# A Guide on Prevention and Control of Indoor Mould

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Indoor Air Quality Information Centre
室內空氣質素資訊中心

環境保護署
Environmental Protection Department

再造紙
Recycled Paper

# 1. PURPOSE

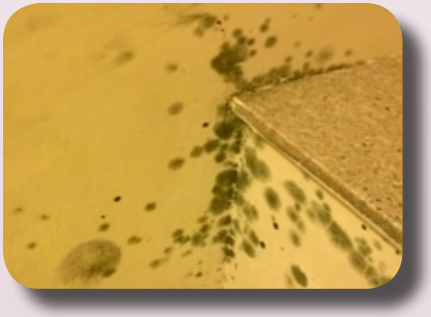
This booklet provides background information and practical guidelines for building/ premises owners or managers to identify, control and prevent indoor mould problems. It covers all types of buildings/premises, in particular those with mechanical ventilation and air conditioning (MVAC) systems.

# 2. INTRODUCTION TO INDOOR MOULD

### What are indoor moulds?

"Mould" is a common term for a group of microscopic fungi, which are microorganisms that live on dead organic matter. Moulds are part of the natural environment and can be found, both indoors and outdoors. Outdoor moulds play a part in nature by breaking down dead organic matter such as fallen leaves and dead trees. Indoor moulds can cause damage to food, textile, leather, carpet and various building materials.

Mould patches are usually dark in colour but can be in any colour. Sometimes moulds' presence can be detected by their "musty" or "damp" smell in damp areas even though they are not seen. Moulds can grow in hidden areas such as behind wallpapers, under the carpet or even inside ventilation ducts.



### What make moulds grow?

Moulds produce tiny spores which are not visible to naked eyes. These spores act like seeds and can grow into mould patches if the conditions are right, including the presence of nutrients (viz. organic matter), at suitable temperature and sufficient moisture.

For mould growth, moisture is essential. Many building materials (e.g., ceiling tile, drywall, wallpaper, or natural fiber carpet padding) collect moisture and dust which provide suitable conditions for mould growth. It is important to prevent any water leakage (e.g. as a result of badly sealed window frames), water spills (e.g. near water dispensers) and floods (e.g. due to leaky/bursting water pipes) in buildings/ premises. Under humid conditions, water condensation will occur readily at the surfaces of building materials and facilitate the growth of moulds. Most of indoor moulds can grow well within a temperature range of 20 to 26°C. If the indoor temperature and relative humidity are both high, mould damage will occur more rapidly. Dust is also an important nutrient source for mould growth as it contains biological particles other than inorganic particles as food for fungi. Dust can gain water from air when relative humidity is high, its accumulation can be conducive to mould growth.

## 3. INDOOR MOULDS AND HEALTH

### Are moulds harmful?

Moulds and dampness have the potential to cause health problems. Inhaling mould spores and particles, or touching mould patches on walls and other surfaces of building materials may cause allergic reactions in mould-sensitised individuals. Exposure to mould and dampness in buildings is associated with increased risk of allergy and non-specific symptoms (e.g. headache) in both atopic and non-atopic individuals. Symptoms other than allergic and irritant types are not common.

### Is there any acceptable level of exposure to moulds?

At present, it is impossible to derive thresholds for the health effects of moulds because exposure to different fungi would likely result in different consequences and further, everyone has a different sensitivity to moulds. However, the area of mould growth is an important indicator of the potential level of exposure for occupants. Since threshold exposure limits for air contaminants of fungal origin have not been established, it is advisable to remove all visible mould growth and apply remediation measures irrespective of the extent of mould growth.

## 4. PREVENTION AND CONTROL OF INDOOR MOULDS

### How can we avoid mould exposure?

Although it is impossible to eliminate all moulds and mould spores in an indoor environment, mould growth can be controlled if moisture and dust are limited. Elimination of moisture intrusion, leaks, and removal of mouldy items, as well as regular or weekly vacuuming using cleaners that have high-efficiency particulate air (HEPA) filtration or central vacuum systems with adequate filtration will help reduce mould exposure.

**General tips for mould prevention**

- Maintain the relative humidity at <70% through proper operation of the MVAC system and use of dehumidifier.
- Close all openings at building envelope and shut off the fresh air/exhaust air outlets to avoid infiltration/ingress of hot humid air inducing water condensation in the air-conditioning space, in particular, when switching off the air conditioners/chillers and/or ventilation system.
- Dry water damaged areas and materials within 24 to 48 hours.
- Remove and clean visible moulds once they are found.
- Remove mouldy materials immediately if moulds cannot be cleaned.

- Vacuum regularly using cleaner with HEPA filtration or central vacuum system with adequate filtration.
- If mouldy odour is detected, take action to locate the visible and/or hidden mould growth.

## How can we prevent indoor mould growth?

The most effective way to control indoor mould growth is to prevent and control dust accumulation, dampness and water problems, which can be achieved by good building design and proper housekeeping in a building. Besides, a mould prevention and control plan is also helpful for addressing mould problems.

### Building design

Mould-resistant and easily cleaned building and fitting out materials (e.g. non-porous flooring and wall covering materials), wherever possible, should be used to avoid dust accumulation. MVAC system should be properly designed to efficiently filter the outdoor air pollutants including dust, to prevent condensation, and to be accessible for regular inspection, cleaning and maintenance. More information on design, construction, and commissioning of buildings for good indoor air quality can be found in ASHRAE's *Indoor Air Quality Guide: Best Practices for Design, Construction and Commissioning*.

### Housekeeping

Good housekeeping and regular maintenance of buildings/premises are critical for prevention of mould growth:

- Clean air diffusers and exhaust grilles regularly.
- Replace dust filters for the MVAC system regularly.
- Inspect and clean air ducts regularly.
- Avoid condensation on walls, ceilings and floors and in the MVAC system.
- Maintain all elements of the MVAC system to ensure cleanliness and optimal performance.

- Prevent leaks and floods in the building such as plumbing leaks, floods from washrooms, seepage from water dispensers and kitchen drains as well as other building operations.
- Clean floor and carpet regularly.
- Avoid placing water dispensers in office areas with carpets, and
- Ensure adequate separation between the water dispenser and carpet.

**Mould prevention and control plan**

Building management should develop and implement a mould prevention and control plan. This plan should include a checklist for routine inspection, regular servicing and maintenance schedules for the building and its facilities as well as remediation plans for water and mould incidents. The routine inspection should cover areas likely to be susceptible to dampness and water problems, and leaks or maintenance failures. Effective implementation of the plan includes the following documentations:

- Documentations of housekeeping works including cleaning and maintenance schedules;
- Records for servicing and maintenance of MVAC system;
- Mould-related inspection schedules and checklist;
- Water and mould incident handling and remediation plans; and
- Event records.

Facility manager or building management staff should be assigned to perform mould-related inspections on a regular basis and more frequently during the humid months. They should be well aware of how to prevent mould growth in the first place and remediate the situation if it happens.

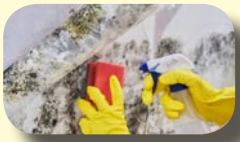
### What should we do when there is mould growth?

When there is visible mould or mouldy/musty odour, an investigation is needed to determine the location, extent and damaged materials of the mould problem, and identify the source of the water/moisture problem before working out the cleanup procedures. Hidden areas (e.g. behind wallpapers, under carpet and walls behind furniture) and the components of the ventilation system (e.g. filters, insulation and coils/fins) should also be checked for any moulds or water damage. The mould and water problem should be fixed as soon as possible to avoid causing health effects to the occupants and limit further damage to the building. After the cleanup, the facility manager or building management staff should inspect the sites to ensure mould problem has been fixed.

Information about mould remediation can be found in *United States Environmental Protection Agency: Mold Remediation in Schools and Commercial Buildings*.

## General tips for mould cleanup

- Engage a competent person for the cleanup if necessary.
- Wear appropriate personal protection equipment such as N-95 mask, rubber gloves and safety goggles, and wash hands immediately after the cleanup work.



- Prevent dust generation during the cleanup and removal of mould-damaged items, for example, gently misting mould-damaged wallpaper with a dilute soap or detergent solution prior to removal; or using HEPA filter vacuum-shrouded tools or a vacuum equipped with HEPA filter at the point of dust generation.
- Minimise effect of mould or mould spores to the occupants and isolate the contaminated area when necessary.
- Use of biocides or disinfectants for cleaning visible moulds are not recommended because of its potential toxic effects to cleaning personnel and other individuals.
- For moulds on hard surfaces or non-porous materials, wash them with cleaning detergent and water, or HEPA vacuum them followed by wet-wiping with cleaning detergent; then dry them completely. It is important to dry water damaged areas and materials within 24 to 48 hours to prevent mould growth.
- For moulds on absorbent and porous materials, such as ceiling tiles and carpet, that cannot be cleaned, remove and put them in a sealed plastic bag. Clean the outside of the bag, and take it away from the mouldy area, then put it in another plastic bag and tie it up for disposal.
- Do not operate the MVAC system if the MVAC system is contaminated with mould to avoid spreading the mould spores through the air duct. Air duct should be cleaned by a competent service provider, and the wetted and mouldy insulation and air ducts have to be replaced if effective cleaning is impossible.

### What should we do when there is flood or water damage?

Floods and burst pipes represent a considerable risk for causing mould damage in a building. Unless the standing water is removed and all building materials are dried within 24 hours, mould growth may result. A water remediation plan for water damaging incidents should be in place for timely and effective actions.

**General tips for water cleanup**

- Employ wet vacuum cleaners or water-pumps to remove the standing water.
- Remove any wetted materials that cannot be dried thoroughly such as wetted carpets.
- Remove the baseboard to assess the situation and facilitate drying if water might have penetrated into the wall cavities,
- Use fans and air driers to accelerate the drying process.

## 5. AWARENESS OF BUILDING OWNERS/ MANAGEMENT AND OCCUPANTS

### What should building owners/management do?

- Train all the building management personnel so that they can have a comprehensive knowledge of the issues and recognise their responsibilities to prevent mould growth;
- Assign and train maintenance and building management staff to report and act on early indicators of moisture/water and mould incidents such as stained ceiling tiles, unusual odours, bubbling of paint, rust stains, signs of water entry, plumbing leak or other early indicators of a moisture problem; and
- Consider hiring competent contractors and/or consultants to expedite action to rectify the mould/water problem if necessary.

### How can the occupants help?

Building/premises management should communicate well with the occupants, through the following means:

- Provide guidelines on good housekeeping practices to the occupants; and
- Set up a reporting system for occupants to report signs of leaks, flooding, dampness, musty or mouldy odours, visible mould growth and ventilation problems.

Setting up a dedicated team comprising building management and occupants to oversee IAQ matters is a good way for different parties to communicate and work together on any IAQ problems including the dampness and mould events.

## 6. ENQUIRIES

For any enquiries about the prevention and control of mould, please contact:

**Indoor Air Quality Information Centre**
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Fax: (+852) 2788 6181
Email: enquiry@iaq.gov.hk

# 7. REFERENCES

**American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE):** Indoor Air Quality Guide: Best Practices for Design, Construction and Commissioning, ISBN: 878-1-933972-59-5, 2009. (https://www.ashrae.org/resources--publications/bookstore/indoor-air-quality-guide)

**United States Environmental Protection Agency:** Mold Remediation in Schools and Commercial Buildings. EPA 402-K-01-001, 2008. (http://www.epa.gov/mold/mold-remediation-schools-and-commercial-buildings-guide)