

Overview

- Sick Building Syndrome – what is it?
- What causes it?
- Why is it important?
- SBS vs. building related illness.
- The role of moulds in building related illness.
- How to investigate it.
- What to do about it.

Sick Building Syndrome – what is it?



- SBS – ‘a group of symptoms of unclear aetiology’ (Burge, 2004) divided into:
 - Mucous membrane symptoms related to eyes, nose & throat;
 - Dry skin;
 - General symptoms of headache and lethargy.
- Common in general population – what makes them part of SBS is temporal relation with work in particular building.
- Most should improve within hours of leaving the problem building.

SBS – where does it happen?

- Most clearly recognised in office environment.
- Similar problems could occur in schools, hospitals, care homes.
- Indoor air problems in domestic dwellings, esp. associated with water damage (Nordic countries' definition).

SBS symptom questionnaire

- In the past 12 months have you had >2 episodes of:
 - Itchy or watery eyes;
 - Blocked or stuffy nose;
 - Runny nose;
 - Dry throat;
 - Lethargy and/or tiredness;
 - Headache;
 - Dry, itchy or irritated skin.
- If 'yes', was it better on days away from office?

(Raw, 1995)

Factors related to increased prevalence of SBS

- Personal factors:
 - Female gender; Lower status in organisation/menial job.
- Individual factors:
 - Paper dust; cigarette smoke; office dust; more use of computers.
- Building factors:
 - High indoor temp.; low fresh air ventilation; poor individual control of temp. and lighting; air conditioning; poor maintenance; poor cleaning; water damage.

The 'Whitehall II' SBS study

- Ongoing health survey of office based civil servants - longitudinal study of 10,308 m+f aged 35-55 at baseline.
- Self-report questionnaire 10 symptoms:
 - Headache; cough; dry eyes; blocked/runny nose; tired for no reason; rashes/itches; cold/flu; dry throat; sore throat; wheeziness.
- 4052 participants (42-62 yrs, m+f) in 44 buildings.

(Marmot et al, 2006)

'Whitehall' SBS study – key findings

- 25% of men and 15% of women reported no symptoms; but 14%/19% reported 5+.
- Physical environment had less effect than psychosocial work environment – including airborne fungi against 'acceptable limit' of 500 cfu/m³ and bacteria of 1000 cfu/m³.
- Control over local workstation related to lower reported symptoms.

SBS and mould exposure

- No clear evidence that SBS is linked with mould exposure.
- However – building related disease:
 - Infectious disease associated with building services (e.g., Legionella);
 - Disease from worker to worker;
 - Toxic reaction to chemicals in building;
 - Fungi, bacteria or their toxins present in buildings.

Mould exposure in buildings – why is it important?

- More extensively researched in USA – more problem there or more aware?
- 4345 adult residents surveyed – association between dampness, air conditioning & respiratory ill health.
- Significant positive association between workplace dampness and sick leave with respiratory symptoms.
- Estimated cost burden of US\$1.4 billion.

(Sahakian et al, Indoor Air Feb 2009).

Factors and causes of mould exposure in buildings

No surprises here:

- Food – construction materials, furnishings.
- Water – high humidity (>60% RH).
- Warmth.

Exacerbated by:

- Inadequate ventilation; poor maintenance; water intrusion; HVAC systems.

Mould contamination in buildings – examples

- Evidence of fungal growth in HVAC condensate drain pan



(Image courtesy CDC NIOSH)

Mould contamination in buildings – examples



- Fungal growth following roof leak.



(Images courtesy CDC NIOSH)

- Fungal growth under carpet

Mould contamination in buildings – examples

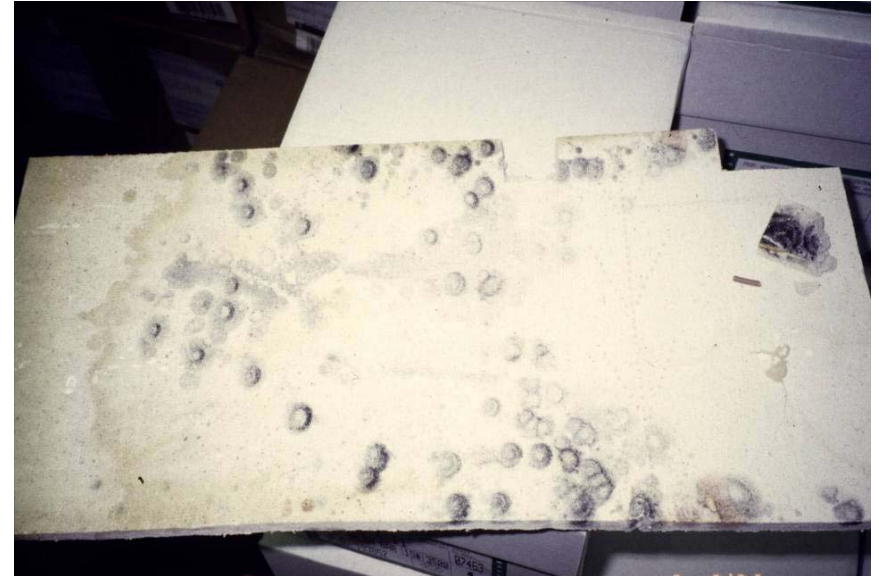


(Images courtesy CDC NIOSH)

- Behind wallpaper

- Undiscovered roof leak

Mould contamination in buildings – examples



(Images courtesy CDC NIOSH)

- Water damage on suspended ceiling panels

- Mould growth behind panels.

Flood damage and mould contamination in buildings

- Sheffield floods 2007.
- Government buildings flooded – personal documents from members public affected.
- Cannot discard – how to retrieve, remediate and recover?
- Lack of generally available information.
- HSL provided practical advice.

Flood damage and mould contamination in buildings

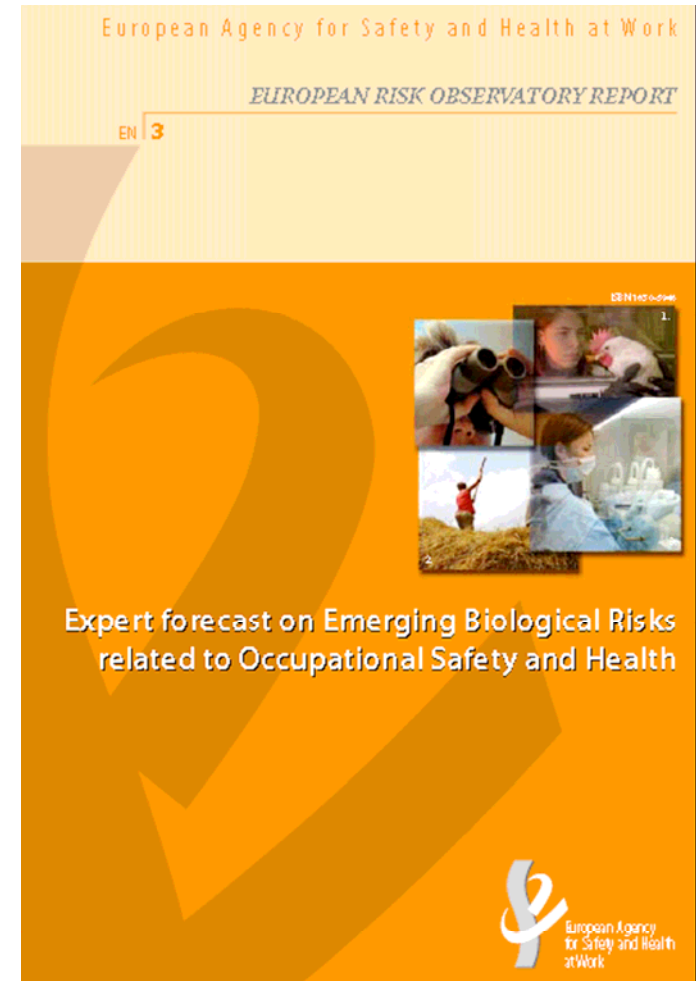


(Image courtesy CDC NIOSH)

- Mould damaged dwelling after Hurricane Katrina

Guidelines for reducing mould exposure in building – when to act?

- US OSHA - $>1,000$ cfu/m³ = probable contamination source.
- EC - >500 cfu/m³ = intermediate; $>2,000$ cfu/m³ = high.
- Investigation & remediation >500 cfu/m³ and health complaints.
- Not just based on numbers, but predominant taxa.



Prevention measures to reduce potential for mould in new buildings

- Minimise exposure of interior building products to exterior.
- Monitor & maintain integrity of building impermeable envelope.
- Check material delivered clean & dry – reject wet or mouldy material.
- Protect stored material from moisture; prevent spillage of water; minimise moisture accumulation; balance control of thermal comfort & humidity.

(European Risk Observatory Report, 2007)

Remediation of mould problems in existing buildings – assessing the problem



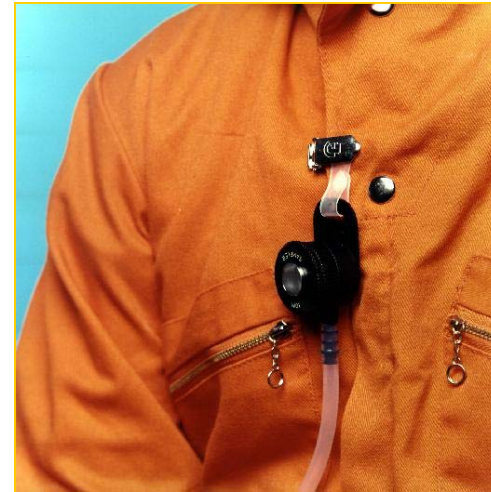
- Walk-through inspection – premises including HVAC system.
- History of water damage.
- Temperature, humidity, air movement.
- Visible mould, mould odours.
- Hidden mould (intrusive inspection behind wallpaper/panels, under carpets, in ceiling or wall cavities).
- Air, surface sampling.

(European Risk Observatory Report, 2007; American Industrial Hygiene Association. Recognition, Evaluation, and Control of Indoor Mold, 2008)

Air sampling for mould exposure in buildings



- Agar plate impaction;
- Filtration.



Other assessment methods for mouldy buildings



- Smoke pencil – air movement

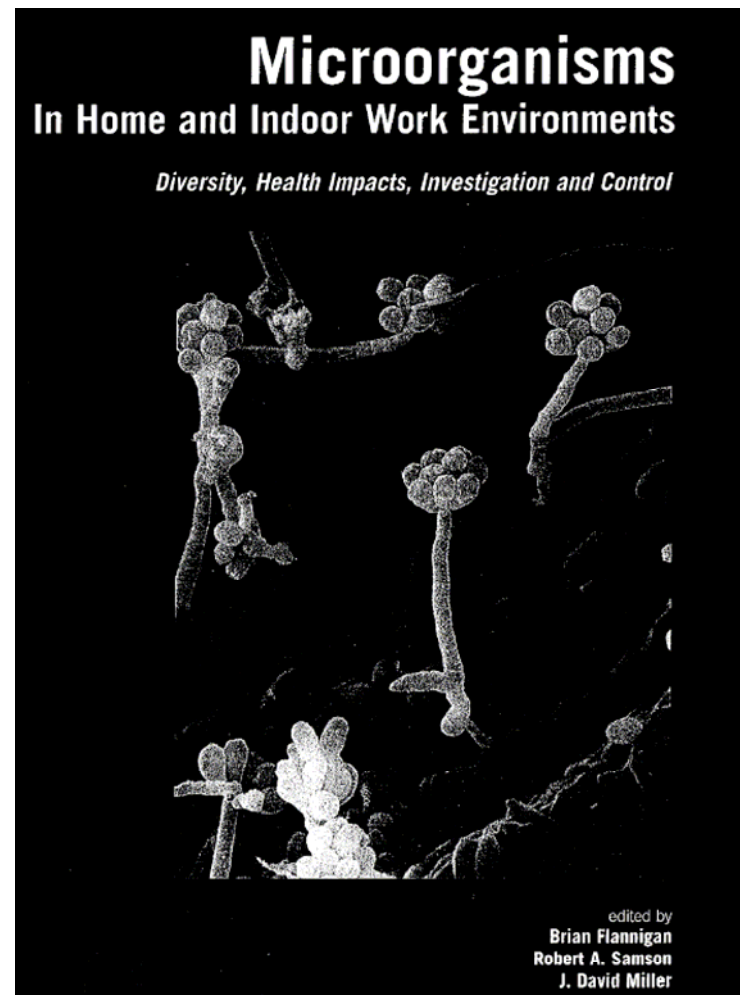


- Checking moisture levels

Mould problems in buildings – the culprits

Gravesen et al, 1997:

- Penicillium 68%
- Aspergillus 56%
- Chaetomium 22%
- Ulocladium 21%
- Stachybotrys 19%
- Acremonium 14%
- Mucor 14%
- Paecilomyces 10%
- Alternaria 8%
- Verticillium 8%
- Trichoderma 7%



- **Highly recommended reading**
(soon to be revised 2nd edition)

Actions to remediate mould problems in buildings

- Remove people from exposure.
- Identify and fix the underlying problem.
- Remove affected material – protect remediation workers from exposure and minimise spread of contamination.
- Chemically treat remaining materials if possible.

Conclusions

- SBS – no evidence of microbial involvement. However.....
- Building related illnesses associated with mould exposure.
- Poor maintenance or water damage → mould → health problems → social & economic cost.
- Monitoring reveals wide range of species.
- Aggressive remediation needed to prevent continued problems.

Other recommended reading



- US Institute of Medicine
Committee on Damp
Indoor Spaces and
Health, 2004:
<http://www.nap.edu/openbook.php?isbn=0309091934>

Damp Indoor Spaces AND HEALTH

Committee on Damp Indoor Spaces and Health
Board on Health Promotion and Disease Prevention

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