switchee

THE ULTIMATE GUIDE TO COMBATING MOULD **WHITE PAPER**

Condensation, damp and mould has been a part of British home life for most of the last century. Our climate is particularly vulnerable to mould growth because of the changeable weather, combined with the construction of our homes. This problem has been something that affordable housing providers have been struggling to combat since their very inception. Unfortunately, with higher than ever demand for social housing, and more and more stringent budgets, some of the traditional solutions to the problem of mould are starting to collapse.

With increasing concern over the long-term health issues associated with mould, housing providers need to start taking more drastic steps to counteract this problem. To help in this, we've pulled together a comprehensive guide all about combating mould growth - to help housing providers who might be struggling to find a solution.

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1. WHY IS CONDENSATION, DAMP AND MOULD A CONCERN?

There are two main reasons in which condensation and mould is bad for the affordable housing market. The first is for residents. Condensation and mould has been clearly linked to a number of medical conditions, including allergic reactions (like sneezing, runny noses, red eyes and skin rashes) as well as asthma attacks.

These effects can be seriously detrimental to vulnerable residents' health who might already have compromised immune systems or be struggling with existing conditions that make them more vulnerable to the more severe side effects. Removing or preventing condensation, damp and mould, therefore, increases the overall well-being of any given property's resident – potentially saving lives.

The second area is to do with the business side of providing housing. Condensation, damp and mould costs money to deal with. It causes significant damage to the fabric of properties - breaking down insulation, stripping wallpaper and causing damage both superficially to the look of the property as well as structurally. This can be as extreme as the growth of wood-decaying fungus as a result of the high humidity.

The damage can be both difficult and costly to repair. These costs can also pale in comparison to the cost of disrepair claims which some providers have reported to be on the rise.
With rights to a decent home and landlord accountability to residents at the centre of policy focus post-Grenfell, the regulatory responsibility – let alone moral and practical concerns - to tackle mould will only increase. The associated cost of repair and disrepair claims can prevent housing associations from investing in other services that would otherwise help residents.

2. WHAT CAUSES CONDENSATION AND MOULD?

First, let's examine what condensation is. There is always moisture present in the air, with levels varying according to temperature and climate. The activities of building inhabitants, weather conditions and the construction of the property all influence how much moisture is created, how long it remains and how much damage it does. Once water vapour is airborne, the key mechanism by which condensation is created is the heating and cooling of air.

When air heats, its ability to hold moisture increases. As it cools, its maximum water content declines proportionally - this moisture in the air then has to go somewhere. This usually takes the form of condensation on surfaces in the property. This is measured in relative humidity (RH) – the amount of water vapour present in any given sample of air expressed as a percentage of the amount needed for saturation at the same temperature. This is essentially the amount of water in the air as a percentage of how much water the air can hold. Another key measure is Dewpoint Temperature – this is the relative temperature at which the air becomes saturated.

In most cases, this water comes to rest on surfaces in the home, usually congregating on surfaces that are the coolest – for example on and around windows. Condensation isn't always visible, especially on surfaces that are wallpapered for example. It also doesn't leave what's called a 'tidemark' – a line around a room where water seems to have settled. This is usually a different problem – often water leaking into the property from surrounding buildings or damaged water pipes.

There are four key factors that can affect condensation and mould in a property:

Resident Activity

Traditional wisdom has always held that the activities of residents have an impact on humidity and therefore on mould development. In a normal 5-person household daily activities create approximately 15 litres of water which is absorbed into the air. For example, cooking on average adds 3 litres of water to the air a day, whilst each individual in the property adds 0.85 litres per day whilst awake and 0.3 litres per day asleep. Washing and drying clothes are the single greatest addition with 5.5 litres a day being added.

A report published by Sustainable Homes stated that occupant density was one of the largest factors in the increased prevalence of mould. With an increased number of people in the home, there is naturally a higher level of moisture being created through the average day-to-day activities of the residents. The property is also unlikely to have a different ventilation system from their lower density neighbours - meaning the "ventilation rates are likely to remain in proportion to the size of the home".

Heating

According to the same Sustainable Homes study, the way a property was heated also had an enormous impact on condensation and mould issues. When a property was consistently under-heated, there was a significant increase in reported cases of condensation and mould, when compared to neighbouring properties that were being heated adequately.

There is also a direct correlation with a property's energy efficiency rating with an increasing rate of condensation, damp and mould. A property with a significantly lower energy efficiency rating will have its heat levels drop faster. The property will therefore experience larger temperature fluctuations than one that is adequately insulated. In general, underheated and inefficient homes are much more likely to experience condensation and mould than those that are not due to their inability to remain warm.

Insulation

Insulation of a property is another big factor in increased rates of condensation and mould. As mentioned above - a property that cannot hold heat well will struggle significantly more to keep its dew point temperature at a high enough level. A property that lacks appropriate insulation (or worse has insulation that is compromised but without the resident's knowledge) will struggle to keep temperatures at an appropriate level.

In poorly insulated homes there is also a far greater likelihood of cold patches on its walls – which are the most likely areas for condensation to occur. This is most common where insulation is either inconsistently applied or where it has failed in locations. A property that is appropriately insulted is less likely to suffer these spots and are therefore less likely to have significant mould outbreaks. Both thermally poor construction (in the cases of solid walls and unfilled cavities) and failed insulation construction (in the cases of failed wall insulation and poorly installed insulation) contribute to this problem significantly.

Ventilation

Ventilation is the fourth and final major factor in condensation and mould development. Ventilation, when properly deployed, keeps moist air from remaining inside the house. It does this by venting moist air from within the property and pushing fresh air from outside into the property which will have a much lower relative humidity (and therefore dewpoint temperature).

An appropriately ventilated property allows for a much higher level of relative moisture generation in the property as the outside air that is pulled in is capable of absorbing far more water than existing air within the property. This is supported by a number of different studies that suggest well-ventilated properties have a significantly lower chance of mould.

3. WHAT ARE THE HEALTH RISKS ASSOCIATED WITH MOULD?

There are a multitude of health risks associated with both short- and long-term exposure to mould spores. Mould spores can trigger a variety of responses from the body depending on where they come to land - ranging from mild to extreme. There are also ongoing studies to understand the impact they can have on Asthma and other respiratory illnesses.
The health risks can be broadly grouped into three types.

Respiratory Reactions

Respiratory complaints are some of the most common when it comes to exposure to mould. The symptoms can include trouble breathing, coughing and wheezing and a tight feeling in the chest. During the early stages of exposure, these can be very mild, but with prolonged exposure (in instances where a property has a chronic mould problem that is not appropriately addressed) these issues can become a chronic health issue.

There is also some concern over how mould spores can inflame asthmatic residents. There are no current studies that suggest that Asthma is directly caused by mould spores, but mould prevalence has been linked to increased respiratory distress in those suffering from asthma. Those residents are likely to have an increase in the frequency and severity of their asthma attacks if the problem is not addressed.

The most likely symptoms for respiratory reactions to mould spores are:

- Coughing
- A runny or a blocked nose
- A mild fever
- Pressure or pain behind the face
- Sneezing
- A sore or scratchy throat

Skin Reactions

This is another common side effect of prolonged mould exposure. The skin is very sensitive to irritants and allergic reactions to mould spores are not uncommon. This most often affects people who are already prone to some form of skin irritation such as those suffering from eczema and other similar conditions. The severity of these symptoms will of course increase with prolonged exposure to the mould.

The most likely symptoms for skin reactions to mould spores are:

- Red, dry and/or cracked skin
- Hives (raised, red rashes that itch)
- Conjunctivitis (itchy, red and watery eyes)

Mental Health

This is one of the less talked about side effects of mould exposure as it isn't a simple medical reaction. Studies have shown that there is a direct link between mould and depression. Living in a home that has a mould problem can increase stress considerably - especially if you feel the issue is not under your control. For example, in cases where the property fabric is to blame for the issue - and not their own behaviour. Mould causes damage to a resident's possessions as well as their home - and can have an unpleasant appearance as well as odour. Research has also started to show that when mould toxins accumulate in the body (known as mould toxicity) it can lead to symptoms of anxiety, brain fog, insomnia and even depression.

The main symptoms of mould-related mental health issues are:

- Brain fog
- Insomnia
- Depression
- Concern about visitors and distress about cleanliness
- The financial strain of temporary remedies

4. WHAT IS CURRENTLY BEING DONE TO CONTROL IT?

Currently the most deployed solutions for controlling condensation and mould are those that can be deployed on an entire block of properties – for example, an entire block of flats might all receive new ventilation systems when that might only be an effective solution for 25-30% of the properties.

Installing the same system in all properties in any given block or area used to cost less money and take less time than installing monitoring solutions to determine the ideal solution for each property. Traditionally the solutions deployed to counter mould come in three main categories:

Resident Advice

The first line of defence usually comes in the form of education and advice. This can take the form of a booklet, a phone call or an in-person meeting with a resident to explain what behaviours are potentially exacerbating the situation. In the case of a Peabody project recently undertaken in south east London: "Traditionally, energy advice covers a range of topics including typical energy costs for heating, hot water, ventilation and running domestic appliances, how to keep warm at least cost, how to minimise the risks of condensation, mould growth and hypothermia". Where there is a recent but dramatic increase in condensation, education and advice is frequently an effective tool.

Insulation

In cases where poor or failing insulation is identified as a factor in a property's condensation and mould issues – a new application of loft and cavity wall insulation is often used. It's an efficient and cost-effective application of insulation. With new insulation installed, the whole house should now contain its heat better without an increase in heating bills. The result of this is increased resident comfort, as well as a reduction of condensation due to the increased temperature (which allows a higher quantity of water in the air without condensation arising).

Ventilation

The final measure is a ventilation system. In most cases, extractor fans are deployed in the kitchen and all of the property's bathrooms (if they have not already been installed) to reduce the relative humidity in those areas. Residents are also given advice on controlling moisture in kitchens through control over the ventilation system and through opening windows at times of cooking. In most cases, extractor fans are wired into the same circuit as light switches and continue for an additional 15 minutes after being turned off, ensuring that they ventilate those rooms when in use.

While these interventions undoubtedly help to combat condensation and mould to varying degrees, one of the issues they face is their difficulty measuring their effectiveness. Moreover, these traditional analogue technologies lack the ability to react to changes in requirements as conditions in properties evolve daily.

For example – whilst ventilation fans that trigger on the use of light switches is a relatively good indicator of humidity, it is in no way perfect. Activity in the bathroom during the day will often not include turning the light on, and when it does get turned on there will be a significant difference in water generation between a property's resident simply using the toilet and taking a long shower.

A well-located humidity sensor, therefore, can give much better information. This is one of many areas where technology is already helping by better identifying issues and helping save landlords money on repairs.

5. WHAT TECHNOLOGIES ARE HELPING TO COMBAT MOULD?

It isn't all bleak news, however, as a host of technological solutions have sprung up to help landlords with the problem. From new building fabrics and designs to innovative home appliances – technology is being applied to old problems with new vigour. The two most effective solutions to the problem are, ironically, updated versions of existing technologies – upgrading existing systems with smarter, more efficient versions of themselves.

Smart Ventilation Systems

In households where fuel poverty is a risk it is common for residents to be unwilling (due to their restricted heating budget), or unaware of the need to, open a property's windows to naturally ventilate their homes. There is also a tendency to either isolate loud extraction fans or turn them off completely due to both the noise and the relative drop in temperature that poorly equipped ventilation systems can result in. Often the fans used may not be fit for purpose.

Ventilation systems are frequently installed to meet building regulations, an approach that is compliant but fails to fundamentally consider either the assumptions behind building regulations or the specific needs of a property. In the U.K., building regulations are based on the average water production of a four-person household. Social housing occupancies can be of a much higher density.

The regulations also assume that residents attend work or school during the day; often schedules of residents in affordable housing are different. The final assumption is that fans are used for a certain number of hours a day. They also fail to consider pets; low temperature drops or drying clothes inside of the property. All of these things as a collective make the building regulations unreliable, particularly when it comes to ventilation.

There are clear benefits to deploying intelligent ventilation systems to adapt to the individual occupancy and habits of the residents. The two main areas that a smart ventilation system helps in are exceeding the minimum airflow required by building regulations, as well as adapting and reacting to the environment within the property.

For example – with humidity detection systems integrated into a smart ventilation system, when a household begins its dinner cooking session, the fans and extraction systems can be boosted to vent this extra water vapour out of the property. They can also reduce airflow when there is a lower level of relative humidity – thereby preventing residents from suppressing ventilation systems for their own comfort.remains efficient, whilst keeping residents heated for less money.

IoT Devices

IoT Devices, like Switchee, are devices that replace a property's room thermostat and programmer – adding smart features in the process. IoT devices like Switchee, give housing providers data that allows them to see heating patterns and understand what would be a better way for their resident to heat their home. The ability to set temperatures lower, for longer and on schedules, means residents heating can run more efficiently, saving them money on their heating bills, whilst heating their homes to safe temperatures.

Many also don't rely on resident intervention and will automatically adjust themselves – allowing those who don't want or choose not to engage with their thermostat to enjoy the benefits as well. One of the key features of our system (Switchee) is its ability to sense various factors attributed to mould through its analysis of temperature and humidity data. It can monitor a property across a number of different metrics including temperature, airflow and humidity – transmitting this information through its GSM connection live to the housing provider which allows for interventions to be made both quickly and on a large scale.

Switchee also uses its sensors to determine a properties individual heat signature – from its heating pattern to its efficiency – alongside other sensor data (such as humidity and occupancy) this allows landlords to make better decisions about pre-emptive maintenance investment in their stock.

According to a report conducted by Rickaby Thompson Associates after a trial Switchee deployment in the Peabody Thamesmead complex as part of their Condensation and Mould Strategy "The value of Switchee to the CDM Strategy is its ability to identify homes where there is under-heating, under-ventilation or high RH (indicating condensation and mould risk) so that interventions can be targeted. Switchee also allows homes to be monitored after improvements have been made, to confirm effectiveness; and it allows energy advisors to brief themselves prior to advice visits."

Furthermore, the Switchee communications functionality means housing providers can proactively communicate with residents they have identified may be at high risk of mould, in order to better understand more about what is happening in the property. This functionality provides on average a 90% response rate. If interventions are required, appointments can be booked with the resident, via the Switchee device, which dramatically increases access rates for maintenance teams.

6. SUMMARY

Mould is and, without being drastically addressed, will always be a concern for social housing providers in the UK. Our housing stock is almost perfectly designed to generate the ideal conditions for mould growth. Understanding what is causing mould for an individual property in the first place is the first battle that needs to be won.

Through technology - access to previously unattainable data has become commonplace. This data gives landlords the capability to reduce the damage that can be done to a property and help to protect their residents. It gives them the ability to remotely understand which properties are suffering from mould - and to understand the root causes for the individual property. Data is helping to reduce the number of disrepair claims through data-based early warnings – giving landlords the necessary information to devise action plans for each property.

Over the past 10 years, significant improvements in connectivity, sensor strength and efficiency as well as interconnectivity between devices has led to the development of a lot of technologies capable of combating mould. With their capacity to analyse significant amounts of sensor data, and then output real-world changes to heating, ventilation and other housing systems – these new technologies are now starting to be deployed at scale throughout the social housing market.

From resident education, all the way through additional installations of ventilation and insulation – new technologies are now limiting vulnerable residents' exposure to the health issues associated with condensation and mould.

In the coming years, with further developments in IoT technologies, more parts of a house's ecosystem will begin to connect with each other – reducing the need for large-scale structural changes and increasing the use of smaller one-off solutions to individual properties problems. This will ultimately reduce cost, whilst increasing the well-being of residents.

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