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Paper on Toxic mould, liability & decontamination issues

Changes in regulations, standards, living style, and construction techniques coupled to novel materials are now seen to be having significant effect on building degradation and occupant's health!

Building materials and techniques have significantly changed over the past thirty years and a move towards chalk and paper construction (plasterboard or Gyprock) means moisture is now generally adsorbed instead of being removed. The application of non permeable wall coverings and paints seals the problems in and the ubiquitous mould develops in ideal conditions within wall and interstitial cavities.

The development of non toxic paints and reduced levels of VOCs *volatile organic chemicals* has removed another defence against the development of mould and the reduction in sulphur emitting fuels means that the mould spore and fungi have few of the recent historic challenges to prevent its growth.

While changing building regulations, materials and construction techniques are responsible for many of the health and environmental problems which have developed, designers, architects and builders may shoulder shared responsibility too. Many have failed to assess the implication of climate change and the movement in Europe from a generally heating climate to that of cooling where air conditioning may be essential in some months of the year.

Inspection of new but mouldy buildings has shown vapour barriers were designed and installed to the detriment of pressure or condensation plain and air sheathing poorly engineered or designed. Poor thermal break insulation and extensive condensation caused significant damage and were seen to be significant factors in mould growth where vapour diffusion was constricted. Timber frame construction must rely on the skill and competence of a building trade who have significantly replaced tradesmen with workers that simple overlay paper "Tyveck" for environmental controls and tape joints and mastic gaps for environmental controls. The increasing requirements of part L (building regs) with regard to permitted leakage standards of new buildings and the introduction of HIPS *Home Inspection Pack* and specifically the insulation standards means that insulation and building tightness is being promoted by governments over and above all associated risks and potential problems.



These pictures show typical markers and remediation process of toxic mould!

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This indicator mould growth appeared days after the homeowner left due to illness. The end result was total removal of the party wall and complete decontamination and clearance of both properties!

Mould

Recent forensic investigation of four separate buildings and case studies found toxic mould:

- Said at post mortem and inquest to be a potential cause of death
- Diagnosed symptom of severe illness and infection,
- Possible contributory factor in tenant's liver disease
- Possible cause of tenant's lung cancer.

Significant points in the investigation were that none of the buildings were more than four years old; none had suffered flood or significant water leakage and had been built to recognised standards. (Some dispute)

From the investigation and lab analysis we found that the design of the buildings coupled to construction materials and in some cases poor workmanship caused the problems and while builders and architects may dispute who is to take responsibility, the major cause appears to be compliance to "Building Regulations" The rise in asthma can generally be plotted in parallel to the rise in the government's requirement for energy efficient buildings which revolved around betterment of insulation. The improvement of U and R-values, which reflect insulation and thermal resistance coupled to reduced ventilation rates and the measurement and control of leakage (part L building regulations) have seen tight box construction.

General living or working conditions result in the production of water vapour in the form of increased humidity. A family of four are said to produce up to 20 litres of water per day **ref 1** and when we consider the average dehumidifier would struggle to remove that amount of water from the air we should envisage the problems caused by hygroscopic materials in an average home built to the increasingly stringent building regulations without dehumidification. Vapour generation is the result of breathing, cooking, boiling kettles and even dehumidification where the temperature differentials of internal or external or processed air results in "Dew Point" is reached because of thermal differences vapour changes to liquid moisture. Dew point is where the air releases the moisture it did carry because it has cooled to a point where it no longer has the energy or capacity to carry it and is usually seen as condensation. In older buildings condensation was usually removed by ventilation but reduced ventilation means that the moisture is adsorbed into building materials.

The problem is not unique to the UK and as a contributor to the American "Toxic Mold Task Force" I worked with many specialists in identifying problems and solutions. What seems incredible is that construction in Europe has

followed many and more of the mistakes made in the USA ten years ago. The mould issue in the USA has crippled many insurance companies and many builders and architects have paid the price for incompetence or poor management.

Concerns of mould problems usually arise from health or allergy issues, extensive condensation, mould growth or odour. The identification of mould is complex and many historic measurement systems such as agar plate or conventional SAS or Anderson 6 viable sampling techniques invariably fail to identify the problem as many moulds fail to be captured or simply don't grow on specific agar. The USA was at the forefront of mould identification fuelled by liability and claim culture and many accurate techniques are now available in the UK.

Following the identification of mould, rectification and control of the problem is the first step. The second step is decontamination and this in the USA mould decontamination is analogous to asbestos removal. Complete enclosures, negative pressures and air locks to prevent cross contamination are typical controls utilised.

The significant liabilities of mould in the UK cannot be overemphasised and the Environment agency, in collaboration with the ABI *Association of British Insurers* have backed the work of CIRIA *Construction Industry Research & Information Association*. In their document "*Repair and Restoration of buildings following floods*" they have significantly accepted the health risks of mould and its health effects from buildings which have been wet for more than 3 days. **Ref 2.**

In this document they state that vulnerable people (that's anyone) who may be affected by mould should stay away from the property and contractors should wear well fitting respirators fitted with toxic particle cartridges. Clearly building occupants who have lived long in buildings affected by condensation or leakage are significantly at greater risk.

Health Issues Ref 3

All mould is said to be allergenic although only 16 of the 100,000 mould species identified have been proved to be toxic. These include *Stachybotrys*, *Penicillium*, *Aspergillus* and others that are most likely to grow or develop in the built environment due to the presence of ideal growth conditions.

Typical health effects can include;

- Flu like symptoms
- Allergies, hives
- Sore or itchy eyes, throat and nose bleeds
- Depression, lethargy and loss of concentration
- Some lung and liver cancers
- Brain and lung and liver tumours
- Spontaneous abortion

Standards for decontamination have internationally been recognised and fungicides or chemical killers have no place in decontamination as dead mould is acknowledged as being more toxic than live mould. While conventional decontamination is often disruptive and extremely costly, the high cost of mould removal should be slashed by the emergence of various new technologies initially developed for the decontamination of anthrax and WMDs weapons of mass destruction. Sanitising and oxidising foaming agents are injected into cavity walls to neutralise metabolites and mycotoxins. The patent application of foam allows adequate dwell time and this can eliminate the need for soft demolition and minimise the need to excessive and usual controls.

The USA has seen an explosion in the liabilities from flooding and often leakage but the UK building industry and their insurers are now far out in terms of potential liabilities. The emergence of the Housing Health & Safety Rating Act in May 2006 means that environmental health officers are now required to assess mould as algorithmic safety assessment of the home, this may increase the awareness of the problems.

Detection Process



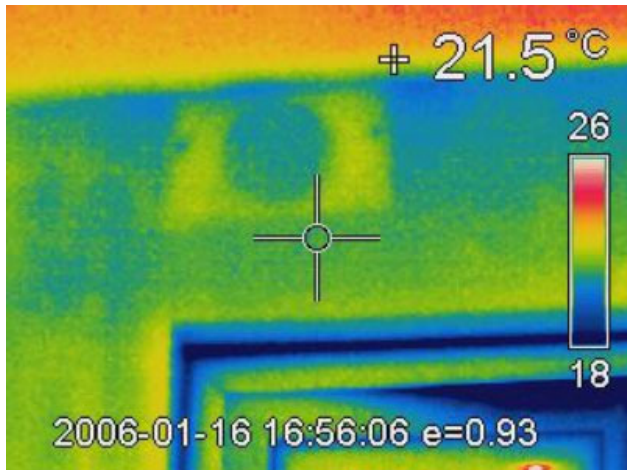
Moisture is the most important component in mould growth



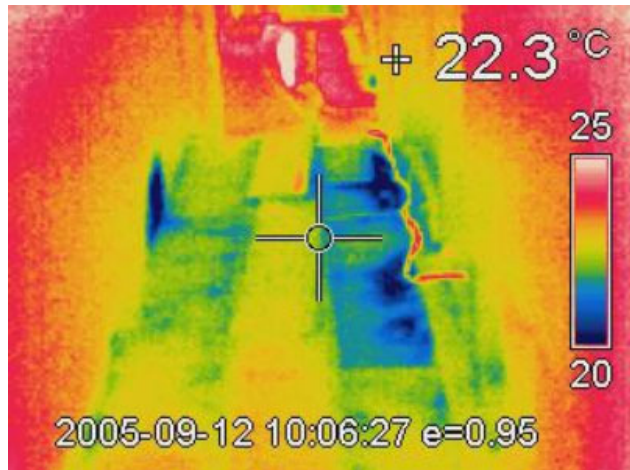
Measurement of ambient background levels of airborne mould spores and of suspect internal cavity walls. The ambient conditions can be used to assess the level (quantity) and differences in mould species.

Moisture detection

Moisture with regard to mould growth, usually originates from liquid and gas phase and may be the result of thermal bridging, leakage, and condensation from dew point. Methods of detection include visual markers, conductive and ultrasonic meters, thermal hygrometers and Infra red thermography.



Typical IR photos showing hidden vent above door and thermal bridge resulting in mould



Several sub floor leaks identified from faulty pipe work installation.

Decontamination



Part of the decontamination and clearance protocol may include air scrubbing and destruction of spores and mycotoxins. This can be achieved in a variety of ways including thermal fogging shown here. A oxidising product is heated to form an expanding cloud which fills the building in minutes. Only those suitably protected can be present during this process.

Ref 1 (BRE Digest 297)

Ref 2 <http://www.ciria.org.uk/flooding/disinfection.htm#mould>

Ref 3 <http://www.nlm.nih.gov/medlineplus/molds.html>

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