National Institutes of Health

Moisture and Mold Remediation Standard Operating Procedures

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A. Introduction

1. The presence of excessive moisture in buildings has been linked with occupant illnesses and deterioration of building material. When mold spores land on wet or damp areas they may begin to grow. Generally, mold will grow on materials where excessive moisture accumulates and remains undiscovered and/or uncorrected, especially in areas where there is relatively little air movement. As the mold grows, it digests the substrate and gradually destroys it. Even if mold cannot be seen, its presence may be noticed as a moldy or earthy smell. Controlling the moisture in the building is key to minimizing mold growth. This especially includes securing leaks and initiating dehydration procedures as soon as possible after they occur.

2. Currently, there are no federal regulations (e.g., OSHA, NIOSH, EPA) for airborne concentrations of mold spores. Strategies for mold prevention and remediation are based on best practices as determined in the field as well as using NIH and other industry guidelines. These strategies are utilized at the NIH and apply to health care and non-health care facilities. Two standards that provide the foundation of the NIH Mold and Water Intrusion Program are:

    - ANSI/IICRC S500-2021, "Standard and Reference Guide for Professional Water Damage Restoration"
    - ANSI/IICRC S520-2015, "Standard for Professional Mold Remediation"

3. This document outlines and describes the best and most current guidance for response to water intrusion and mold contamination.

B. Background

1. Molds are the most common forms of fungi found on the planet. They mostly reproduce through the formation of spores; which are microscopic cells that float through the indoor and outdoor air. When the spores land on a suitable surface and under suitable conditions, they can begin to grow and digest the surface. Inside buildings, mold growth may occur when and where excessive moisture accumulates in buildings or on building materials such as carpet; ceiling tile; insulation; wallboard; paper; wood; or (to a lesser extent) in heating, ventilation, and air conditioning systems. Left unchecked, molds can eventually destroy the surfaces upon which they live. Therefore, besides health effects, structural damage to buildings is another concern regarding uncontrolled mold growth.

2. All molds share the characteristic of being able to grow without sunlight. This explains why mold infestation is often found in damp, dark, hidden spaces; light and air circulation dry areas out, making them less hospitable (but not impossible) for mold growth.

3. Concern about indoor exposures to mold has increased along with awareness that mold exposures can cause a variety of health effects and symptoms; primarily allergic reactions. Molds, their fragments and metabolic by-products have all been associated with adverse health effects. The onset of allergic symptoms may be either immediate or delayed. They

may cause localized skin or mucosal infections, but rarely cause systemic infections in humans, except for persons with impaired immune function (AIDS), uncontrolled diabetes, or those taking immuno-suppressant drugs. Molds can cause asthmatic reactions in some individuals who are allergic to mold. However, most exposure in sensitive persons causes eye, skin, nose, or throat irritation. Symptoms other than allergic and irritant types are rarely reported as a result of inhaling mold in an indoor environment. Regardless, people who have chronic respiratory conditions, or immune system disorders need to be very careful around molds; and take measures to minimize their exposures as much as possible.

4. Molds are part of the natural environment; there is mold in every building on the earth. Molds play a vital part in the decomposition of organic matter throughout the planet. The air we breathe every day contains, at least, minute amounts of mold spores. It is impossible to eliminate all mold spores in the standard indoor environment. However, moisture control is the single most important strategy for reducing indoor mold proliferation. It is mold growth that is behind most health-related issues related to this subject.

C. Procedures

1. This instruction outlines methods to prevent mold growth, the conditions under which mold and moisture remediation must be performed and the responsibilities of the affected parties. The goal is to reduce or eliminate excess moisture in less than 48 hours as the primary means to prevent mold growth.

2. This manual applies to the ICs, Clinical Center, and to all ORS and ORF staff participating in moisture remediation.

3. Whenever the following conditions are present or suspected, the Division of Occupational Health and Safety (DOHS) must be contacted for consultation, prior to, or concurrent with initiating response activities outlined in this SOP:

    a. If the source of the water is NOT clean (e.g., not potable) or is suspected of being contaminated (i.e., with chemical, radiological, or biological sources), such as sewage, wastewater from food preparation or other similar areas, drainage from toilets, and/or effluent from laboratory and/or medical settings.

    b. Large areas of mold growth (greater than approximately 10 contiguous square feet).

    c. Any water leak or mold growth situations in sensitive indoor environments, including all healthcare settings, research laboratories and animal research spaces.

    d. If water and/or mold-damaged building materials are suspected to contain asbestos or other regulated materials (contaminants of concern).

    e. If the water and/or mold remediation work presents the potential for physical or other health and safety concerns, such as electrical hazards.

    f. Whenever stakeholder(s) wish to have the extent of water intrusion/penetration into

building materials quantified.

D. General Responsibilities

1. Division of Occupational Health and Safety (DOHS), upon request will:

a. Conduct a walk-through of the areas impacted by water intrusion and collect qualitative and quantitative data.

(1) Provide technical assistance and recommendations to facility managers and project officers for drying and moisture remediation.

(2) Evaluate areas suspected to be contaminated by mold growth and provide recommendations to facility managers and project officers for remediation.

b. Assist in identifying the underlying causes of water intrusion and mold growth and develop the appropriate response(s) to prevent recurrence.

c. Assess conditions for occupancy after water restoration or mold remediation activities.

2. The Office of Research Facilities Development and Operations (ORF):

a. Shall identify and fix the source(s) of water leak(s) or intrusion.

b. Shall perform or arrange for contract services for water removal and restorative drying of affected structure.

c. Shall notify DOHS of water intrusion when: total surface area affected is greater than $10ft^2$; the water source originates from other than a sanitary source (e.g., rain or sewage); or is suspected to be contaminated.

d. Shall notify DOHS immediately when an area of suspected mold growth is discovered.

3. Drying and Remediation Contractor:

a. Shall evaluate and document the extent of damage (e.g. water or mold) in the structure, systems and building contents using appropriate monitoring and detection equipment.

b. Shall designate a Project Leader, representing the Contractor, to work with ORF, DOHS representative, and facility personnel during the entire project.

c. Shall provide ORF and DOHS representative an action plan. Depending on the extent of the water intrusion and/or mold growth this shall be a written action plan. Additionally, depending on the response activity, the action plan will include a timeline and goals for drying and the implementation of mold remediation techniques.

d. Shall record and document all activities and services performed in response to the problem. Water restoration records would include complete moisture readings including

both atmospheric (temperature, relative humidity, and specific humidity) and moisture content levels of all affected building materials throughout the drying process. At least one set of readings each day shall be documented, preferably using the same measuring instrument each time. Records and documents will be provided to ORF and DOHS representatives.

e. Shall complete the project in a manner which complies with all government regulations and NIH policies and procedures.

4. Building Occupants:

a. Shall notify the Central Call Desk at 301-435-8000 or online at https://58000.nih.gov/ to report water infiltration.

b. Building occupants should report any health concerns due to the environmental conditions in a facility to the Occupational Medical Service (OMS) in Building 10, Room 6C306, for evaluation by a health practitioner.

c. Remember that mold odors are not necessarily dangerous, but they do indicate a problem that should be addressed.

E. Guidance for Moisture Infiltration (i.e. water intrusion/flooding event)

1. Initial Response

Building occupants should follow the following steps if water infiltration is discovered in an NIH facility:

a. Notify the Central Call Desk at 301-435-8000 or online at https://58000.nih.gov/ to report water infiltration.

b. Notify the Facility Management Team. https://www.orf.od.nih.gov/PropertyManagement/Pages/FacilityManagement.aspx. Click on the link that opens up the "Facility Management Team "email account."

c. Contact the DOHS at 301-496-3353 to request an evaluation of the affected area. Both the building occupant and building management team are responsible for implementing the DOHS recommendations. Depending on the recommendations, other services may be required; including those of a professional water restoration contractor.

d. Mechanical Rooms: Mechanical room leaks, standing water, consistent relative humidity levels above 60%, and condensation problems should be fixed as they are detected. If standing water is found in areas that have concrete or tile floors and there is no apparent visible mold, the DOHS does not need to be contacted.

2. Guidance for Remediating Moisture within the First 48 hours of Infiltration

In the event of water infiltration into building areas, action within the first 48 hours is

critical in prevention of mold growth.

a. Hazards: Water infiltration may create physical hazards. Some physical hazards to be aware of are electrical, slip/trip/fall hazards, falling ceiling tile, etc.

b. Identification of the source of the infiltration: The underlying cause of the infiltration needs to be identified; and managed in order to ensure drying occurs unimpeded. At times, permanent repairs may be unable to be completed, and interim measures put into place. The key is to ensure that water is no longer infiltrating into the area once remediation measures are begun.

c. Moisture control: Moisture problems should be identified, located, and corrected or controlled as soon as possible. Following the discovery of water infiltration into building spaces, the first step is to identify whether the moisture source is clean or polluted water.

   (1) If the water infiltrating the building originates from a sanitary water source (no chemical or biological pollutants or sewage), the sooner that repair, clean up and drying are accomplished, the greater the likelihood of preventing mold growth.

   (2) If mold growth is found or if the water is non-sanitary, contact the DOHS at 301-496-3353 and review the information in Moisture Infiltration after 48 Hours.

   (3) Contaminated Water: Contact the DOHS immediately if the water infiltrating a building area is (or is potentially) polluted. Following repairs to prevent any further infiltration, any contaminated ceiling tiles, carpet, upholstered furniture, paper products, or similar materials must be disposed of in sealed containers by personnel wearing appropriate personal protective equipment (protective clothing, gloves, boots, and, at a minimum, a N-95 type respirator). The entire area must be disinfected.

   Note: Potable, de-ionized, reverse osmosis, "laboratory" and distilled water are considered sanitary, unless they have come in contact with a pollution source. All others are considered non-sanitary. However, clean water may not remain 'clean' if it has come into contact with certain other surfaces or materials.

d. Remove excess water: The next step is to halt further moisture intrusion by repairing the water leak. Conduct an inventory of the water damaged areas, building materials, and furnishings, paying special attention to identifying wet carpet under cabinets, furniture, and furnishings. If you can't determine the start time of the water infiltration, it should be handled as if it has existed for more than 48 hours (see section titled "Guidance on Moisture Infiltration after 48 hours").

e. Determine whether materials are "dry": Using the appropriate detection equipment to evaluate materials in the impacted area for excess moisture (see section titled "Response Equipment").

f. Drying strategies: The objective of drying is to minimize the amount of time materials spend in an abnormally wet state and to return affected materials to an acceptable level of dryness as quickly and safely as practical. Once excess water is collected and removed, evaporation of the remaining water in materials should be promoted (Appendix 1).

g. Dehumidification / Ventilation / Air Circulation: To avoid secondary damage, moisture evaporating into the air should be exchanged with less humid air from other sources, and/or it should be collected and removed from the air through dehumidification. Blowers should also be used to direct air towards wet materials to circulate air and promote drying. Consider opening small holes along the bottom of walls (e.g., behind the cove base) and using an air injection system to promote air circulation inside wall cavities (see section on Restorative Equipment). In addition, consider operating air-conditioning equipment serving the areas being dried continuously (i.e., 24-hours a day) to promote dehumidification and ventilation. Care should be taken to protect openings to HVAC-equipment in any area when dust generating activities may occur as a result of restoration work. Temperatures in the drying environment should be maintained to enhance the evaporation rate and effectiveness of dehumidification.

   Note: Do not use blowers before determining that the water is clean or sanitary. Also, if damaged building materials are suspected to contain asbestos or other regulated materials, contact the Division of Occupational Health and Safety for analysis/ consultation prior to disrupting the regulated building material.

   Note: In addition, do not use blowers in patient care areas, contact the Division of Occupational Health and Safety for analysis/consultation. Per Joint Commission for Health Care Accreditation standards, all wet building materials will be removed and replaced with new materials. No active drying of building materials and furnishings is to take place within health care/patient care areas.

h. Documentation: Upon initial evaluation and throughout the restoration project, notes should be kept documenting all steps taken to correct the problem. Is recommended that a "drying log" be update daily and posted in a visible location in the affected area.

   (1) A drying log is a record of:

      (a) Daily temperature and relative humidity readings of both indoor and outdoor air;

      (b) Moisture readings and the recorded location of affected building materials;

      (c) Should contain the drying goal and dry standard for the affected materials.

   (2) A properly completed drying log, an industry standard, should also include: a sketch of the room/ area; a moisture map; the daily operating status of the building's HVAC system; and all the instruments and equipment used by the technician. In addition, mark each affected wall (use blue painter's tape or attach a

paper form) and record data daily to indicate moisture migration and moisture levels for that particular wall.

(3) Readings should be taken using the same instrument(s) each time to ensure consistency.

i. Cleanup Strategies: Appendix 1 presents strategies to respond to water damage. These guidelines are designed to help avoid the need for remediation of mold by taking quick action before growth starts. It is essential that water-impacted materials be dried and/or removed as soon as possible following a leak event to minimize the possibility for mold growth. It is recommended that building materials be dried and/or removed within 48-hours following a water release event to minimize the potential for mold growth. To reiterate, all wet materials within health care/patient care areas will be removed; unless after specific consultation with DOHS and a patient safety representative, the materials are permitted to dry *in situ*.

3. Guidance on Moisture Infiltration After 48 hours

a. When water infiltration has remained uncorrected or building materials are not "dry" after 48 hours, mold growth may have begun. There may be visible evidence of growth or a moldy, damp smell. However, evidence of mold may be deduced merely by the odor, without readily apparent visible evidence. In these cases, the situation is now one of potential mold remediation. The guidance provided here is for information purposes only and is not a substitute for DOHS or other professional expertise.

b. Remediation efforts are more intensive, extensive, and costly than prevention; and they must be designed to protect the health of building occupants and remediation personnel. Recommendations for cleanup or remediation by DOHS will depend on the extent of the damage, the types of materials affected, and the presence/type of mold growth. DOHS will make recommendations on whether current occupants should be relocated; on the containment/cleanup methods to be used (including whether remediation can be done by in-house personnel or if professional contractors are required); and on the types of personal protective equipment required by remediation personnel.

c. Air handling units (AHUs) servicing the affected area(s) should not be shut down unless gross, visible mold growth has been identified (especially within any duct work) and a containment area cannot be established. Having the AHU running helps the drying process and controls humidity in the area.

d. If water infiltration necessitates the replacement of any portion of a gypsum shaft or partition assembly, or any interior wall, ceiling or floor finishes, the facility manager will coordinate the repairs/replacement through the Division of the Fire Marshal, ORS. Use of specific materials and construction methods may be necessary to maintain required fire protection ratings of partition and shaft assemblies. U.L. classified wall, ceiling, and floor finish materials may be required in accordance with the International Building Code, the National Fire Protection Association 101 *Life Safety Code*, or the

NIH Design Requirements Manual. In addition, any extensive repairs that affect significant portions of an area may affect existing emergency egress patterns. Any work affecting building egress (such as the blocking of doors or closing of hallways) must be evaluated by the Division of the Fire Marshal.

e. Mold Growth: Water damaged building materials, especially those that are porous – such as wallboard and/or ceiling tiles – that have been wet for an extended period of time or have been chronically wet can develop mold contamination. If mold growth is encountered during the restoration project, water damage restoration activities should stop until such time that the area of existing or suspected mold contamination is contained. Appendix 2 presents strategies to respond to mold growth when found or suspected on indoor materials, including those mentioned in Appendix 1. These remediation guidelines are for building materials that have or are likely to have mold growth. These guidelines are designed to protect the health of occupants and cleanup personnel during remediation and are based on the size and type of material affected by water damage and/or mold growth. If possible, remediation activities should be scheduled during off-hours when building occupants are less likely to be affected.

f. Although the level of personal protection suggested in these guidelines is based on the total surface area contaminated and the potential for remediator and/or occupant exposure, professional judgment should always play a part in remediation decisions. These remediation guidelines are based on the size of the affected area to make it easier for remediators to select appropriate techniques, not based on health effects or research showing there is a specific method appropriate at a certain number of square feet.

g. In cases when extensive or hidden mold is expected, when remediation may involve demolition of moldy materials that could generate elevated airborne mold sources, or when sensitive individuals are present, a more cautious approach to remediation may be required. Always ensure the safety and protection of remediators and building occupants from exposure to mold. In all these cases, DOHS must be involved to evaluate the nature and extent of damage; to help determine the appropriate response actions and control methods; and to document the effectiveness of remediation.

1. **Prevention Strategies:**

The key to mold prevention is moisture control. The most important initial step in prevention is visual inspection and regular checks of the building envelope and drainage systems.

a. Fix leaks immediately;

b. Clean and dry wet or damp spots immediately;

c. Remove mold-contaminated materials;

d. Regularly inspect and maintain heating, ventilating, and air conditioning (HVAC) systems;

e. Routinely inspect and clean HVAC drip pans; check proper flow and that drain is unobstructed;

f. Maintain low indoor humidity, ideally 30-60%;

g. Vent moisture-generating equipment to the outside, where possible;

h. Increase surface temperature or reduce the humidity to prevent condensation that results when surface temperature is below dew point temperature. Surface temperature can be increased with insulation or by increasing air circulation. Humidity can be reduced by repairing leaks, increasing ventilation (if outside air is cold and dry), or by dehumidifying (if outdoor air is warm and humid);

i. Keep gutters and downspouts in working order and ensuring that they drain water away from the foundation;

j. Provide adequate drainage and slope the ground away from building foundations so that water runs away from the building;

k. Regardless of the original source of water damage (e.g., flooding versus water leaks from point-of-use fixtures or roofs), remove wet, absorbent structural items (e.g., carpeting, wallboard, and wallpaper) and cloth furnishings if they cannot be easily and thoroughly cleaned and dried within 48 hours; replace with new materials as soon as the underlying structure is declared by the facility manager to be thoroughly dry.

G. Off-Campus Leased Facilities

1. The DOHS references this policy when asked to evaluate possible mold and water infiltration at privately owned, off-campus facilities.

2. For privately owned, off-campus facilities, the DOHS conducts indoor environmental evaluations and mold investigations with ORFDO Facility personnel assigned with management oversight of the leased facilities, with the assistance of building property owners.

H. Building Re-occupancy

1. Upon completion of water and/or mold remediation, the affected areas will be surveyed using the building re-occupancy checklist. The purpose of the survey is ensuring that the building is free of excessive moisture, mold, and physical hazards.

2. Because even “dead” mold can still potentially cause health problems due to mycotoxins and mold-related, volatile organic compounds (MVOCs), mold removal should be complete and no dead mold should remain behind after remediation, regardless of the size and scope of the remediation project.

3. The building re-occupancy checklist can be found in Appendix 3. This checklist is not a

requirement for re-occupancy; however, the information contained within should be verified to have been completed, or acknowledged, prior to re-opening a space to its occupants.

I. Response Equipment – this is not a comprehensive list of all equipment that can be used to bring a space back to its baseline condition; just some of the more common ones used at NIH. For a more extensive list of equipment, refer to the ANSI/IIRCR S500.

1. Moisture Monitoring and Evaluation Equipment

The following is a list of equipment that can be employed to evaluate high moisture levels and facilitate drying of affected areas.

a. Moisture Meters: A moisture meter may be useful in the following situations:

(1) When a stain has been found on wallboard and a decision is needed as to whether the stain can be cleaned; or if further action is required;

(2) Sometimes it is difficult to determine when wallboard has been completely dried. In these cases, use a moisture meter to check drywall in the affected area and compare the reading to a non-affected area. Readings should be the same;

(3) Some moisture meters use metal prongs to penetrate wallboard. Some are non-destructive and involve resting the meter on the surface of the material. Others offer a choice of penetrative or non-destructive analysis. Safety professionals should use their best judgement based on the situation and should consult applicable user manuals as needed;

(4) Table 1 references acceptable moisture levels for select building materials provided by William Yobe & Associates & U.S. Forest Products (USDA);

Table 1 - Acceptable moisture levels for select building materials

Material/Component	Moisture Content %
Baseboard	7 to 10
Gypsum Wallboard	7 to 10
Hardwood Flooring	7 to 10
Framing Lumber	15 to 19
Wood Furnishings (interior)	7 to 12

Source: William Yobe & Associates & U.S. Forest Products (USDA)

(5) Because the moisture meter uses the mild electrically conductive properties of water molecules, underlying metal materials such as wall studs, conduit, etc. may be registered by the meter and provide a "false" positive result. Because of this, it is best to use a moisture meter in conjunction with the infrared camera, described below.

b. Infrared Camera (FLIR): A thermal camera may be useful in the following situations:

(1) Infrared (IR) cameras are used to detect surface temperature. An infrared camera produces a thermal image of a material that can provide rapid identification of potentially moist areas by indicating temperature differences at the surface of materials. Areas of potential moisture show up as cooler than the surrounding areas and are imaged as such in the viewfinder. In these cases, use a thermal camera to check drywall in an affected area and compare the reading to the surroundings to detect thermal disparities attributed to moisture;

(2) This method may be used in conjunction with a moisture meter. The IR camera shows suspect elevated moisture, and the meter can confirm or rule out the presence of moisture;

(3) Because a FLIR camera uses temperature to indicate the potential presence of water, there are certain limitations with relying, solely, on this device to determine the presence of moisture/water;

a. If the water source is due to a steam (or other high-temperature water) leak, the temperatures inside the materials may be at – or even above – ambient temperatures and the camera may fail to register the moisture intrusion;
b. During some seasons of the year, exterior walls can be much cooler than ambient interior temperatures. This will be indicated by the FLIR and may be misinterpreted as moisture saturation, when instead it is just a cold, dry wall;

(4) Using a moisture meter in conjunction with the FLIR will provide most accurate results when attempting to quantify the extent of any moisture/water penetration incident.

c. Borescope: A borescope may be useful in the following situations:

(1) To inspect behind walls for pockets of water or mold;

(2) To inspect inside ducts, behind motors and compressors of HVAC systems.

d. Ambient relative humidity detector: This device (e.g. the TSI, IAQ Calc) measures the relative humidity levels of an interior space. Absent a definitive water source, some instances of mold growth can occur because the relative humidity of the space is above 60%, usually due to inadequate ventilation of the area.

(1) For any complaints of mold growth, without a specific water intrusion scenario, use the IAQ Calc to take relative humidity measurements in a least three different locations within the space;

(2) Record results; and provide information to building maintenance so they can evaluate the ventilation system and make adjustments/repairs as needed.

2. Restorative Equipment

a. Wet Vacuum: Wet vacuums are vacuum cleaners designed to collect water. They can

be used to remove water from floors, carpets, and hard surfaces where water has accumulated. They should not be used to vacuum porous materials, such as gypsum board. They should be used only when materials are still wet – they may spread spores if sufficient liquid is not present. The tanks, hoses, and attachments of these vacuums should be thoroughly cleaned and dried after use since mold and mold spores may stick to the surfaces; and may grow inside the unit itself.

b. Dehumidifiers: Dehumidifiers are devices designed to remove water vapor from the air. They can be used to lower humidity levels in affected areas to aid in dying. The number of dehumidifiers is dependent on the type of dehumidifier being used, the size of the affected area, and the type of building material affected.

c. Air Movers and Axial Blowers: Air movers are designed to force air along floor and wall surfaces, while axial blowers are designed to force a large volume of air across a large area. Residential box fans, circular fans, etc. should not be used for structural drying in affected areas due to possible electrical shock hazards. Fans and blowers shall not be used in health/patient care environments.

d. Air Injection System: Air injection systems work by using an air mover and air hose system to inject air through tiny nozzles into the wall cavity. Small holes are drilled into drywall or cabinets usually behind the cove base and then the injection nozzles are inserted. Pressurized air is pumped in. These systems work well to dry out inaccessible areas without cutting large ventilation holes. These systems are not to be used in health/patient care environments.

e. HEPA Vacuum: HEPA (High-Efficiency Particulate Air) vacuums are recommended for final cleanup of remediation areas after materials have been thoroughly dried and contaminated materials removed. HEPA vacuums are also recommended for cleanup of dust that may have settled on surfaces outside the remediation area. The user must ensure that the filter is properly seated in the vacuum so that all the air must pass through the filter. When changing the vacuum filter, remediators should wear PPE to prevent exposure to the mold that has been captured. The filter and contents of the HEPA vacuum must be disposed of in well-sealed plastic bags.

J. Mold Remediation

1. Microbial "Mold Remediation" Policy

   The NIH follows the latest versions of the Institute of Inspection Cleaning and Restoration Certification: "Standard for Professional Water Damage Restoration: (ANSI/IICRC S500); and Standard for Professional Mold Remediation (ANSI/IICRC S520). Prior to and during activities that disturb mold, engineering controls and work practices shall be implemented to prevent mold contamination from spreading to other clean areas. Remediation efforts should be coordinated with the DOHS at 301-496-3353.

2. Determine the size of the impacted area: Assess the size of the moisture problem before planning the remediation work (see Appendix 2). Remediation should not proceed until the

source of the water intrusion has been fixed, or the problem may reoccur. Remediation techniques may vary greatly depending on the size and complexity of the job; and may require revision if circumstances change or new facts are discovered.

3. Biocides, Sampling and Verification

   a. Biocides: The goal of mold remediation is to remove the mold and prevent human exposure and damage to building materials. Physically removing mold contamination is the primary means of remediation. Even after mold is rendered non-viable, the remaining mold fragments are still allergenic, and some are potentially harmful. Therefore, the use of biocides is not routinely recommended during remediation. However, there may be some instances when the use of a biocide may be justified, such as when immune-compromised individuals are present. Biocides are toxic to humans as well as molds. If biocides are used, occupants must first be evacuated from the area. Biocides must be applied with adequate ventilation. Remediation personnel must wear appropriate personal protective equipment. Since some biocides are registered pesticides with the EPA, these may only be applied by licensed applicators. The NIH does not normally use biocides for mold remediation. Any requested use of biocides will need to be approved by, and closely coordinated with, DOHS.

   b. Mold Sampling: In most cases, sampling for mold is unnecessary even if there are visible signs of mold or moldy, musty odors. In some specific instances, such as where litigation is involved or the source of the mold is unclear, then sampling may be part of the site evaluation. Air sampling may be necessary if an individual(s) has been diagnosed with a disease that is or may be associated with mold exposure (e.g., aspergillosis) and the occupational health physician/medical practitioner desires to confirm the causative agent. Sampling for mold should only be done after a sampling strategy has been developed. Since no OSHA or other occupational exposure levels have been set for mold, sampling – by itself – cannot be used to check a building's compliance with existing standards.

   c. Post Remediation Verification: Remediated structures, systems, and contents can be considered clean (by post remediation evaluation) when contamination or unrestorable contaminated materials and debris have been removed, and surfaces are visibly free of dust. Additionally, remediated areas should be free of odors.

K. References

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APPENDIX 1 WATER DAMAGE – CLEANUP AND MICROBIAL GROWTH PREVENTION

(http://epa.gov/mold/table1.html)

Guidelines for response to clean up water damage and to help prevent microbial growth.

Water-Damaged Material:	***Action(s):***
Books & Papers	• For non-valuable items, discard books and papers • Photocopy valuable/important items, discard originals • Freeze (in frost-free freezer or meat locker) or freeze-dry
Carpet & Backing (dry within 24-48 hours)	• Remove water with water extraction vacuum • Reduce ambient humidity levels with dehumidifier • Accelerate drying process with blowers • Steam clean • Ensure the subfloor under the carpet is clean and dry
Ceiling Tiles	• Discard and replace
Cellulose Insulation	• Discard and replace
Fiberglass Insulation	• Discard and replace
Concrete or cinder block surfaces	• Remove water with water extraction vacuum • Accelerate drying process with dehumidifiers, blowers, and/or heaters
Hard surface, porous flooring (Linoleum, tile grout, vinyl)	• Vacuum or damp wipe with water and mild detergent and allow to dry; scrub if necessary • If suspected to need attention, check to make sure subflooring is dry; dry sub-flooring if necessary
Non-porous surfaces (Plastics, metals, seal-coated tiles/grout)	• Vacuum or damp wipe with water and mild detergent and allow to dry; scrub if necessary
Upholstered furniture	• Remove water with water extraction vacuum • Accelerate drying process with dehumidifiers, blowers, and/or heaters • May be difficult to completely dry within 48 hours. If the piece is valuable, consider consulting a restoration/water damage professional who specializes in furniture
Wallboard (Drywall and gypsum board)	• May be dried in place if there is no obvious swelling and the seams are intact. If not, remove, discard, and replace. “When in doubt, tear it out” • Wet wallboard in patient/health care areas should be removed • Ventilate the wall cavity, if possible and safe to do so. Do not direct blowers toward contaminated (e.g. asbestos, mold, etc.) building materials
Window Drapes	• Follow laundering or cleaning instructions as recommended by the manufacturer.
Wood Surfaces	• Remove moisture immediately and use dehumidifiers, gentle heat, and blowers for drying. (Use caution when applying heat to hardwood floors) • Treated or finished wood surfaces may be cleaned with mild detergent and clean water and allowed to dry • Wet paneling should be pried away from wall for drying

If mold growth has occurred or is suspected, consult Table 2 for proper guidelines for mold remediation/prevention.

***Note**: mold growth can occur sooner than, or after 48 hours; the EPA provides this time as a suggestion only. If there is doubt, consult the safety office.

***Note**: these guidelines are for damage caused by clean water. If contamination (e.g. chemical, radiological, or biological) is suspected, contact the Division of Occupational Health and Safety for consultation and cleanup assistance. In this case, proper Personal Protective Equipment and adherence to OSHA Standards are required. Do not use blowers before determining that the water is clean or sanitary. Also, if damaged building materials are suspected to contain asbestos or other regulated materials, contact the Division of Occupational Health and Safety for analysis / consultation prior to disrupting the regulated building material.

Further remediation information is available in the IICRC *Standard and Reference Guide for Professional Water Damage Restoration.*

APPENDIX 2 – WATER INTRUSION AND MOLD REMEDIATION PROCESS CHART

Remediation methods start with the type of material that had come into contact with the water.
Begin at "Type of Material" and follow the path down for the proper action, and if necessary, remediation method, PPE and containment required.
Tables are color-coded to correspond to applicable action on the chart.

Type of Material																							
Hard Surfaces & Porous Flooring		Wood Surfaces		Wallboard, Gypsum Drywall		Upholstery & Drapes		Ceiling Tiles & Insulation		Paper & Books		Cinder Block & Concrete		Carpet & Backing									
"Wet" Time Actions																							
Less than 48 Hours	More than 48 Hours	Less than 48 Hours	More than 48 Hours	Less than 48 Hours	More than 48 Hours	Less than 48 Hours	More than 48 Hours	Less than 48 Hours	More than 48 Hours	Less than 48 Hours	More than 48 Hours	Less than 48 Hours	More than 48 Hours	Less than 48 Hours	More than 48 Hours								
10, 11		4, 5, 6, 10, 12		8, 9		4, 6, 13, 14		7		1, 2, 3		4, 6		4, 5, 6, 11									
Area of Mold Contamination																							
<10 sq. ft.	10-100 sq. ft.	>100 sq. ft.	<10 sq. ft.	10-100 sq. ft.	>100 sq. ft.	<10 sq. ft.	10-100 sq. ft.	>100 sq. ft.	<10 sq. ft.	10-100 sq. ft.	>100 sq. ft.	<10 sq. ft.	10-100 sq. ft.	>100 sq. ft.	<10 sq. ft.	10-100 sq. ft.	>100 sq. ft.	<10 sq. ft.	10-100 sq. ft.	>100 sq. ft.	<10 sq. ft.	10-100 sq. ft.	>100 sq. ft.
Clean Up/Mold Remediation Methods after 48 Hours																							
A, B, C	A, B, C	A, B, C, D	A, B, C	A, B, C,	A, B, C, D	C	C, D	C, D	A, C	A, C, D	A, C, D	D	D	D	C	C	C	A, C	A, C	A, C	A, C, D	A, C, D	A, C, D
Personal Protective Equipment (PPE)																							
M	L or F	F	M	L or F	F	M	L or F	F	M	L or F	F	M	L or F	F	M	L or F	F	M	L or F	F	M	L or F	F
Containment																							
NR	L	F	NR	L	F	NR	L	F	NR	L	F	NR	L	F	NR	L	F	NR	L	F	NR	L	F

Action Tables – follow the action/method below that corresponds with the number/letter above

Action for Areas, Wet Less than 48 Hours Damage caused by clean water only	
1	Discard non-valuable items
2	Photocopy valuable items; discard originals
3	Freeze (frost-free) or freeze dry
4	Remove water with water extraction vacuum
5	Use dehumidifier to reduce humidity
6	Accelerate drying with heaters and/or fans. DO NOT use heat on carpet; USE CAUTION with heat on wood floors
7	Discard and replace
8	Dry in place if there is no swelling and seams are intact; otherwise discard and replace
9	Ventilate wall cavity
10	Vacuum or damp wipe with water/mild detergent. Allow to dry; scrub if necessary.
11	For flooring, ensure sub-flooring is clean and dry
12	Pry wet paneling away from wall for drying
13	May be difficult to dry; if items are valuable, consult restoration professional
14	Launder or professionally clean fabrics

Clean-up/Remediation Methods after 48 Hours Damage caused by clean water only	
A	**Wet Vacuum** – If material is porous, some mold fragments or spores may remain, but they will not grow if the material is completely dried
B	**Damp wipe** surfaces with water/mild detergent solution. On wood floors, use a wood floor cleaner
C	**Use HEPA** (High Efficiency Particulate Air) vacuum after material is dry. Dispose of vacuum bag as contaminated waste (double bag and seal)
D	**Remove and discard** water damaged materials and seal in plastic bags inside the contaminated area. HEPA vacuum after it is dry.

PPE Codes May vary depending on conditions encountered	
M	**Minimum** – Gloves; N-95 respirator; goggles/eye protection
L	**Limited** – Gloves; N-95 respirator or half-face with HEPA filter; goggles/eye protection; disposable coveralls
F	**Full** – Gloves; full-face respirator with HEPA filter; disposable, full body coveralls; head and foot coverings

Containment Codes May vary depending on conditions encountered	
NR	**None Required**
L	**Limited** – Contain remediation area with 1-layer polyethylene sheeting; block off supply and return air vents; keep under negative pressure with HEPA-filtered fan unit
F	**Full** – Contain remediation area with double poly sheeting; use airlock entrance; secure ventilation to/from the affected area; maintain negative pressure with HEPA-filtered fan unit, exhausted outside of the building

Appendix 3

RE-OCCUPANCY CHECKLIST

Date inspection conducted: _____ **Location (Bldg/Room):** _____

Name(s) of those participating in this inspection: _____

Topic	Current Status	Action Needed
Water Intrusion		
1. Have affected building materials been returned to a "dry" condition (unaffected state)?	□ Yes □ No	
2. Have water damaged building materials been replaced?	□ Yes □ No	
3. Is the affected area free of excessive moisture, humidity, and odors?	□ Yes □ No	
4. Has the carpet been professionally cleaned and is free of odors and stains?	□ Yes □ No	
Mold Contamination		
1. Is the area free of visible mold growth?	□ Yes □ No	
2. Have porous mold contaminated surfaces been removed and replaced?	□ Yes □ No	
3. Have nonporous surfaces been wiped with a disinfectant cleaning solution?	□ Yes □ No	
4. Have all visible signs of mold been removed with remediation?	□ Yes □ No	
Housekeeping		
1. Is the area free of any slip/trip/fall hazards?	□ Yes □ No	
1. Are buildings materials (e.g., ceiling tile, drywall, and carpet) clean and in good condition?	□ Yes □ No	
2. Has furniture been returned to original position?	□ Yes □ No	

Monitoring: _____

_____

_____

_____

Comments: _____

_____

_____

_____