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MOLD REMEDIATION AND HUMIDITY CONTROL

At:

UNIVERSITY OF MARYLAND
ELKTON HALL

Prepared for:
University of Maryland Department of Residential Facilities

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1.0 EXECUTIVE SUMMARY

Building Dynamics, LLC (BDL), conducted a mold remediation and humidity control evaluation for moisture and mold in previously moisture affected areas in Elkton Hall, located at Elkton Hall in the University of Maryland Campus.

At the start of the fall 2018 – 2019 academic semester, widespread mold growth was found in the residence hall, Elkton Hall at the University of Maryland, College Park (UMD). The Department of Residential Facilities (DRF) requested Building Dynamics, LLC (BDL) to evaluate the incident to determine the root cause of this condition and the effectiveness of response measures. BDL was also to conduct an engineering study and recommend the best strategy for preventing a future reoccurrence.

- What caused mold growth at Elkton Hall?

Mold growth was found in localized areas on all residential floors and was most often reported on furniture and the air conditioner (fan coil units) and window frames. It was occasionally found on furnishings and some contents. The majority of surfaces were free of mold growth.

The mold growth was humidity-related, from outside infiltrating the building during the summer. Indoor relative humidity (RH) was particularly elevated this past summer due to sustained hot/humid weather, creating conditions inside Elkton which grew mold.

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 HVAC system exhausted more air than supplied, placing the building under "negative pressure," drawing in unconditioned humid air. Extreme hot/wet/humid weather during the summer of 2018 caused mold growth throughout the region in buildings whose HVAC systems had not been designed for humidity control (i.e., Elkton).

- Has mold growth been remediated?

A comprehensive cleanup of Elkton Hall effectively remediated mold and restored the indoor environment to normal background conditions.

Remediation was conducted consistent with national guidelines. Affected surfaces were wiped off with disinfectant and discard water-damaged. Work was controlled to prevent mold spreading and ensuring a safe environment prior to re-occupancy.

DRF formulated a plan for relocating residents one floor at a time to allow for remediation of all surfaces and air-conditioning units (fan coils). DRF hired two restoration contractors and a mechanical contractor to expedite this process, assisted by

DRF staff and management. An additional consultant was also retained for independent verification that conditions on each floor were acceptable prior to re-occupancy.

Remediated rooms were cleared for re-occupancy by independent inspectors under the supervision of a Certified Industrial Hygienist. They verified that no growth or dust was visible on structural surfaces, furnishings, furniture or contents and all surfaces had been cleaned, sanitized and dried.

- Is humidity being controlled to prevent additional mold growth?

Air-conditioning in Elkton is provided by one fan coil unit per room. Contractors evaluated each unit to identify and repair any malfunctions related to humidity control. This improved humidity control in some rooms.

BDL had UMD set up continuous temperature/humidity monitors in representative rooms and found that RH still increased to over 80% on hot/humid days.

Monitoring was repeated in seven Elkton rooms after the onset of cooler, fall weather. RH in dorm rooms averaged ~45%, with a few brief peaks up to 60%. This is well below conditions needed to grow mold (i.e., frequent days exceeding 80%). With forecasted weather not exceeding 65°F through the winter, humidity-related mold will not be able to grow for several months. This will allow time to complete the necessary engineering work and implement improved humidity control.

- What other measures are needed to control humidity

BDL evaluated the cost-effectiveness of various strategies for lowering humidity and concluded:

- Significant improvements cannot be made in building pressurization at Elkton without system modifications.
- Lower-cost HVAC adjustments will not provide sufficient improvement in de-humidification to prevent mold growth.
- Replacing the fan coil unit controllers would be too costly.
- If electric reheat is added to the fan coil units, in addition to the new controllers, humidity would be sufficiently controlled, but at a high cost.
- Adding a Dedicated Outdoor Air System (supplemental central unit that supplies conditioned outside air) would provide effective dehumidification and pressurization to improve IAQ and minimize the potential for mold growth at Elkton. Funding and scheduling are not feasible to implement this in time for the next cooling season.
- The most cost-effective solution to the Elkton humidity control problem is installation of a small dehumidifier in each room to supplement the fan coil.

Is mold a health hazard?

(a) Because the majority of building occupants are not affected by mold, it is not considered a health hazard like asbestos or carbon monoxide. Mold spores are ubiquitous in the environment and there are no accepted standards for occupant exposure. Public Health Officials advise that visible mold growth in a building be eliminated, as a precaution.

(b) There are many different types of mold, but all present similar health risks to building occupants. Mold health effects are generally limited to temporary symptoms in individuals with pre-existing allergies. Allegations that some molds are particularly toxic to occupants are not accepted by Public Health officials.

(c) Simply testing for mold cannot determine the cause of occupant-reported symptoms. Occupants suspecting mold-related illness first need a medical diagnosis by a physician. If this diagnosis could be related to environmental exposure, the physician must consider the patient's environments, focusing on the timing and location of all potential contaminants, not just mold.

(d) When Elkton residents attributed symptoms to mold exposure and a physician, determined that this may be mold-related, DRF facilitated temporary relocation.

2.0 INTRODUCTION

At the start of the fall 2018 – 2019 academic semester, widespread mold growth was found in the residence hall, Elkton Hall at the University of Maryland, College Park (UMD). The Department of Residential Facilities (DRF) requested a Building Dynamics, LLC (BDL) evaluation of the building and its systems to determine the root cause of this condition and to review DRF's response to mold growth in Elkton.

BDL conducted this investigation between September 25 and November 14, 2018. BDL met with DRF staff, reviewed documentation, inspected affected rooms and air-conditioning equipment, evaluated fan coil controls, observed contractors remedial work, conducted progress inspections, data-logged room conditions and assisted UMD Communications with interviews and statements.

BDL's assessment of mold growth was consistent with ASTM D7338- Standard Guide for Assessment of Fungal Growth in Buildings. Based on this protocol, BDL uses the term "suspect growth" based on visual characteristics to identify likely mold growth on surfaces.

Elkton Hall is an eight-story dormitory built in 1966 housing approximately 550 residents. Rooms range in size from single, double, triple and quad and each floor has a large bathroom. Elkton Hall is air-conditioned and has a laundry facility located in the basement.

Air-conditioning is provided by a fan coil unit in each room. These two pipe units provide heating or cooling, depending on outside air temperatures. Heating water or chilled water is supplied to the fan coil units from heat exchangers and pumping system in Elkton Hall, which in turn is supplied from a nearby Satellite Central Utility Plant. In summer mode, the plant provides a consistent 44 deg chilled water to the fan coil units.

Chilled water pressure differential is maintained at approximately 20 PSI by modulating variable speed pumps in the Elkton Hall mechanical room. The automatic control valves in the fan coil units are 2-way valves that modulate to maintain room temperature setpoint on floors G-7, with 3-way control valves located on the 8th floor to ensure continuous system flow. Fan speed is also controlled by room temperature in Low, Medium or High speed. On a call for cooling, the fan starts in low speed and the valve is positioned to 33% open. On a further call, the fan is set to medium speed and the valve is 66% open. On a full call for cooling, the fan is set to high speed and the valve opens 100%. Outside air ventilation for the dorm rooms is via natural ventilation through windows. Exhaust fans serve the bathrooms and basement laundry. A small air unit in the basement provides make-up air for the laundry room.

3.0 EXTENT OF MOLD GROWTH

It is necessary to understand when and where mold has grown to eliminate exposure and prevent a re-occurrence.

DRF reports longstanding concerns for humidity levels in Elkton Hall and minor suspect growth in past summers. Observations of suspect growth became more frequent in August 2018 and, by September, mold was found on all occupied floors (1 – 8).

Mold growth was most often reported on the furniture (desks, dressers, chairs and shelves), and the fan coil units (mostly on the supply vent and chilled water pipe insulation). The next most reported site was window frames. Residents occasionally reported mold on curtains, windows, closets, bed springs, shoes, backpacks, doors, ceilings, floors and contents. An example of growth on contents was a canvas bag stored by the fan coil return vent, which was blocked by storage under the bed. This blocked made the fan coil colder and prevented air circulation around the bag, creating condensation, which grew mold.

4.0 ROOT CAUSE ANALYSIS

Many factors can contribute to mold growth. Identifying the critical factor(s) initiating mold growth is critical to preventing a re-occurrence.

4.1 Type of Mold

Mold growth in buildings consists of variety of types commonly present in the environment. Because all types involved with building growth present similar health risks, it is not necessary to determine the species of mold. The category of mold growth is important, and this can be deduced from appearance and pattern. Humidity-related growth is characterized by powdery surface deposits, often spotted. It occurs on materials in frequent contact with high humidity or at a cool temperature promoting condensation. This is readily distinguished from water damage mold, which was not found at Elkton. Moderate increases in RH can be associated with occupant discomfort, but do not initiate mold growth. However, very high indoor humidity (i.e., frequently exceeding 80%) can exceed threshold moisture conditions promoting mold growth.

DRF continuously measure temperature and relative humidity at Elkton for BDL. This confirmed that RH at Elkton frequently exceeded 80% in summer conditions and could support mold growth. Humidity-related mold is often localized and found only on surfaces which are cooler (i.e., chilled water pipes) or blocked from air circulation (allowing moisture accumulation) or on materials which are more susceptible to growth (i.e., suede).

4.2 Lack of Humidity Control

The Elkton HVAC system was replaced in 2011 to provide air-conditioning. However, the system installed was designed to control temperature, not humidity, thus allowing relative humidity (RH) to rise during humid weather. For example, when the thermostat calls for cooling, the coil does not become cold for the duration needed to wring out moisture. The result is a cool room with high RH susceptible to mold growth.

BDL confirmed the inability of Elkton fan coil units to remove moisture from the air by observing their operation during various weather conditions. In all cases, cooling coils and drip pans remained dry. BDL then had UMD set up continuous temperature/humidity monitors. While the temperature remained constant at 74℉, RH increased on hot days to over 80%.

4.3 Air Infiltration

A major factor contributing to mold growth can be HVAC systems which exhaust more air than supplied, placing the building under “negative pressure,” drawing unconditioned air into the building. Elkton Hall is negatively pressurized by design (the only outside air provided is a small amount to make up for laundry exhaust). Negative pressure caused by design air imbalances can be increased by “negative stack effect” (cold air sinks from the top of a high-rise during air-conditioning drawing in make-up air) and wind blowing against the building.

BDL used smoke tubes to test pressurization to the outside through windows and consistently found the building strongly negative.

4.4 Extreme Summer Weather

The Baltimore/DC area experienced unusually hot/humid weather during the summer of 2018, which was the wettest in recorded history. This caused mold growth throughout the region in buildings like Elkton Hall, where HVAC systems had not been designed for humidity control.

4.5 Other Factors Potentially Contributing to Mold Growth

BDL reviewed these additional factors and found they were unlikely to be significant contributors to overall mold growth:

- Thermostats set too low (RH are air temperature is lowered)
- Windows open while air-conditioning (high humidity condenses on cool surfaces)
- Poor air circulation (moisture can accumulate on covered-over materials)
- Fan speed settings (fan coils remove more moisture at lower speed)

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 to rise during humid weather to levels exceeding the threshold for growing mold. Additionally, the HVAC system exhausted more air than supplied, placing the building under "negative pressure," drawing in unconditioned humid air. Extreme hot/wet/humid weather during the summer of 2018 caused mold growth throughout the region in buildings whose HVAC systems had not been designed for humidity control (i.e., Elkton).

5.0 REMEDIATION

Elimination of mold growth is most effectively accomplished by either wiping off surface growth or discarding water-damaged materials. All surfaces must be sanitized and dried, with moisture sources controlled. The remediation process must not allow mold spread beyond the remediation area and occupants should be kept away during the work. All exposed surfaces should be sanitized at completion, and should be re-inspected and re-treated, if necessary, before occupants return.

5.1 Initial Response to Elkton Mold

Dehumidifiers were set up and operated in various locations, primarily in residential corridors. Suspect growth at Elkton was originally addressed on a room-by-room basis.

When residents reported mold to DRF, accessible surfaces in rooms were inspected and affected areas were cleaned. Residents were advised to check their contents and clothes for signs of mold growth, and either discard or clean. UMD made the dormitory washer/dryers available at no cost and assisted with additional cleaning as needed. Furniture with significant growth was replaced. When students attributed symptoms to mold exposure and a physician, determined that this may be mold-related, DRF facilitated temporary relocation of that resident.

Effectiveness of mold remediation in individual room requests was dependent on access to surfaces. Hidden surfaces were addressed when residents assisted remediators by moving room contents.

5.2 Comprehensive Restoration

DRF determined that a building-wide effort was needed to address mold at Elkton. A plan was formulated for relocating residents one floor at a time to facilitate remediation of all surfaces and air-conditioning units (fan coils). DRF hired two restoration contractors and a mechanical contractor to expedite this process, assisted by DRF staff and management. An additional consultant was also retained for independent verification that conditions on each floor were acceptable prior to re-occupancy. Residents were again advised to check their contents and clothes for signs of mold growth, and either discard or clean. UMD continued to make the dormitory washer/dryers available at no cost and assisted with additional cleaning as needed. Furniture with significant growth was replaced.

Mold was remediated at Elkton Hall between September 24 and October 10, following procedures consistent with mold remediation guidelines (i.e., U.S. EPA). This process included the following steps:

(a) <u>Prepare the work site</u>. An entire floor was first vacated. Each floor is already isolated from the rest of the building (i.e., doors closed to stairwells, no HVAC recirculation). Fan coils were to be off during work that raise dust. Each room was contained with plastic barriers (i.e., flapped doors, plastic covering furniture and fan coil units). A HEPA-filtered air scrubber was operated in each room. Although negative pressure is not necessary for surface remediation, many of the air scrubbers were exhausted to the outside.

(b) <u>Access potentially affected surfaces.</u> All furniture was pulled back, drawers opened, and mattresses lifted. Access to chilled water piping was opened, where available (Floors 1 and 8 only).

(c) <u>Clean surfaces with high-efficiency vacuum.</u> HEPA-vacuum cleaners are used for mold remediation because they filter out particles instead of exhausting them back into the room. All room surfaces, including walls, floors, doors, closets and furniture, were cleaned by this method.

(d) Sanitize surfaces. All surfaces were then wiped with a hospital-grade cleaner which disinfects mold.

(e) Treat carpets.

Some carpeting was HEPA-vacuumed in place, while students' throw rugs were removed for specialized cleaning.

(f) Clean up work area. Plastic was removed from rooms and floors were recleaned as a final step. Bathrooms, halls, elevators and stairwells were also cleaned and sanitized.

BDL evaluated contractor work at the beginning and worked with DRF to modify procedures, where needed. Among the changes implemented at this time were:

- Switch cleaning product to one containing a verified mold disinfectant.
- Ensure fan coil units were shut off during work.
- Cover fan coil units during room remediation
- Clean all potentially impacted surfaces, including egress routes (i.e., common areas, halls, stairwells, elevators).

5.3 Post-Remedial Verification

Following contractor's completion of their work in each room, the area was inspected for acceptability (and touched up, if needed) two times, and sometimes three. The first was by DRF personnel, who were followed up by independent inspectors from Vertex. BDL then re-checked some areas to gauge effectiveness. BDL found all suspect growth gone, with a few minor exceptions. In those cases, BDL instructed onsite personnel how to avoid these oversights in future work.

Remediated rooms were cleared for re-occupancy when inspectors verified that no growth or dust was visible on structural surfaces, furnishings, furniture or contents and all surfaces had been cleaned, sanitized and dried.

6.0 FAN COIL REPAIR

Air-conditioning in Elkton is provided by one fan coil unit per room. These were opened and inspected by a mechanical contractor, who cleaned the unit, sanitized any suspect growth and corrected equipment or control deficiencies potentially contributing to elevated humidity.

Remediation of fan coil units was done prior to room treatment. A disinfectant was used to treat equipment surfaces and clean cooling coils, and air filters were replaced.

Suspect growth was observed on some pipes which delivered chilled water to the fan coil units. This was addressed by cleaning the insulation covering, encapsulating exposed pipe insulation, sealing holes into pipe chases (shaft enclosing pipes to isolate from occupied space) and sanitizing chilled water pipes inside the chases. In two areas chases passed through plywood enclosures inside resident's closets. At those sites, plywood was removed, the area sanitized and then reconstructed.

With respect to humidity control, mechanics tested each unit to identify and repair any malfunctions and to verify operation per design specifications. Thermostat set-points were changed to 71℉.

BDL evaluated initial work by the mechanical contractor and had procedures adjusted to better meet remediation objectives. These included switching the HVAC cleaning product to one containing a verified mold disinfectant, shutting off fan coil units during work and treating chilled water pipe insulation.

7.0 HUMIDITY CONTROL

Modifying or adjusting the HVAC system is the key to prevention of future mold growth at Elkton.

7.1 Current HVAC Operation

Fan coil components not operating per design were repaired or adjusted during the Elkton remediation. While this potentially improved humidity control in some rooms. BDL found that RH still increased to over 80% on hot/humid days. Monitoring was repeated in seven Elkton rooms October 18 – 22, after the onset of cooler, fall weather (outdoor temperature ranged from 45 - 60℉ with RH 30 – 80%). During this period, relative humidity in the dorm rooms averaged ~45%, with a few brief peaks up to 60%. This remained well below conditions necessary to grow mold (i.e., frequent days exceeding 80%) and will prevent growth through the winter. This will allow time to complete the necessary engineering work and implement improved humidity control.

7.2 Options for Improved Humidity Control

BDL evaluated the cost-effectiveness of various strategies for lowering humidity and concluded:

(a) Significant improvements cannot be made in building pressurization at Elkton without major system modifications.

(b) HVAC adjustments would not provide sufficient improvement in de-humidification to prevent mold growth.

Among the options considered were setting fan coil valves to 0-5 vdc, allowing them to open more in low speed, and programming the unit to cycle the fan off when room temperature is satisfied. This would only produce slight reduction in RH.

When students leave windows open with the fan coil unit cooling, very high humidity levels can be generated. Installation of window position sensors that disable fan coil units when the window is open would improve humidity control slightly. The existing controllers have an input available to perform this function. These sensors would lower RH. This modification would cost approximately $60,000 but provide little overall RH reduction.

(c) Replacing the fan coil unit controllers would be too costly. The controller installed in the Elkton units lacks flexibility. Another model of the same controller does include dehumidification programming. Current controllers could be replaced, and temperature sensors relocated outside the fan coils. Since there is no reheat available in the fan coil unit, dehumidification improvement would be limited and might not prevent mold growth. This option is not cost-effective.

(d) In addition, the changing the controller, if electric reheat is added to the fan coil units, in addition to the new controllers, humidity would be sufficiently controlled. But this option is too costly.

(e) Adding a Dedicated Outdoor Air System (supplemental central unit that supplies conditioned outside air) would provide effective dehumidification and pressurization to improve IAQ and minimize the potential for mold growth at Elkton. Funding and scheduling are not feasible to implement this in time for the next cooling season.

(f) The most cost-effective solution to the Elkton humidity control problem is installation of a properly sized small dehumidifier in each room to supplement the fan coil unit.This would bring the best assurance of good results for the lowest cost. For example, one available unit that removes up to 10 pints of moisture per day, uses only 210 watts (1.9 amps) and has a low noise rating (50 dB). It would be wall mounted with a drain hose to the fan coil drain pan. It would only cycle on when relative humidity is high (i.e. 60%). Dimensions are 11” x 6.7”x 19.1” and weight 22.1 pounds. It is anticipated that 1.9 amps is well within the capacity of the existing electrical system. To add this to Elkton is estimated to cost $60,000 for equipment $30,000 for installation.

APPENDIX A
Building Dynamics' Qualifications

Building Dynamics, LLC (**BDL**) is an independent engineering and industrial hygiene consulting firm specializing in HVAC systems, Indoor Environmental Quality (IEQ) and Energy Analysis. BDL was founded in 1996 by Ed Light, Certified Industrial Hygienist (CIH), and James Bailey, Professional Engineer (PE), to provide clients with a multi-disciplinary perspective and cost-effect solutions to building issues and occupant concerns. Ed has been a nationally recognized leader in the IAQ field for 35 years, while Jim's 40-year career in HVAC design and operation includes specializations in moisture control and building science.

Project manager for the Elkton Hall study was Ed Light, CIH. Mr. Light is a Senior Fellow of the American Industrial Hygiene Association, has authored over 40 scientific publications on assessment and control of the indoor environment, including peer-reviewed research on mold assessment and remediation. He has also been appointed to several national scientific reviews of mold regulation, including advisory committees to the States of Maryland, Delaware and California.

Engineering analysis of humidity control issues at Elkton Hall was performed by Rick Meetre, PE, CEM, CBCP. Mr. Meetre has specialized for thirty years in HVAC building automation controls, focusing on engineering design, programming, onsite system startup, commissioning, troubleshooting, and training.

APPENDIX B
Frequently Asked Questions About Mold

1. When is mold considered a problem?

   Mold is an important part of the natural environment and spores are present in all buildings. Health becomes a potential concern when mold growth is visible on surfaces. Exposure to mold growth only affects sensitive individuals. There are no standards for mold exposure. Public Health officials simply recommend eliminating indoor mold growth.

2. What type of mold is it?

   There are many different types of mold, but all present similar health risks to building occupants. Mold health effects are generally limited to temporary symptoms in individuals with pre-existing allergies. Allegations that some molds are particularly toxic to occupants are not generally accepted by Public Health officials.

3. Is mold a hazard?

   Because the majority of building occupants are not affected by mold, it is not considered a health hazard like asbestos or carbon monoxide. Mold growth should be eliminated following common-sense precautions to protect occupants, but stringent hazardous materials procedures are generally not needed.

4. Are allergy symptoms related to mold?

   While 40% of the population is allergic to various environmental agents, only 5% experience allergy symptoms when exposed to mold. Allergy symptoms are generally minor (i.e., short-term congestion or watery eyes), although asthmatics may experience more severe reactions. Building-related allergies are often triggered by substances other than mold (i.e., dust, animal dander, insect residues) and allergy symptoms can be similar to those associated with other illness (i.e., colds and flu). Mold allergies can be triggered by both the outdoor and indoor environment. Allergic reactions generally occur at the time of exposure and resolve quickly after leaving a problematic environment. Building-related mold illness is dependent on the individual's susceptibility, the extent of mold growth, and the individual's direct exposure (i.e., are they in rooms with visible growth? Is the mold wet and growing?).

5. Are respiratory infections related to mold?

Most respiratory symptoms are caused by factors other than mold. The average adult has two to three respiratory infections per year, and these are typically spread person-to-person. Sinus infections occur in about 10% of the population and are generally bacterial or viral in nature. Immune-compromised patients are uniquely susceptible to mold in that are open to opportunistic fungal infections (i.e., aspergillosis). Fungal infections are associated with occupational exposure and healthcare facilities.

6. Are other symptoms associated with mold?

The average adult experiences at least one common symptom per week (i.e., headache, fatigue, eye irritation). Non-specific symptoms have many potential causes and a link to environmental exposure may be coincidental. For example, headaches can be associated with job stress and eye irritation with dry air. Media reports attribute a variety of symptoms to “black mold” in buildings, including neurological effects such as “brain fog” dizziness and headache. Evidence does not support toxic effects from exposure to mold growth in buildings. Mold growth in buildings has not been associated with cancer or other chronic diseases and is not known to impact pregnancies.

7. How is mold-related illness diagnosed?

   Simply testing for mold cannot determine the cause of occupant-reported symptoms. Occupants suspecting mold-related illness first need a medical diagnosis by a physician. If this diagnosis could be related to environmental exposure, the physician must consider the patient’s environments, focusing on the timing and location of all potential contaminants, not just mold. It is possible that highly susceptible individuals may experience mold-related symptoms which have not been confirmed by research studies.

8. Why aren’t you testing for mold?
   Key questions to be answered by a mold assessment are “What is the health risk?” and “What must be done to eliminate mold growth?” Testing the air and surfaces for mold spores does not answer these questions and is not recommended by EPA or CDC. A science-based procedure for building mold assessment includes, visual inspection, moisture testing and evaluation of HVAC systems, building structure and maintenance.

9. How is mold remediated?
   Remediation is generally accomplished by either wiping off surface growth or discarding water-damaged materials. All surfaces must be dried, and moisture sources controlled. The remediation process must not allow mold spread beyond the remediation area and occupants should be kept away during the work. All exposed surfaces should be sanitized at completion. Remediation sites should be verified as dry and mold-free before re-occupancy. Mold testing is not a scientifically valid way to make this decision. Areas can be cleared based on confirmation of work practices, visual inspection and moisture testing.

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