



Session 7

Mould and health

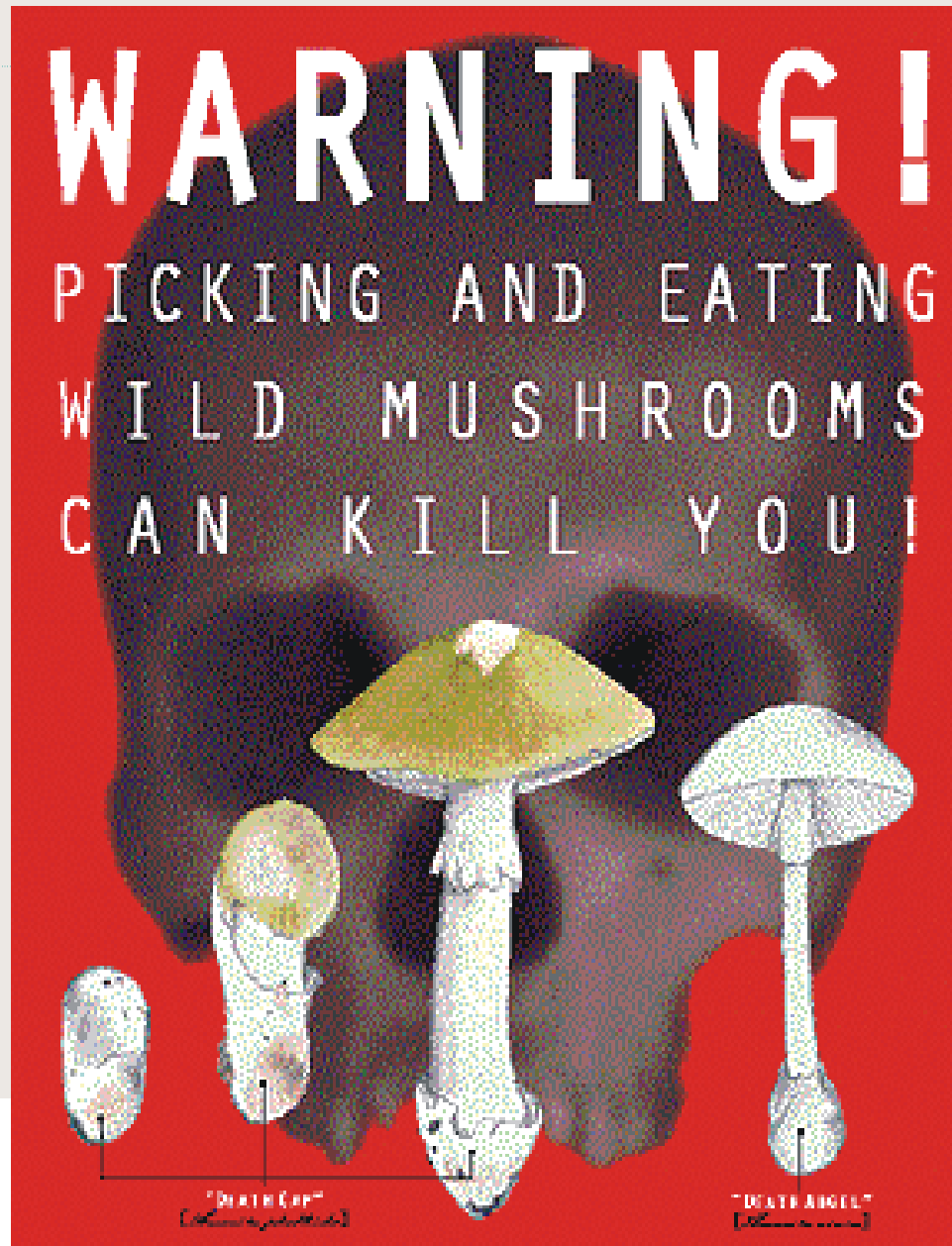
Johan Mattsson, R&D Manager, Mycoteam

How dangerous are mould fungi?





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What effect can mould cause?

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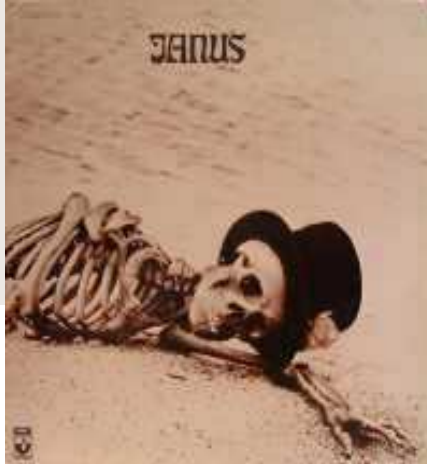
- The Good



- The Bad

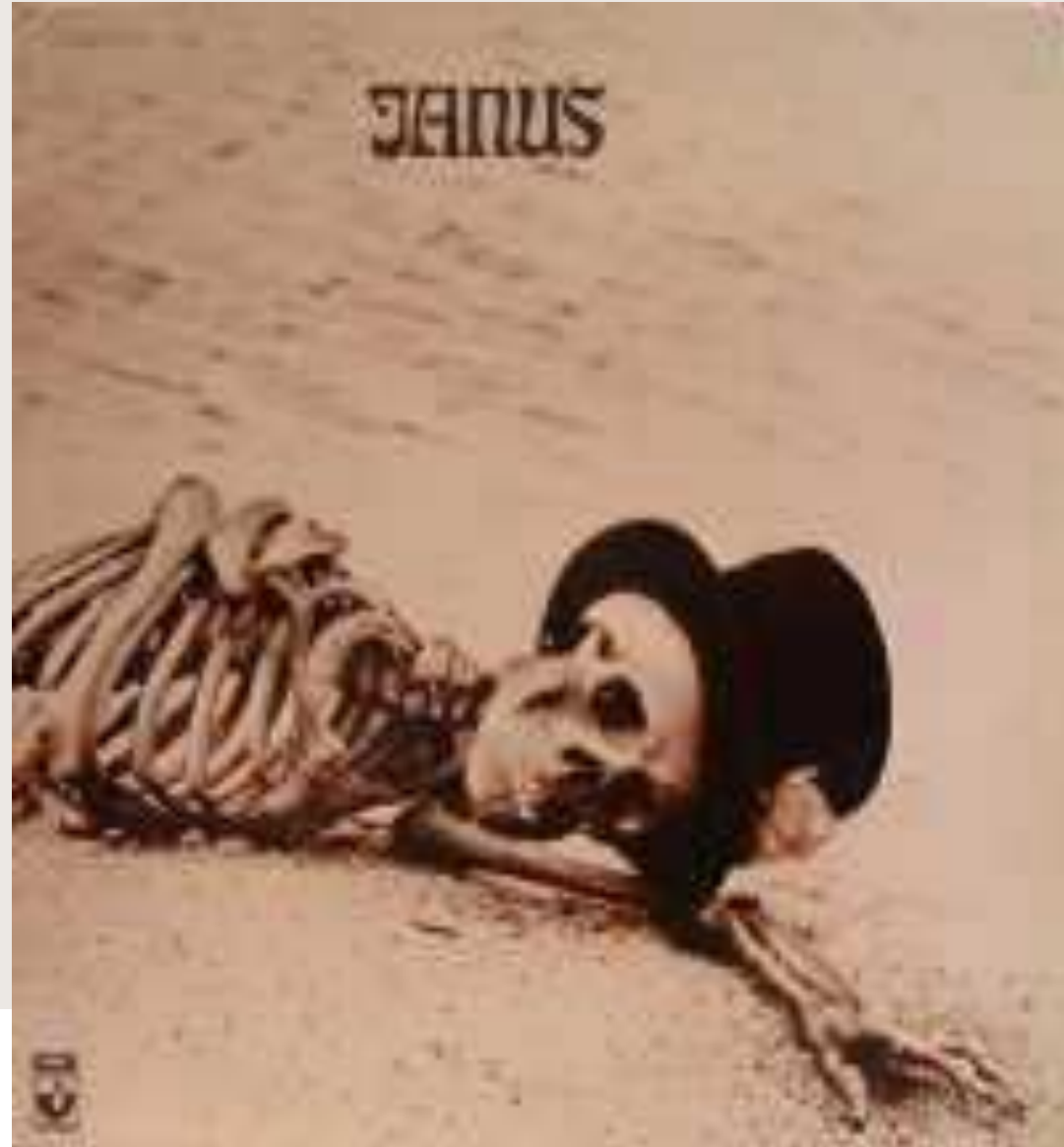


- The Ugly



What do you find on internet?

- Only the «Ugly truth»

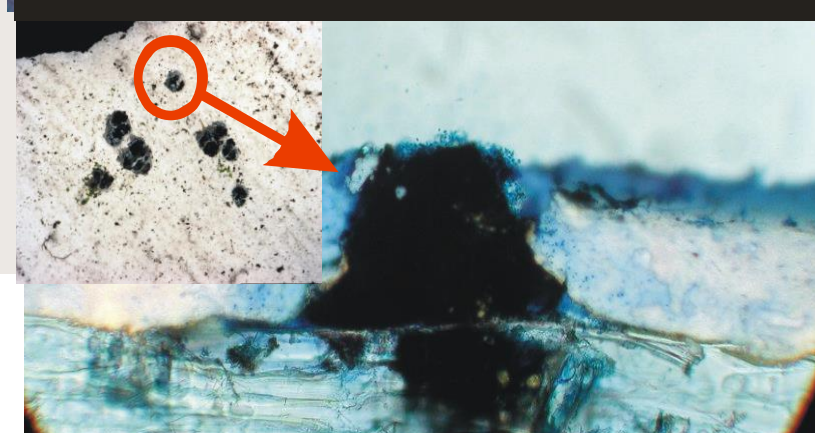
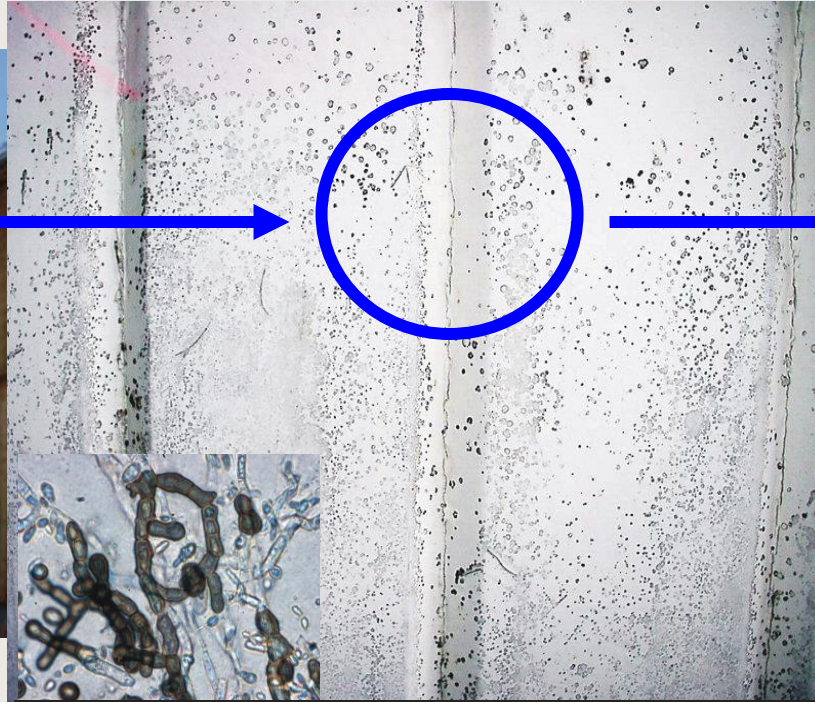


Well-documented facts about mould fungi (WHO, Norwegian Institute of Public Health)

- Exposure to damp and mould increases the risk of both developing and worsening of health problems. However, there is no evidence base for setting a health-based, quantified norm for moisture or mould in Indoor Air Quality.
- Persistent moisture and mould growth on surfaces indoors and in building construction should be avoided. Signs of risk factors is mould odor and frequently occurring condensation on surfaces or in construction.
- Former major moisture damage where materials are not quickly dried, cleaned or removed may also represent a health risk. Where such conditions are detected, the damages must be repaired as quickly as possible.

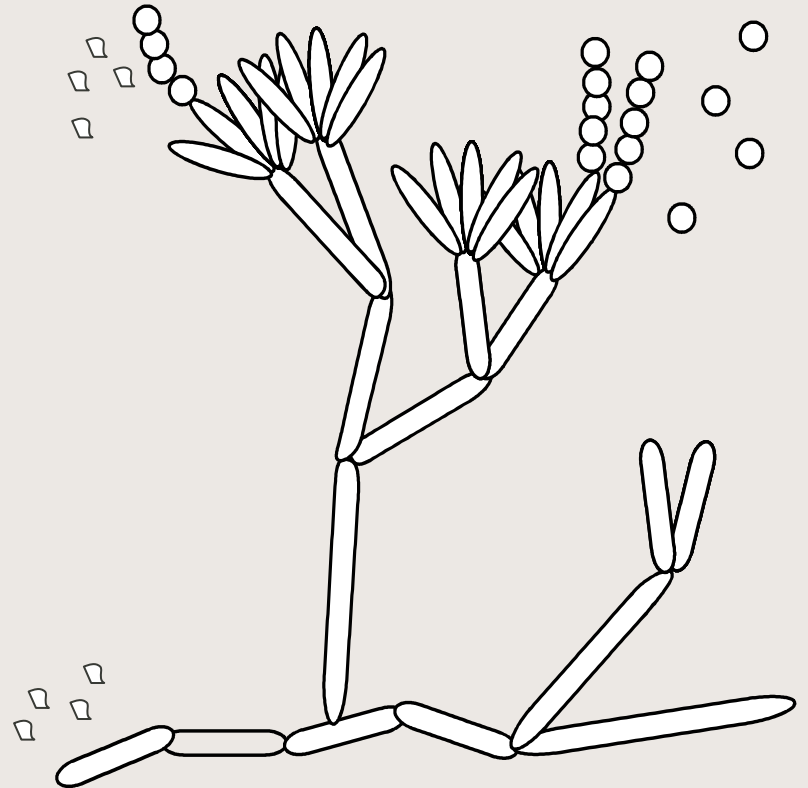
When is a mould damage a health risk?

Blue-stain fungi = Mildew fungi = Mould fungi



Biological substances from mould fungi

- Spores
- Fragments of mycelia
- Various substances, including mycotoxins
- Microbial volatile organic compounds (mVOC)



A mycotoxin is a metabolites that causes a toxic response when introduced by a natural route in low concentrations to higher vertebrates and animals

Exposure of mould fungi can happens by three ways

- Digestion
- Breathing
- Skin contact

Health effects

- Sick Building Syndrome
 - Head ace, fatigue, concentration problems
 - Problems in nose, eyes, throat, air-way infections
 - Bronchitis, asthma
- Allergic alveolitis
- Atopic allergy
- Various sensitive reactions
- Infections.

Allergic alveolitis (IgG allergy)

- Extreme exposure of «biological» dust. The particles reach the alveoles of the lungs and cause inflammation of the alveoli.
- The result is fever, difficulty breathing, cough and flu symptoms.
- Symptoms decrease after terminated exposure (hour/days) and they are caused by antibodies to the allergen which is formed in the blood after repeated exposure.
- Repeated exposure can cause chronic effect on the lungs, i.e. *Chronic obstructive pulmonary disease (COPD)*, also known as *chronic obstructive lung disease (COLD)*.
- The condition is often caused by labour related exposure; "Farmer's Lung", "Cheese washer's lung", "Wood Trimmer's disease" (and «Mould survey workers disease»?).

Health reactions – Atopic allergy (IgE allergy)

- Over reaction of immune system by either high exposure or long-term exposure.
- Nonspecific reaction (mould, mites, pollen...).
- The result is, for example contraction of the muscle tissue in the airways.
together, asthma and hay fever.
- The symptoms occur immediately (<10 min) and the symptoms is caused by immune complex where IgE antibodies bind to cells in the tracheal mucosa and releases histamine from the cells.
- People with asthma and allergy are often affected.

Infections

- Some mould fungi can grow at 37 °C – is that a problem?
- People with extremely poor health or immune system may be affected by infections in the organs by for instance aspergillosis, but it is very rare.



(Photo from Gravesen, 1994)

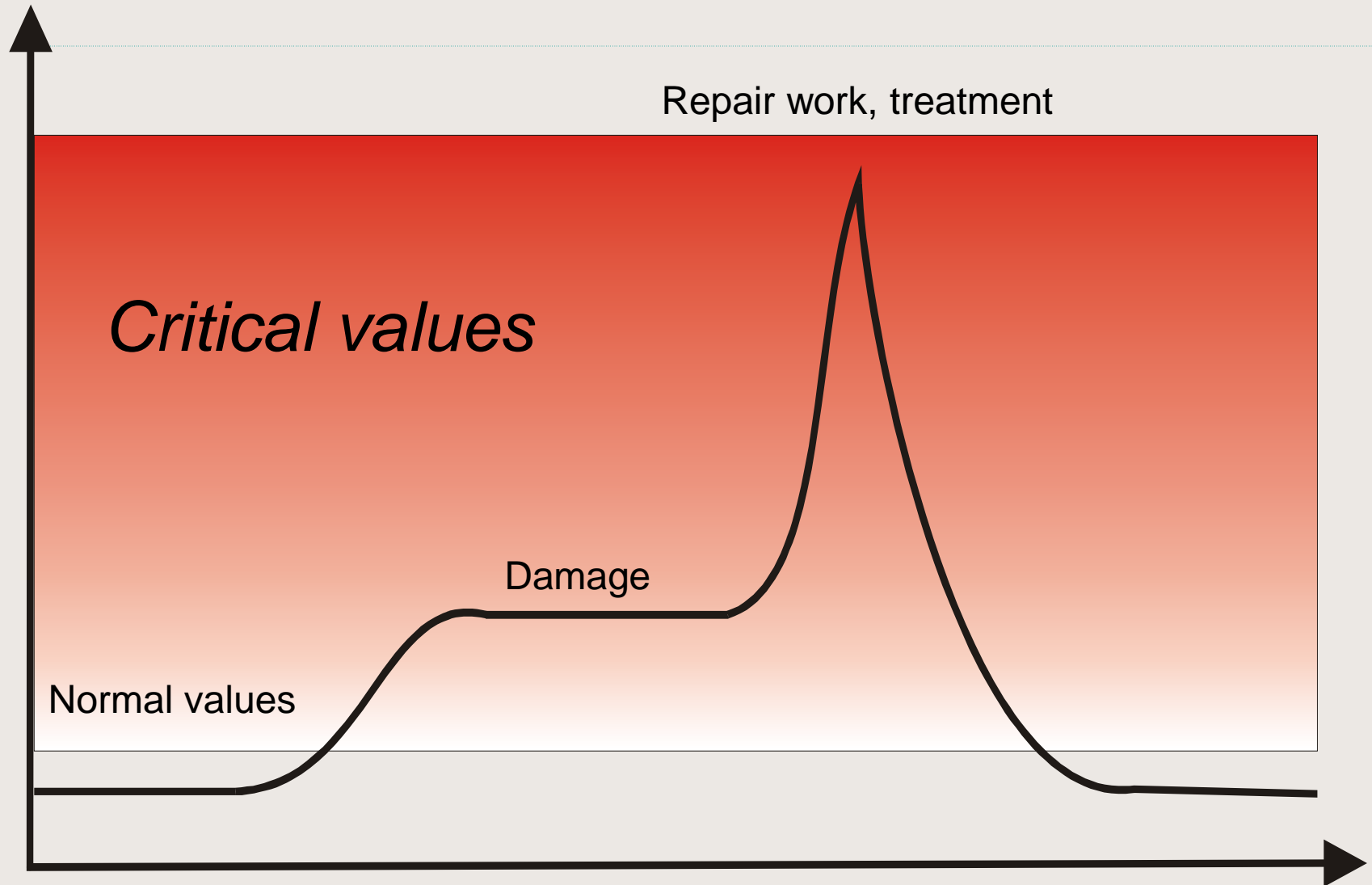
Mycotoxins

Toxin	Active fungi	Effecs	Occurence
Aflatoksins	<i>Aspergillus flavus, A. parasiticus</i>	Cancer, mutations, damage on liver	Nuts, grain, food for animals
Secalonacids	<i>Claviceps purpurea, Penicillium oxalicum, Aspergillus ochraceus</i>	Damages on unborn childs	Products of grain
Ochratoxins	<i>A. Ochraceus, Penicillium viridicatum, P. cyclopium</i>	Damages on kidney, cancer, imunotoxic effects	Products of grain, nuts
Trichthecens	<i>Fusarium spp., Trichderma spp., Trichthecium roseum, Stachyborys chartarum</i>	Cell poision, mutations, cancer, imunotoxic effects	Products of grain, hay
Patulin	<i>Penicillium spp., Aspergillus clavatus, Byssochlamys spp., Paecilomyces variotii</i>	Cell poision, mutations, cancer	Fruit
Moniliformin	<i>Fusarium spp.</i>	Cell poision, mutations, cancer	Products of grain
Zeralenon	<i>Fusarium spp.</i>	Sterility	Products of grain, corn
Ergotoxines	<i>Claviceps spp.</i>	Nerve poision, muscel contractions	Products of grain

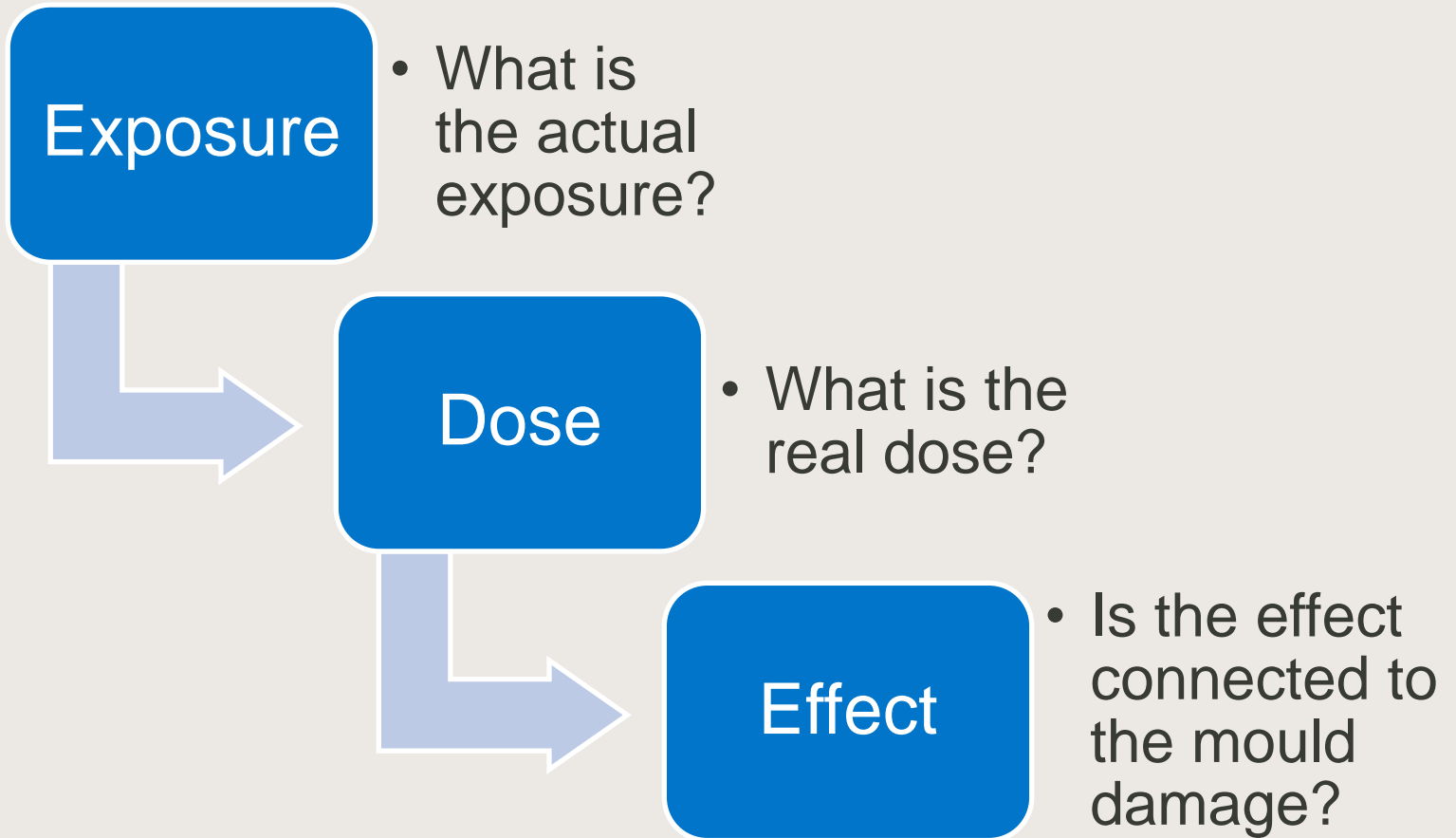
Health reactions - Mycotoksins

- Mycotoxins is how the mould fungi protect itself against bacteria and other organisms.
- Many species have a potential for producing mycotoksins, but it is not necessary every time they do that.
- The toxicity is influenced by several factors; type of substance, dose and exposure pathway.
- Normal exposure is with food.
- The effects can be acute or have a long term effect.
- The effect via the airborne exposure is not well known, but it is very unlikely that this exposure could affect people as much as by digestion.

Exposure of indoor air from mould fungi



Effect?



Measures at mould damages



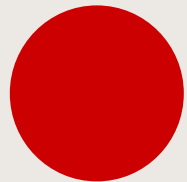
No sign of mould fungi. Further actions is not recommended



Restricted areas with damages (< 1 m²). Local actions can be done.



Moderate size of damages (1 – 3 m²). Maybe local sealing should be done. Protection equipment should be used.



Extensive damages (> 3 m²). Underpressure ventilated enclosure must be established. Protective equipment must be used, especially dust mask with P3 filter.

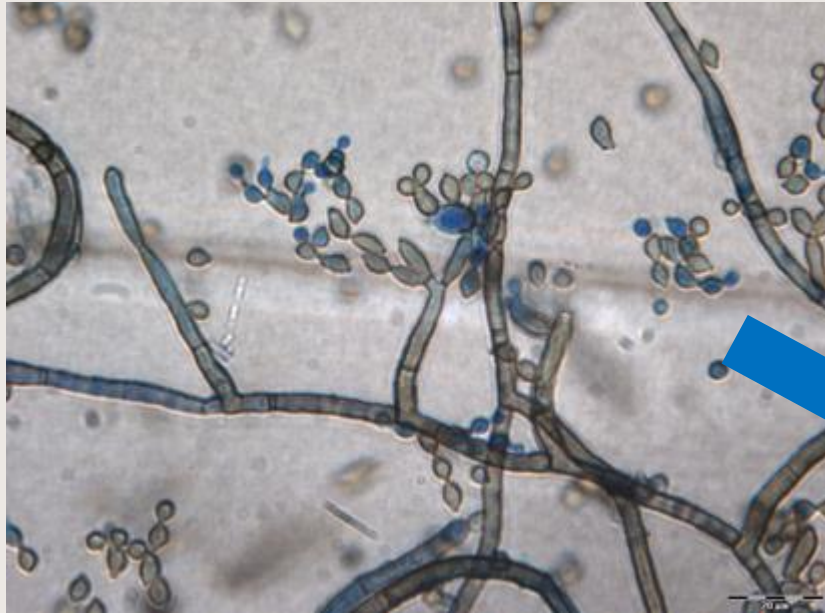
Personal protection

At work with mould damaged materials, personal protection against undesired exposure is very important!

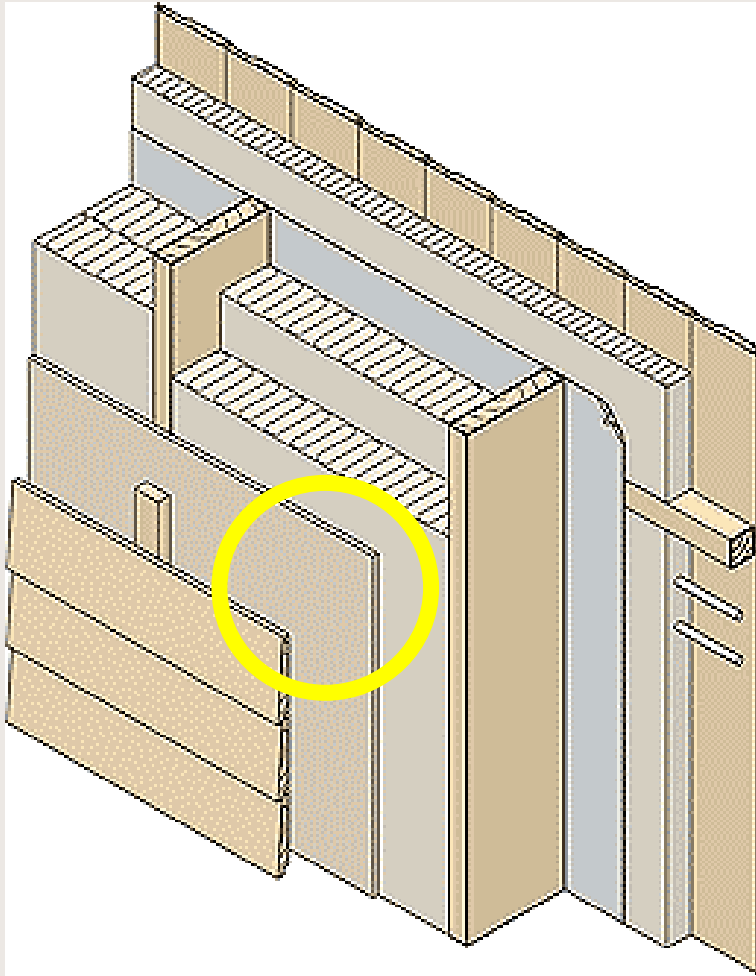




It does not look nice...



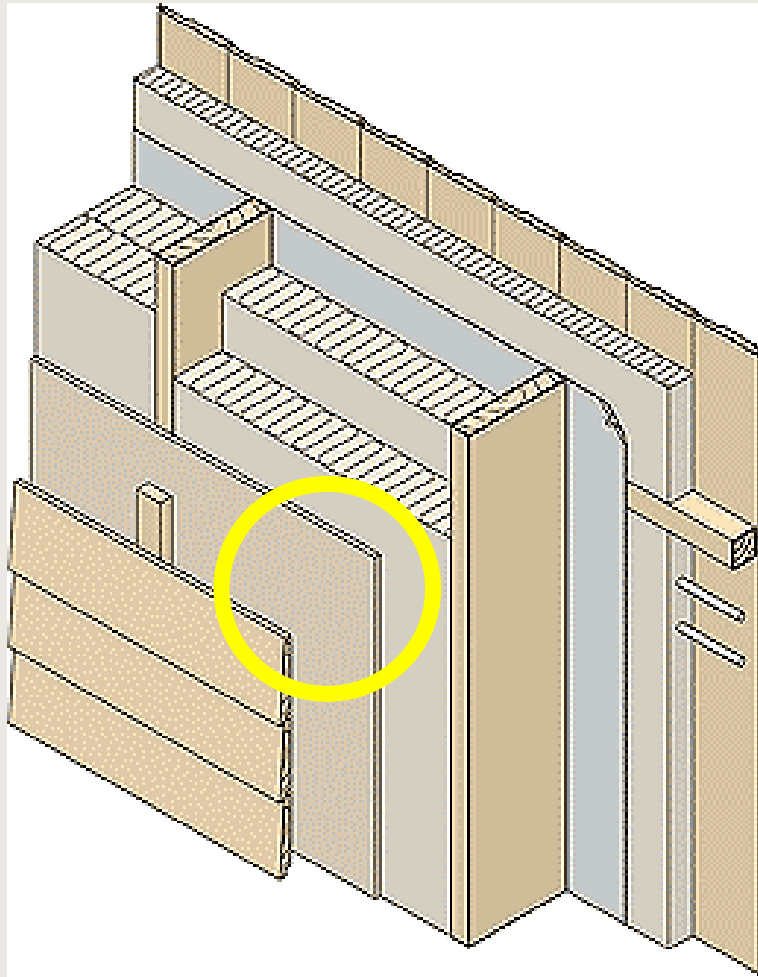
Where is the mould damage?



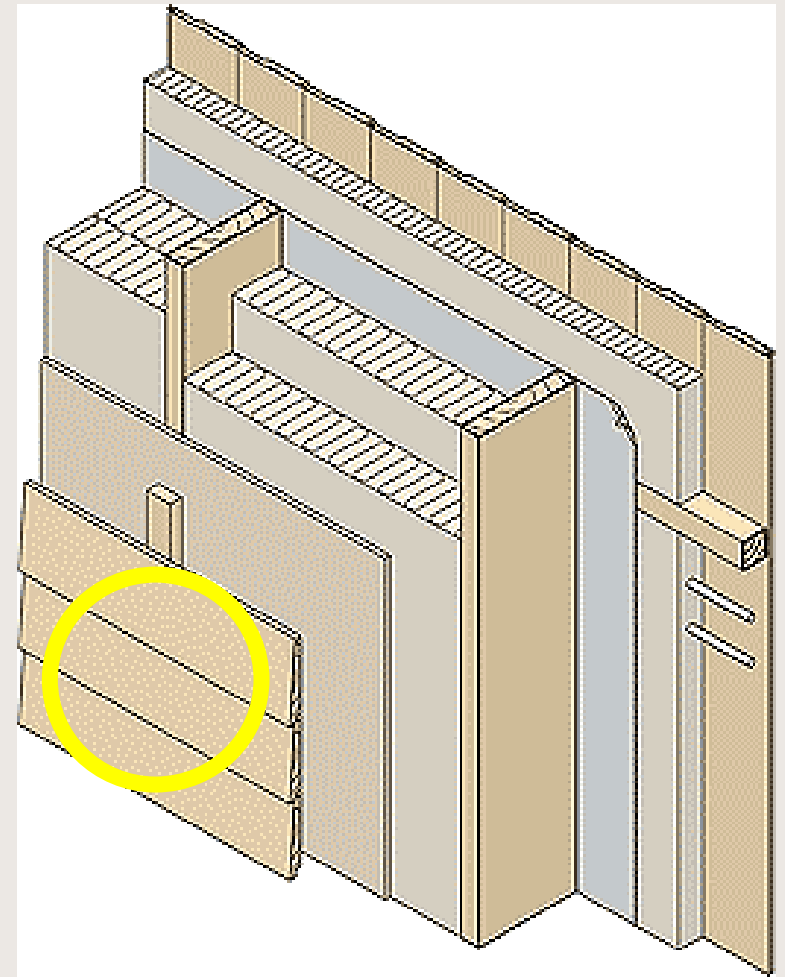
Tegningen er hentet fra SINTEF Byggforsk



Is it a risk for exposure to the IAQ?

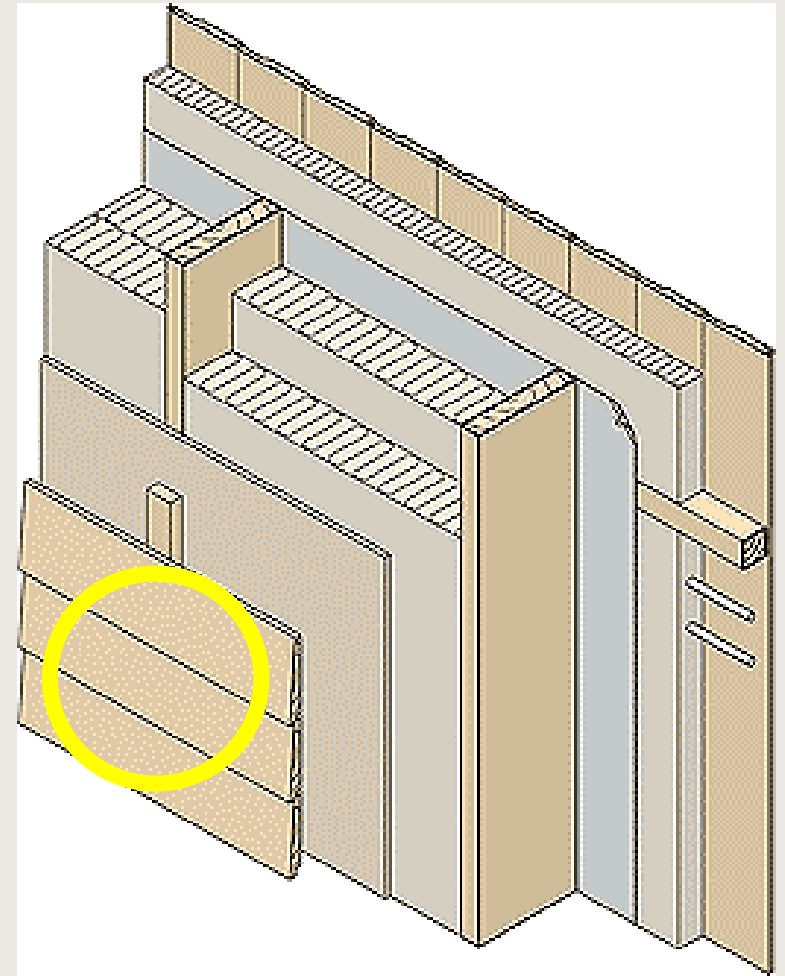


Tegningen er hentet fra SINTEF Byggforsk



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What is the overall picture?



Tegningen er hentet fra SINTEF Byggforsk

Evaluate the risk for critical exposure

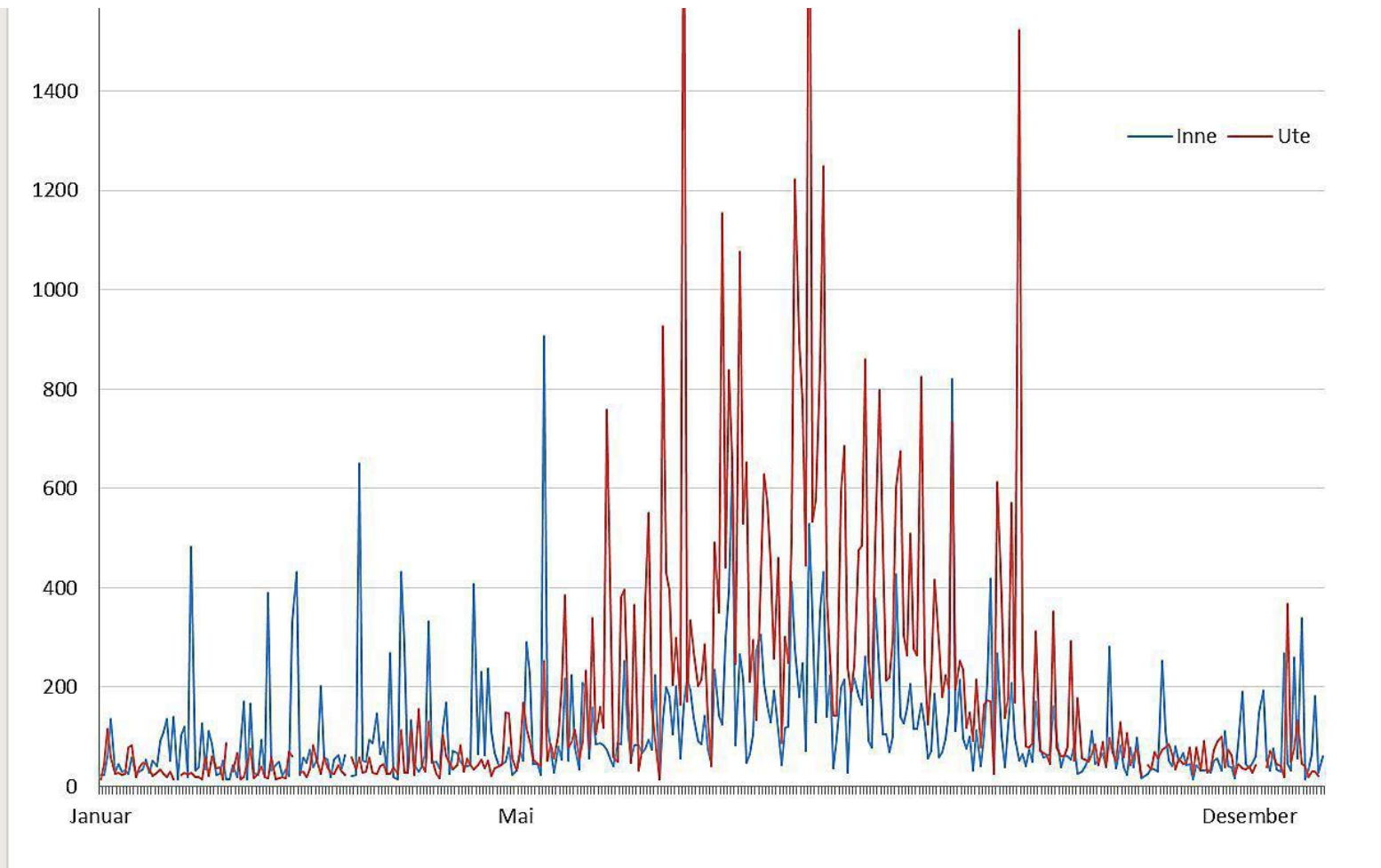


Where is the sources of mould exposure?



What is normal?

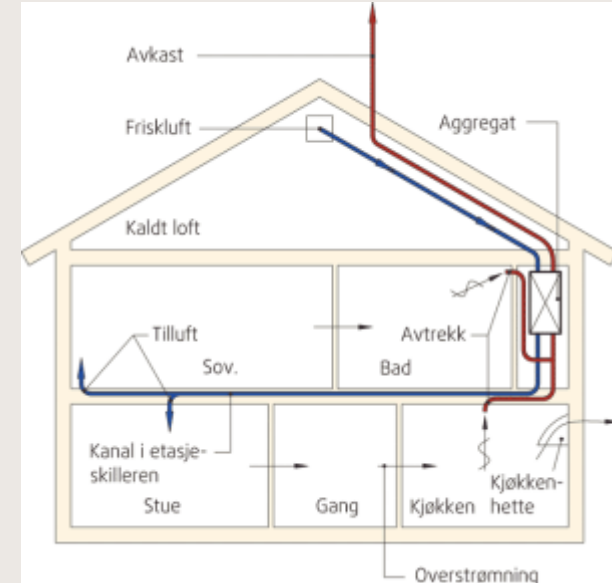
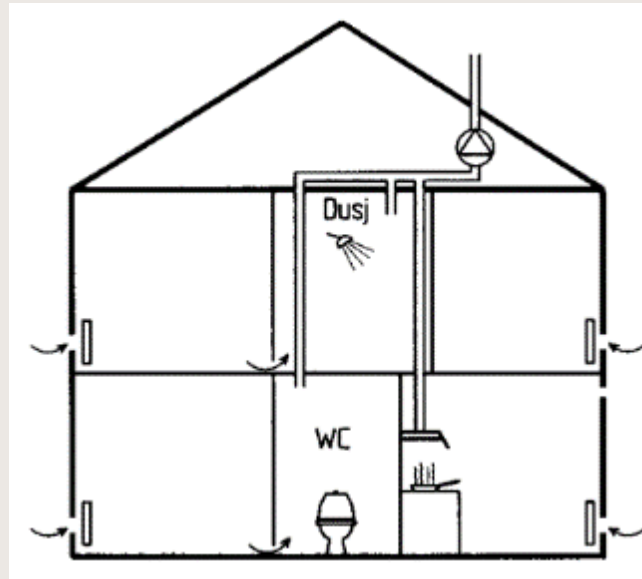
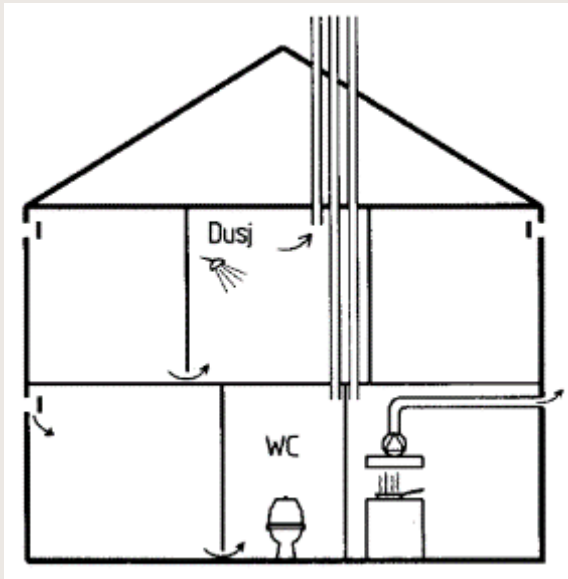
Air sampling of *Cladosporium*-spores indoors and outdoors through a year



Where is the damage? Risk for exposure?

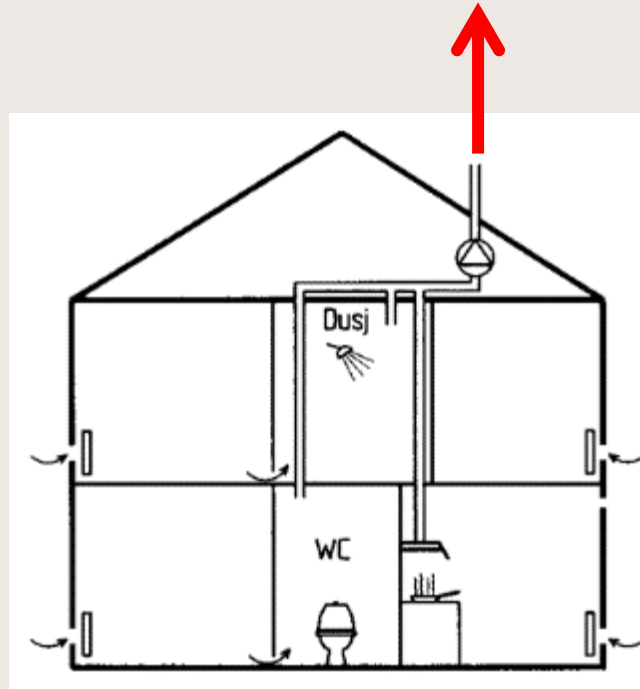


Building physics is central for prediction of exposure



(Figures from the Norwegian Building Research Institute)

Consequenses in a bathroom?



«Identical» damages – different consequences

Damage against concrete wall

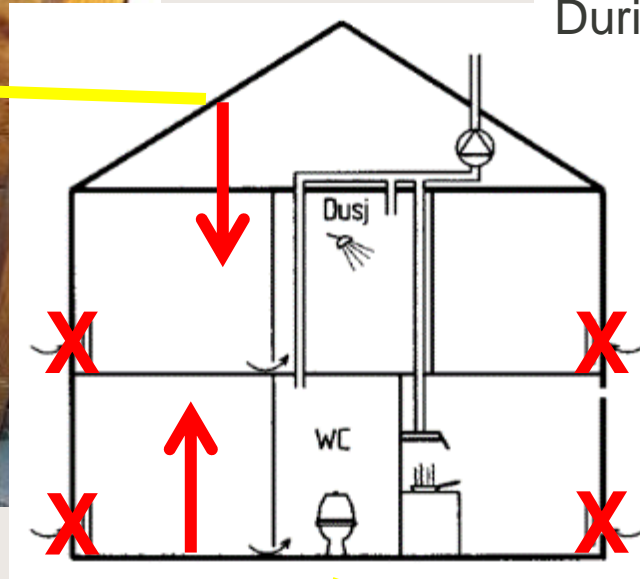
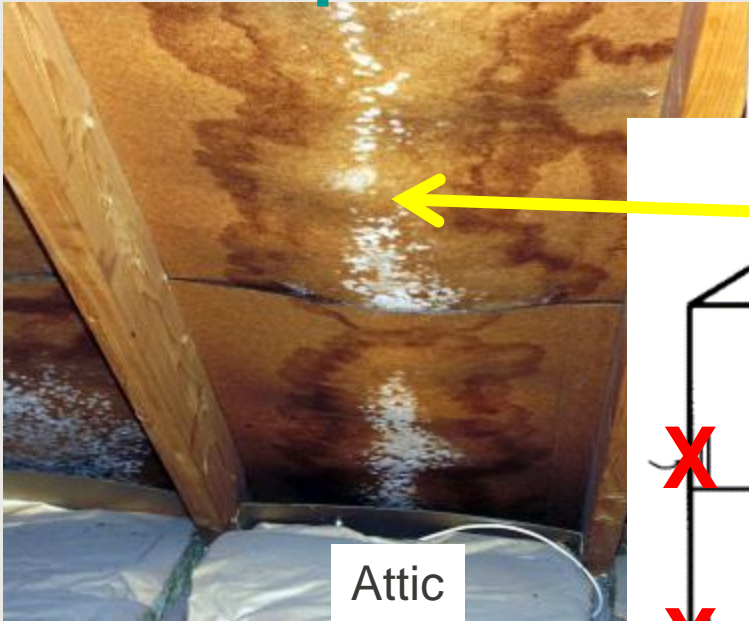
- non or small influence on IAQ,
- but deterioration of materials



Damage against insulated gypsum board covered wall – clear risk of negativ influence on oposite side



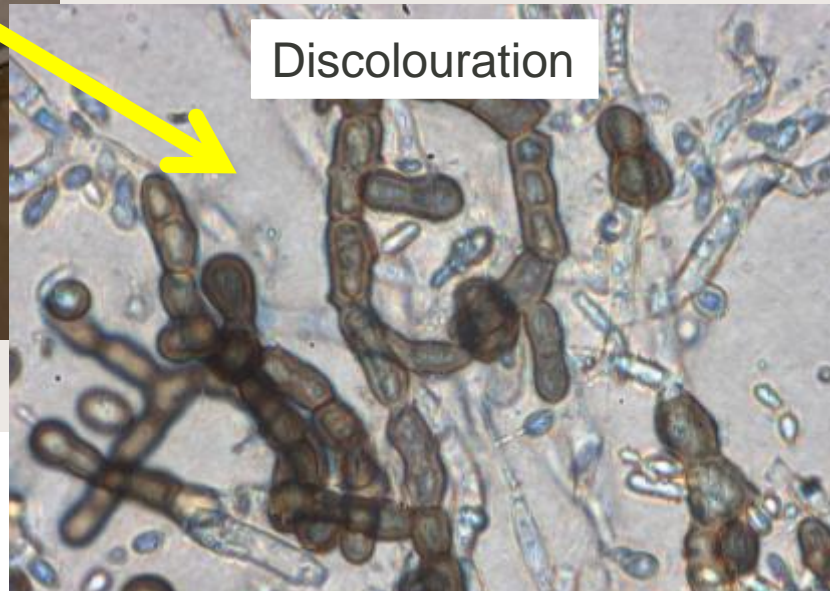
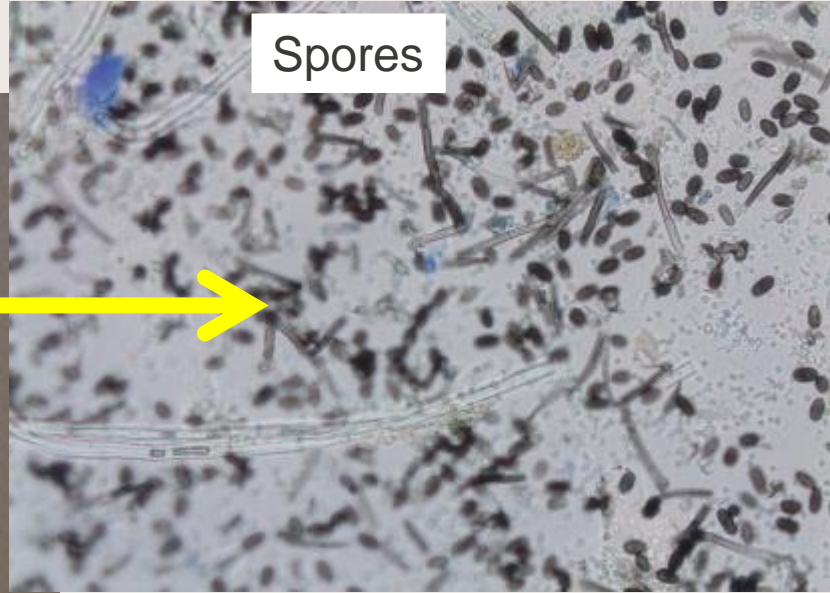
«Identical» damages – can be the same consequences under certain conditions



During the heating season



Exposure – what dose does the damage cause?



Example

Extensive mould damage in an attic



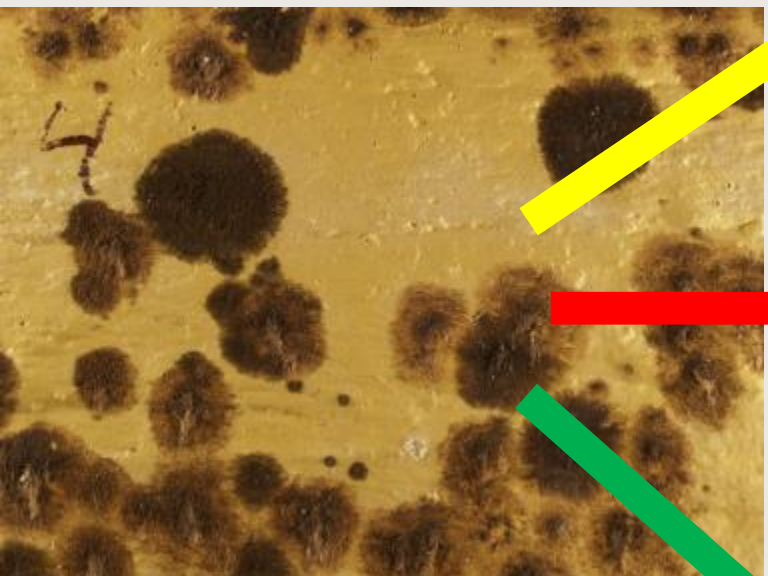
Evaluation





So, this is a «harmless damage

Do you have the correct understanding of the damage?



Important to understand and remember

- It is a great variation in what exposure different mould damages cause.
- Position and building physics have crucial importance for how serious the consequences are for the risk of a negative IAQ.
- General aspects give us a good start, but in order to understand damages, must each damage be evaluated individually.