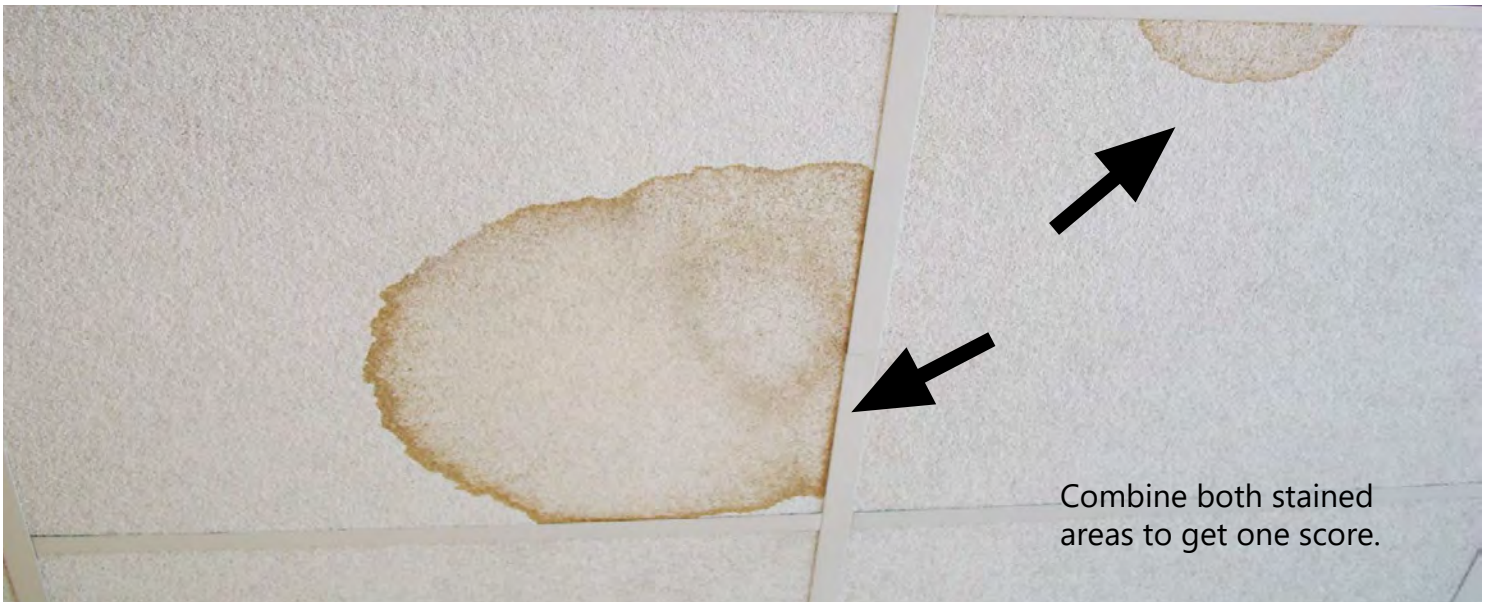
- "Component Notes" includes information on the material or location affected.
- "Assessment Notes" includes information on common indicators of dampness.

Fill in the bubble(s) that most accurately apply to your observational assessment.

Example:

Component Notes	**Assessment Notes**
Fill in the bubbles for the type of material that is affected.	Fill in the bubbles for additional detail. Describe if "Other"
●Ceiling tile ○Plaster ○Concrete ○Sheet rock ○Metal ○Wood	●Peeling paint ○Rust Other:
○Sheet rock ●Plaster ○Concrete ○Block ○Brick ○Tile ○Wood	○Peeling paint ○Efflorescence Other: *rt corner crumbling*

Scoring Example 1



In this assessment, these two stains are the only problem areas identified on this room's ceiling. Therefore, combine the size of **both** stained areas to determine a score.

Damage or Stains

The stains on these ceiling tiles are very visible. A score for this would be a **2** because both stains combined are bigger than the size of a standard sheet of paper but smaller than an interior door.

Both stains are not within 3 feet of an exterior wall.

Visible Mold

There does not appear to be any mold growth on these two stains at this point. The visible mold score would be **0**.

Both stains are not within 3 feet of an exterior wall.

Wet or Damp

Both areas were formed after a recent rain and appear wet. Together, they are larger than the size of a standard sheet of paper but smaller that the size of an interior door. This example would have a score of **2**.

Both stains are not within 3 feet of an exterior wall.

			Damage or Stains	Check if near exterior wall*	Visible Mold	Check if near exterior wall*	Wet or Damp	Check if near exterior wall*
✓	Ceiling		⓪ ① ● ③		● ① ② ③		⓪ ① ● ③	

Scoring Example 2

Damage in this area is severe and includes two wall sections that meet at the corner. Determine scores based on the combined size of this entire area.

Damage or Stains	Visible Mold	Wet or Damp
The damage to this wall is extensive, and the area is larger than the size of an interior door. Therefore, the score should be a **3**. This area is within 3 feet of an exterior wall.	The visible mold on this damaged wall area is larger than the size of an interior door, so the score should be a **3**. This area is within 3 feet of an exterior wall.	The damage to this wall is very discolored and likely wet.The size of the dampness is larger than an interior door, so the score should be a **3**. This area is within 3 feet of an exterior wall.

			Damage or Stains	Check if near exterior wall*	**Visible Mold**	Check if near exterior wall*	**Wet or Damp**	Check if near exterior wall*
✓	Walls		⓪ ① ② ●	✓	⓪ ① ② ●	✓	⓪ ① ② ●	✓

Note this damage in the "General Notes" section of the form for immediate attention.

Scoring Example 3

This entryway carpet is visibly saturated along the edges. Therefore, combine the size of the wet edges for scoring.

Damage or Stains

This entryway appears extremely wet. The size of the sides combined are larger than a sheet of paper, but smaller than an interior door, so the score would be a **2**.

This area is within 3 feet of an exterior wall.

Visible Mold

The carpet does not seem to have any visible mold. The score would be a **0**.

This area is within 3 feet of an exterior wall.

Wet or Damp

As with the Damage and Stains score, this extremely wet carpet is larger than a sheet of paper, but smaller than an interior door, so the score would be a **2**.

This area is within 3 feet of an exterior wall.

			Damage or Stains	Check if near exterior wall*	Visible Mold	Check if near exterior wall*	Wet or Damp	Check if near exterior wall*
✓	Floor		⓪ ① ● ③	✓	● ① ② ③	✓	⓪ ① ● ③	✓

Is it a stain or is it mold?

Many times this is difficult to determine. If you are not certain what you see is mold:

1) Score as **0** in the **Visible Mold** column.
2) Write a note in the **General Notes** section of the form for further evaluation.

	Pipes		⓪ ① ② ③		⓪ ① ② ③		⓪ ① ② ③	

General Notes *Not sure if mold or something else?*

Photographs can be useful for documenting conditions. You may consider taking a photograph of an area that seems severe and referring to the photograph in the **General Notes** section of the form.

Questions? Contact NIOSHBreathe@cdc.gov.