Moisture in buildings

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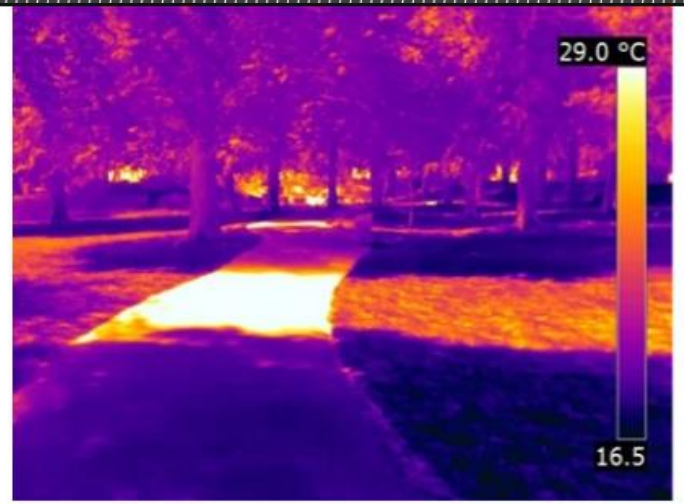
Sustainable Behaviour

Our research provides insight into how people behave and explores how to develop behaviour change interventions that enable people to live more sustainably.

Sustainable Buildings

Research into how to design, build and evaluate buildings which are healthy and have low environmental impacts.



Sustainable Urban Environments

Monitoring urban landscapes to promote healthier, more sustainable cities and communities.

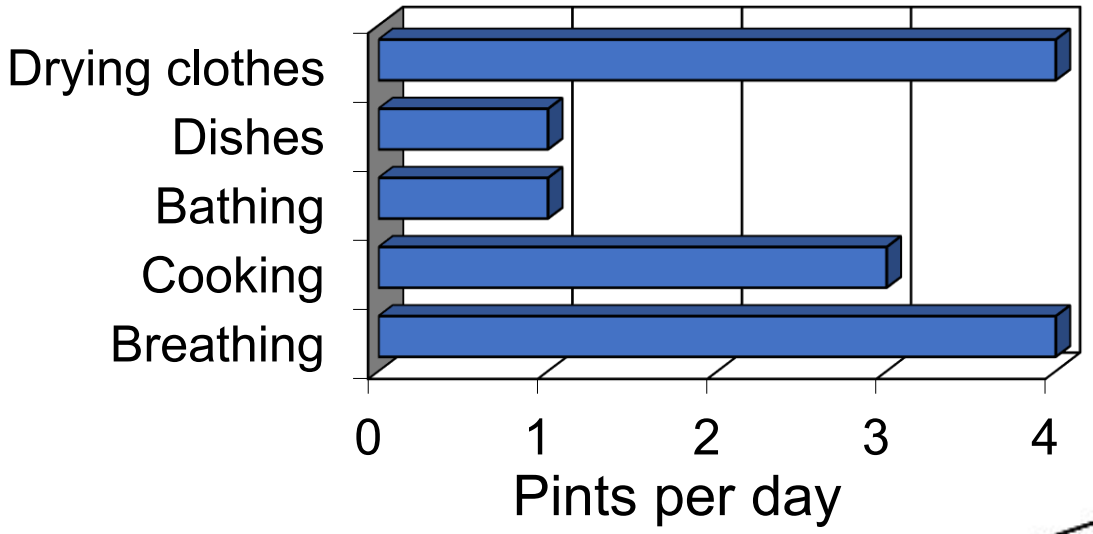
What do we mean by moisture in buildings?

As a solid – ice

As a liquid – liquid water

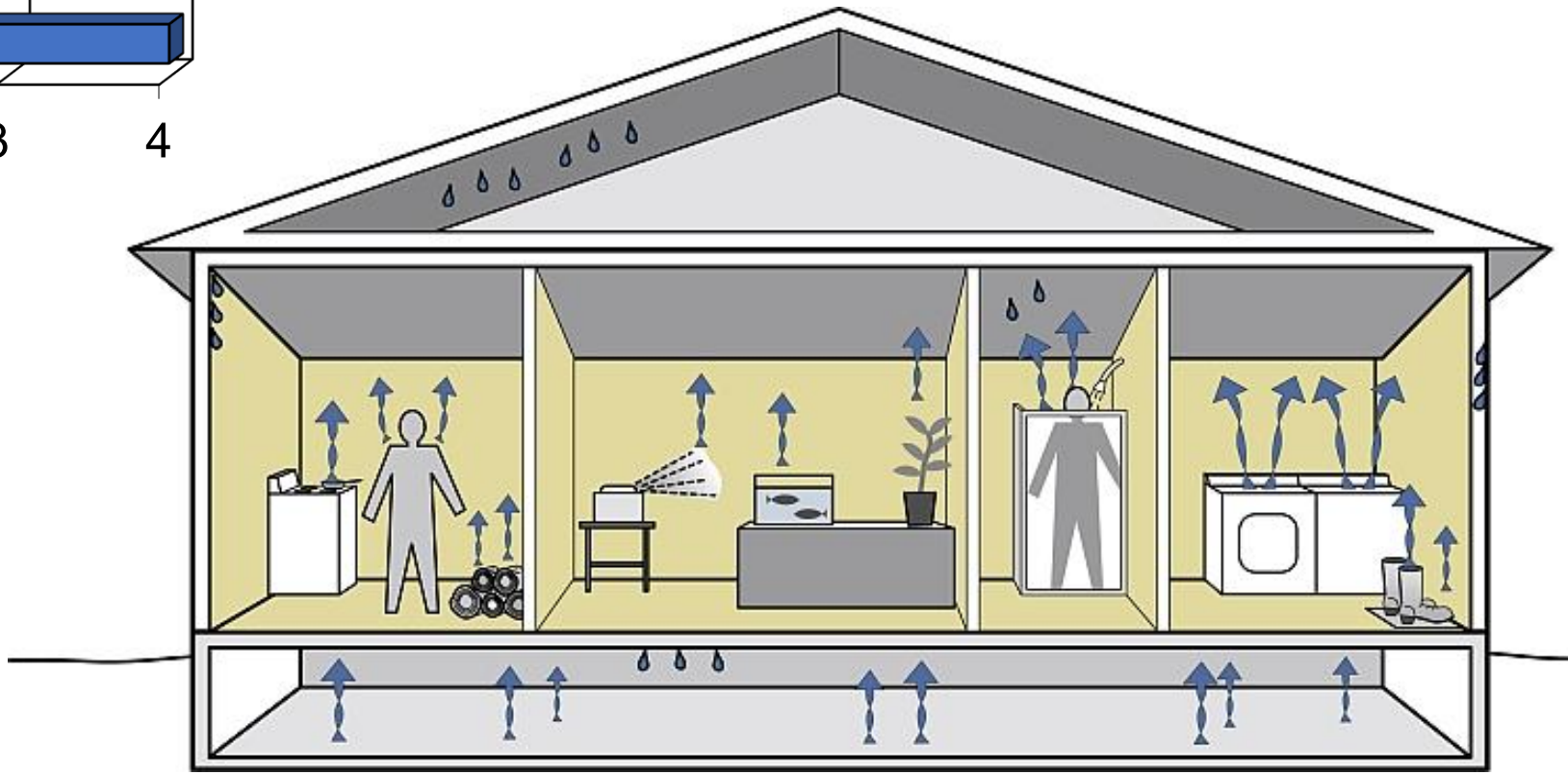
As a gas – water vapour

Where does it come from?



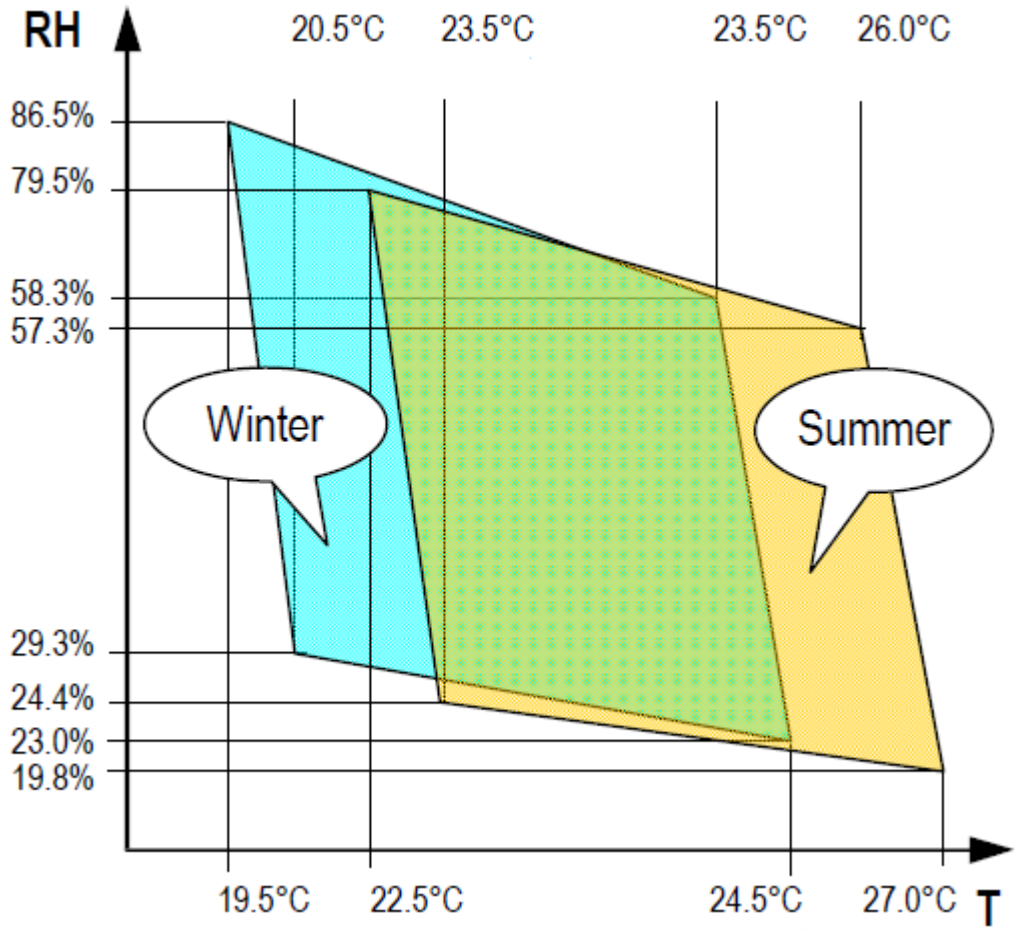
A family of four produces over 20 pints of water vapour in a day

- People (see above)
- Plants
- Wind driven rain
- Construction moisture
- Rising damp
- Ventilation (in the air)



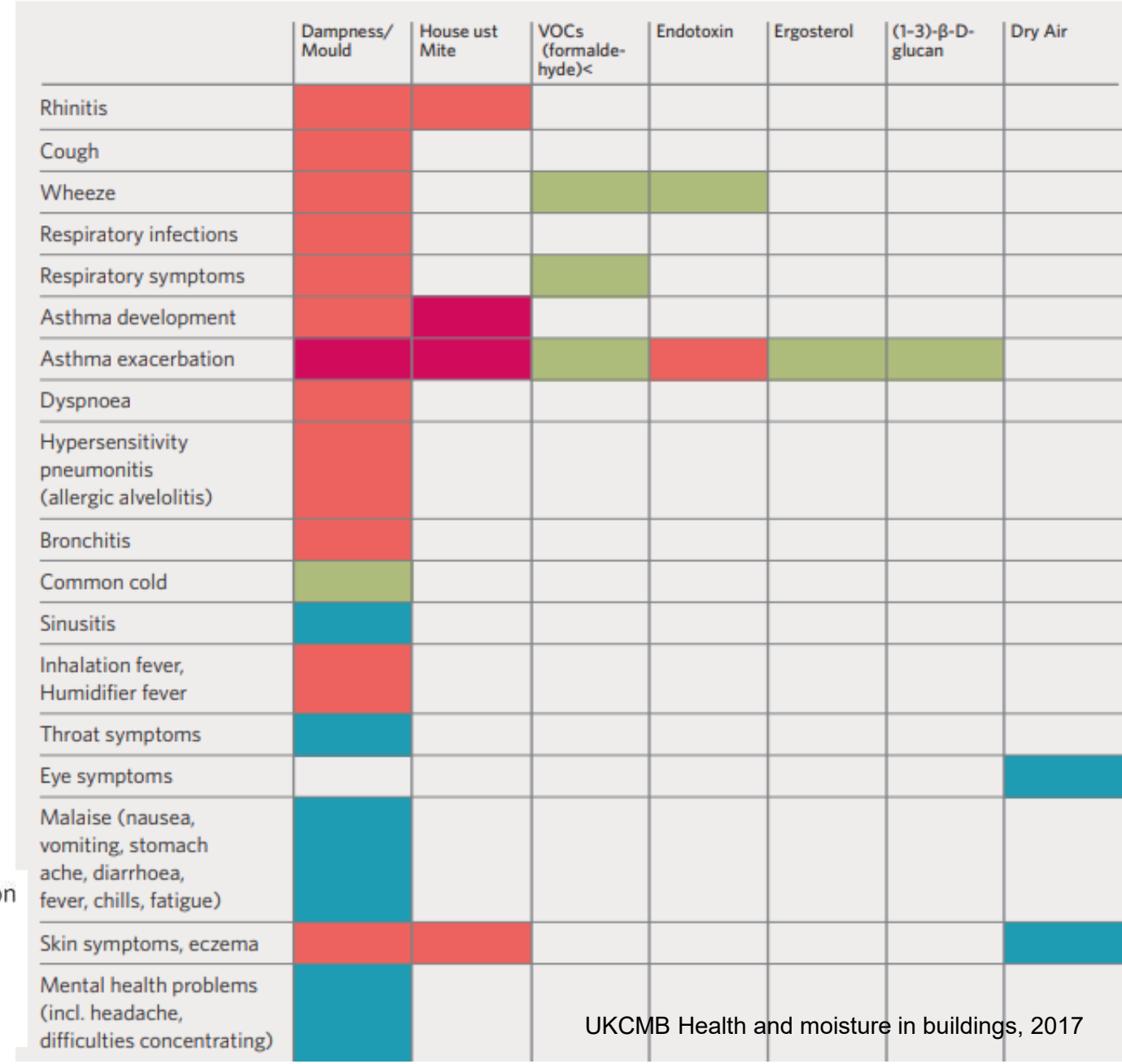
Why is moisture so important in homes?

It affects comfort



Ali Alahmer, 2013, RELATIVE HUMIDITY (RH) / TEMPERATURE (T) DIAGRAM BASED ON COMFORT ZONE ACCORDING TO ASHRAE 55-1992 (ASHRAE 55, 1992; SENSIRION CO., 2011)

The heath risks from damp and mould were reviewed by the UK Centre for Moisture in Buildings, 2017

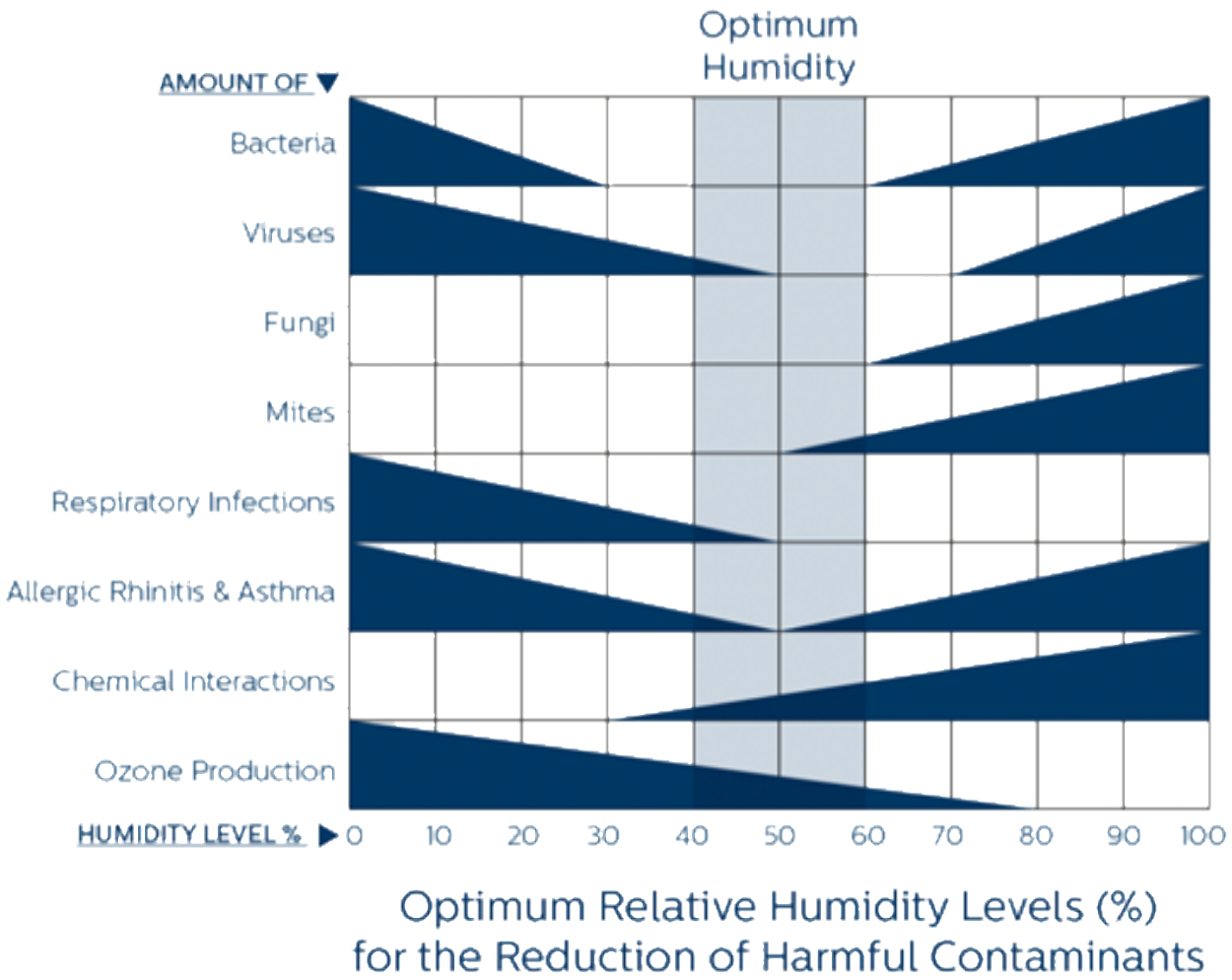


	Dampness/ Mould	House ust Mite	VOCs (formalde-hyde)<	Endotoxin	Ergosterol	(1-3)-β-D-glucan	Dry Air
Rhinitis							
Cough							
Wheeze							
Respiratory infections							
Respiratory symptoms							
Asthma development							
Asthma exacerbation							
Dyspnoea							
Hypersensitivity pneumonitis (allergic alvelolitis)							
Bronchitis							
Common cold							
Sinusitis							
Inhalation fever, Humidifier fever							
Throat symptoms							
Eye symptoms							
Malaise (nausea, vomiting, stomach ache, diarrhoea, fever, chills, fatigue)							
Skin symptoms, eczema							
Mental health problems (incl. headache, difficulties concentrating)							

Literature reveals evidence of a possible association but more evidence is required
Limited evidence of an association exists
Good evidence of an association exists
Evidence of a causal relationship exists

UKCMB Health and moisture in buildings, 2017

Health risks from relative humidity



Optimum Relative Humidity Levels (%)
for the Reduction of Harmful Contaminants

Sterling, E.M.; Arundel, A.; Sterling, T.D. Criteria for Human Exposure to Humidity in occupied buildings. ASHRAE Trans. 1985, 91, 611–622

High and low moisture content in the air is related to an increase in harmful contaminants

Moisture is damaging to buildings

Research indicates that **80% of building failure** is related to **moisture**

(Kumaraperumal et al., 2006)

Source: Fraunhofer IBP, WUFI seminar

Source: Natural Building Technologies

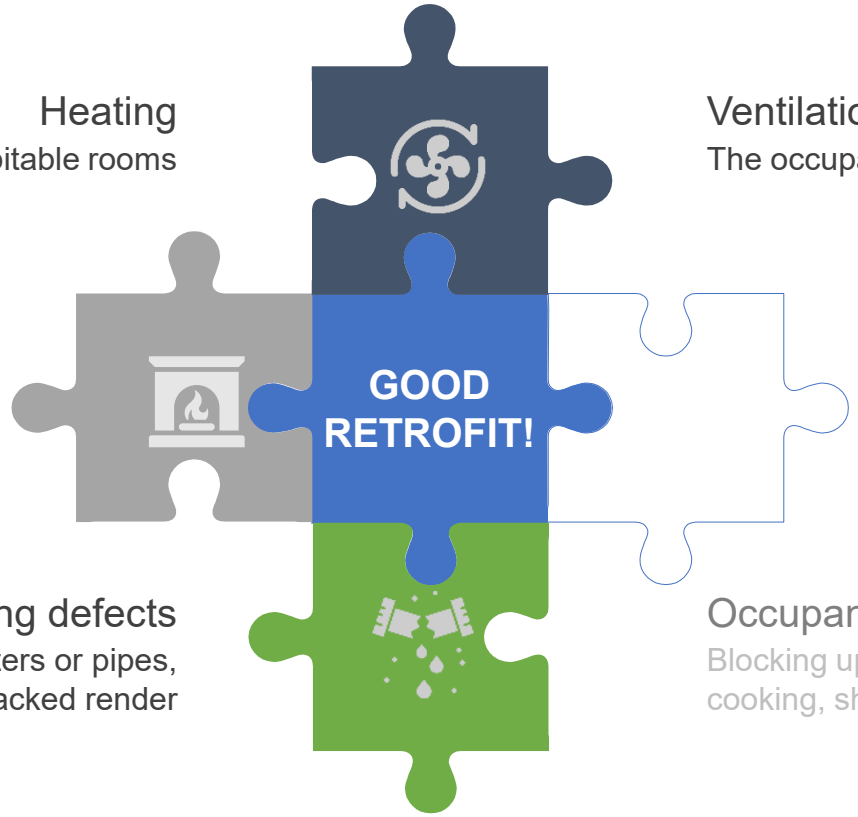
Source: TE Dean & Son Damp Proofing
www.tdeandampproofing.co.uk/Gallery

How can we solve moisture problems in retrofit?

Condensation, damp and mould jigsaw

Heating
The occupant must be able to heat habitable rooms

Ventilation
The occupant must be ale to remove excess humidity at source

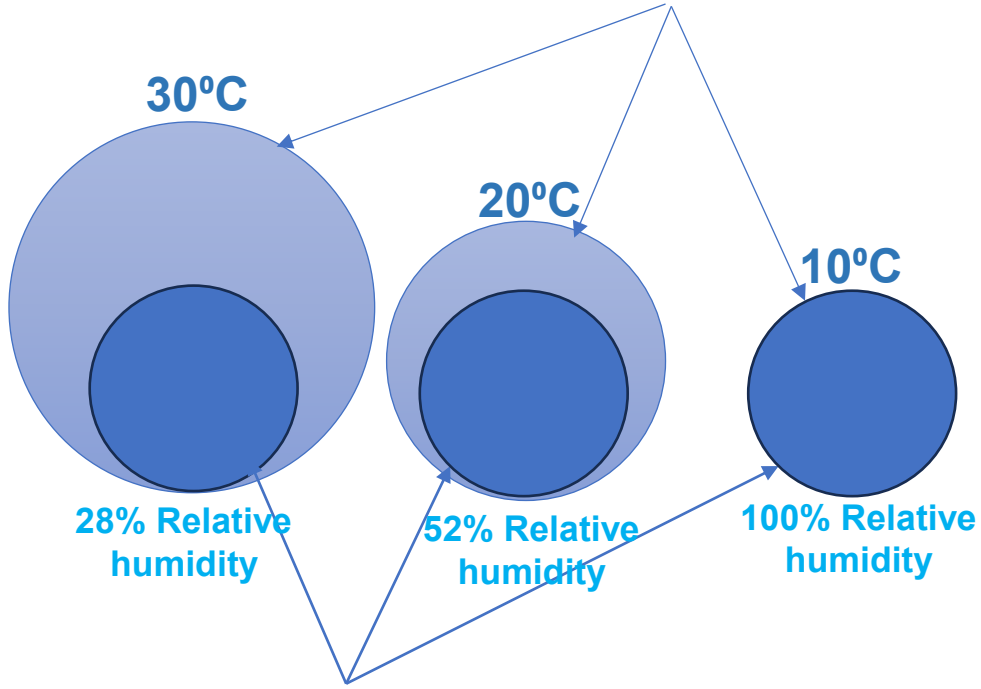


Building defects
Rising damp, leaking gutters or pipes, cracked render

Occupant behavior?
Blocking up trickle vents, opening windows, drying clothes, cooking, showering, pets, plants.

Condensation

Amount of water vapour that the air can hold (saturation)

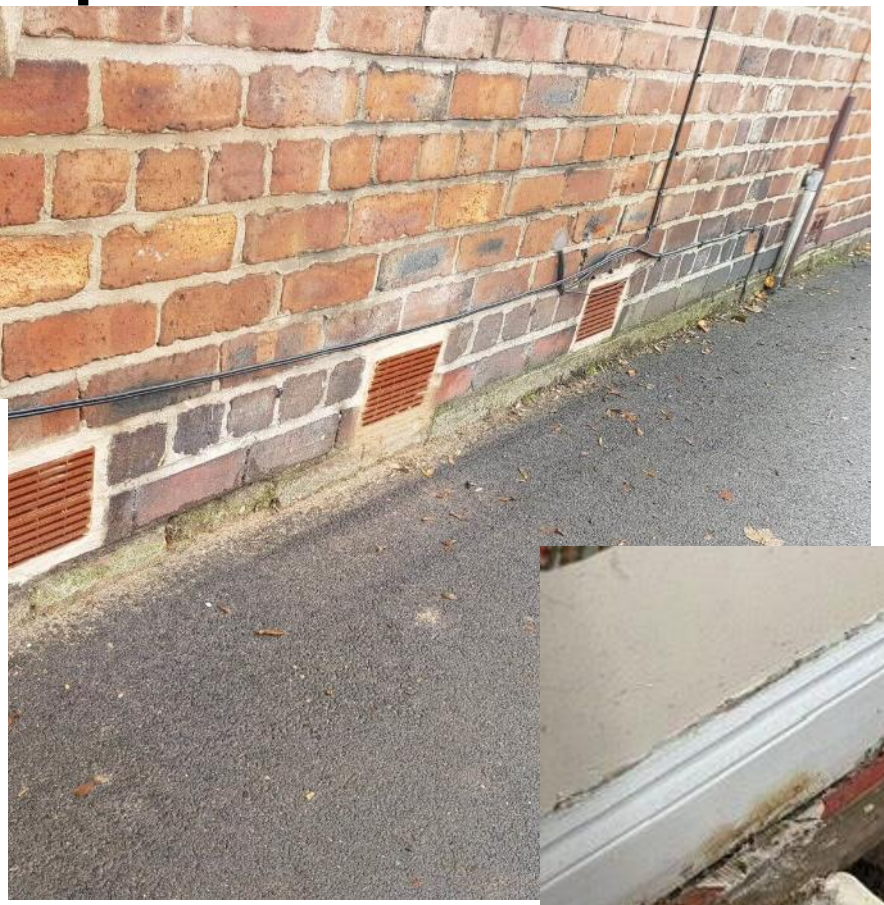


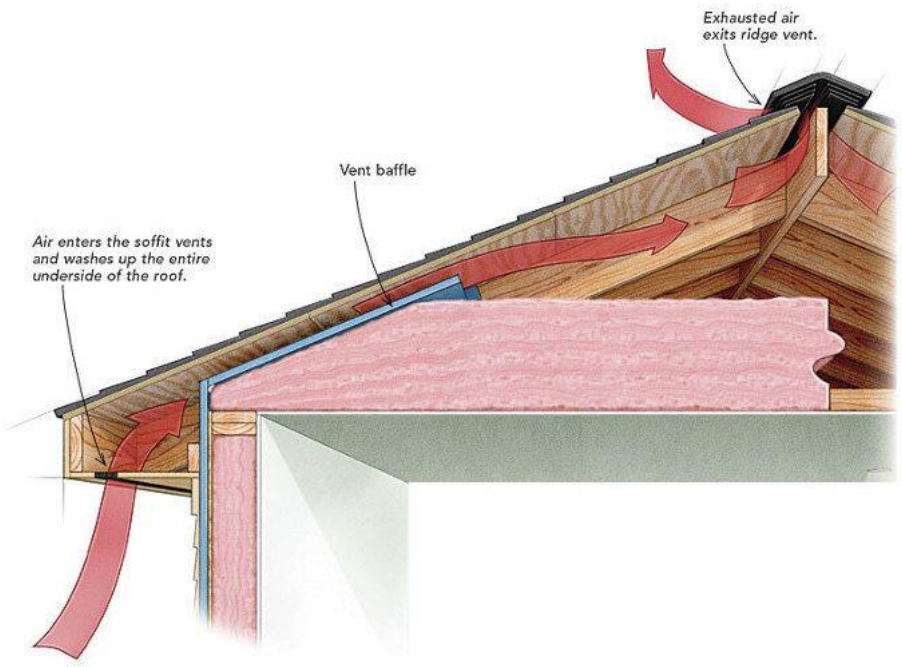
Amount of water vapour in the air

Avoid uninsulated areas

$$f_{\mathrm{Rsi}} \geq 0.75$$

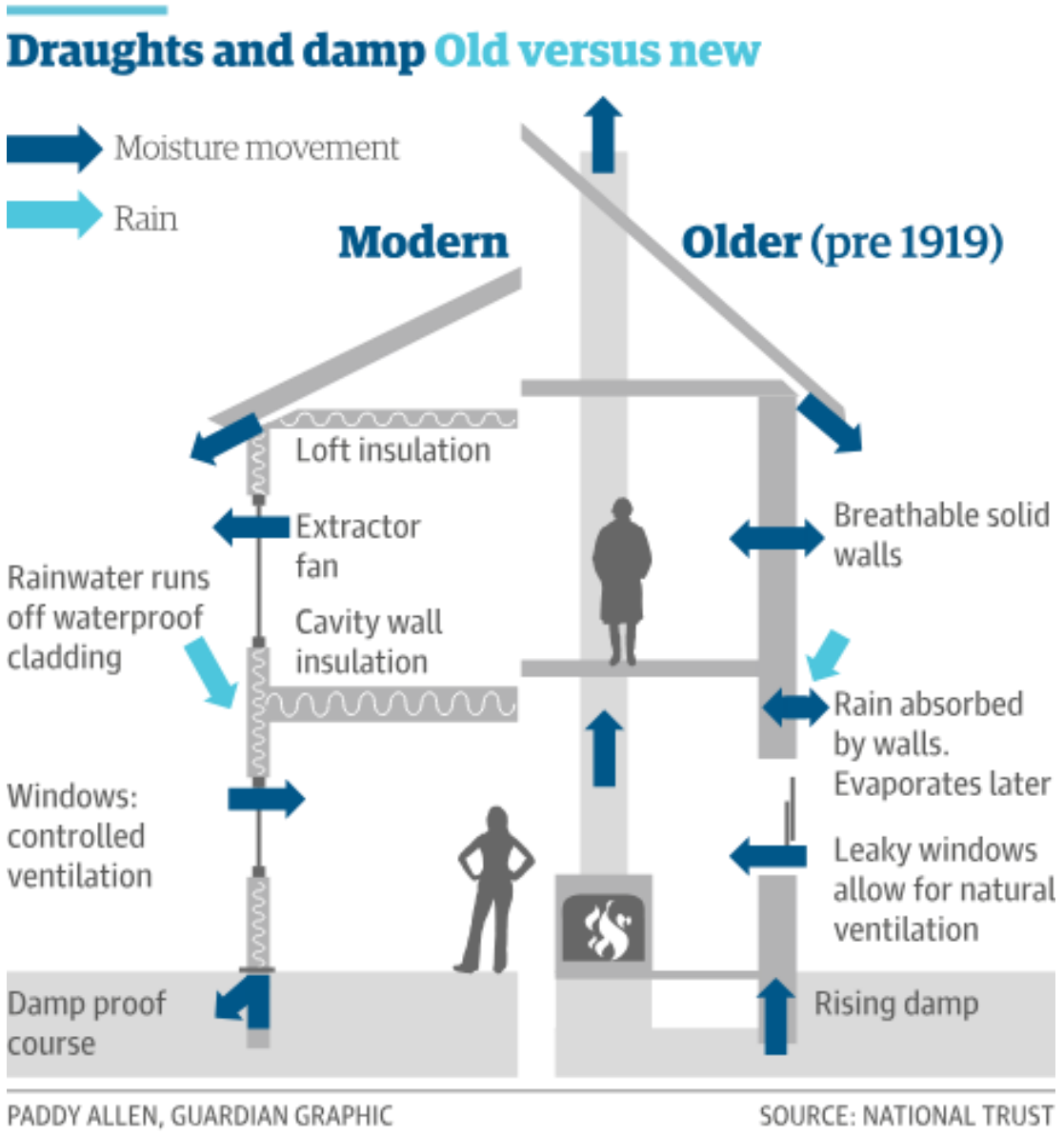
Ventilate enclosed spaces





Traditional vs Modern Construction

Moisture open vs moisture closed

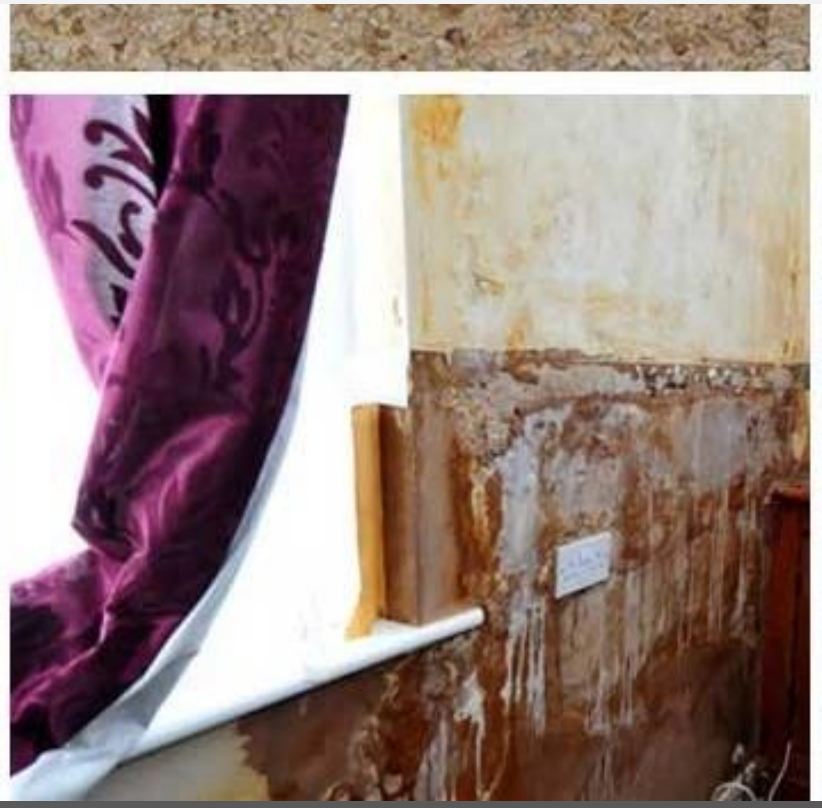


Moisture properties of retrofit materials matters

- Vapour open or vapour permeable
- Hygroscopic
- Capillary active

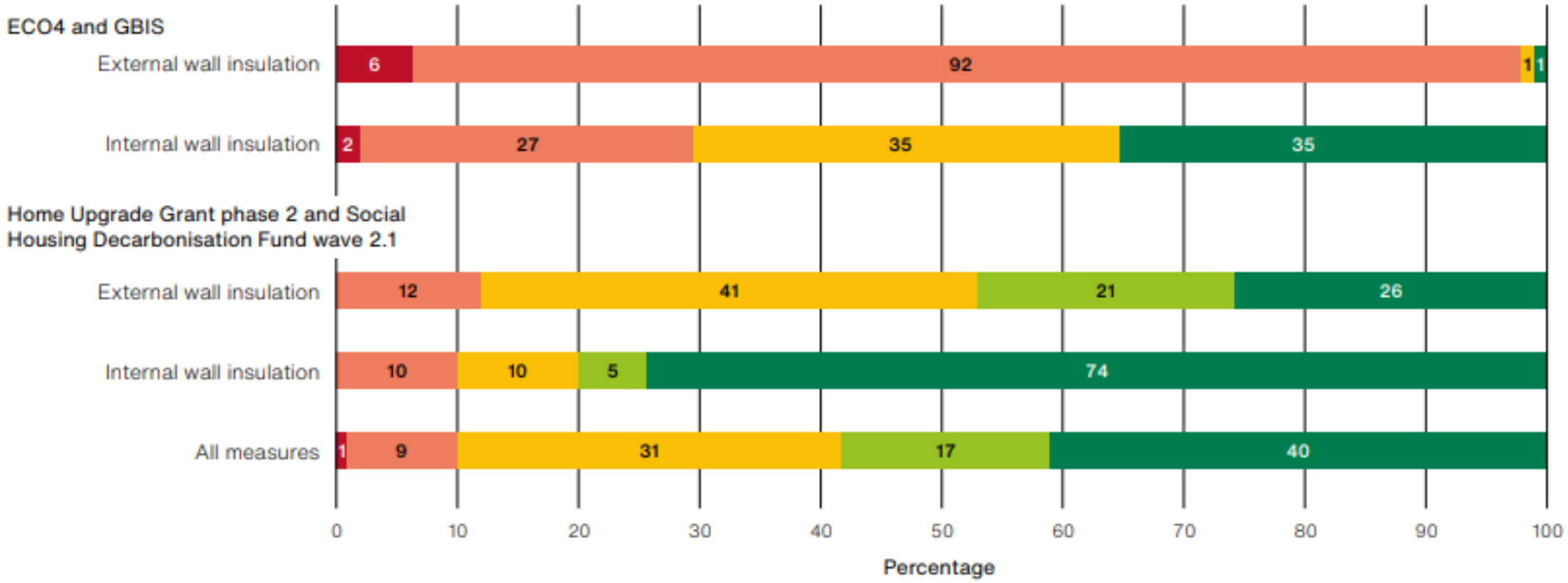


SWI FAILINGS

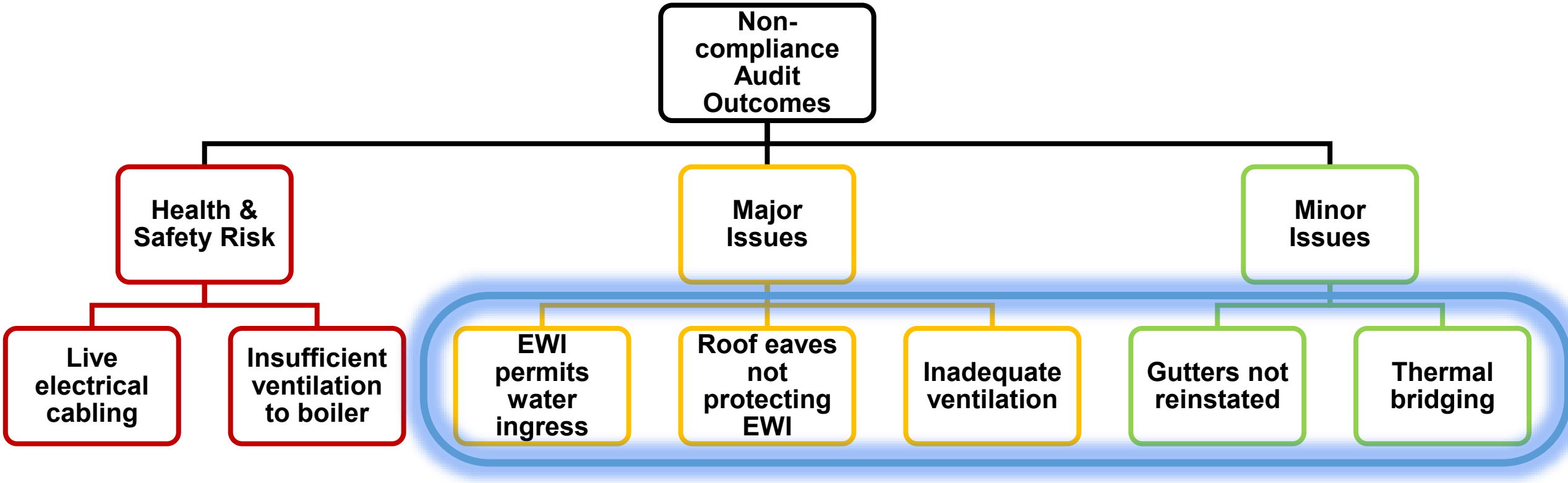




NAO REPORT: SWI ISSUES UNDER ECO

"**92%** (of audited SWI retrofits) had **major issues** requiring remediation because they will affect the insulation's performance, often creating the risk of **water ingress and mould**"



What is going wrong?

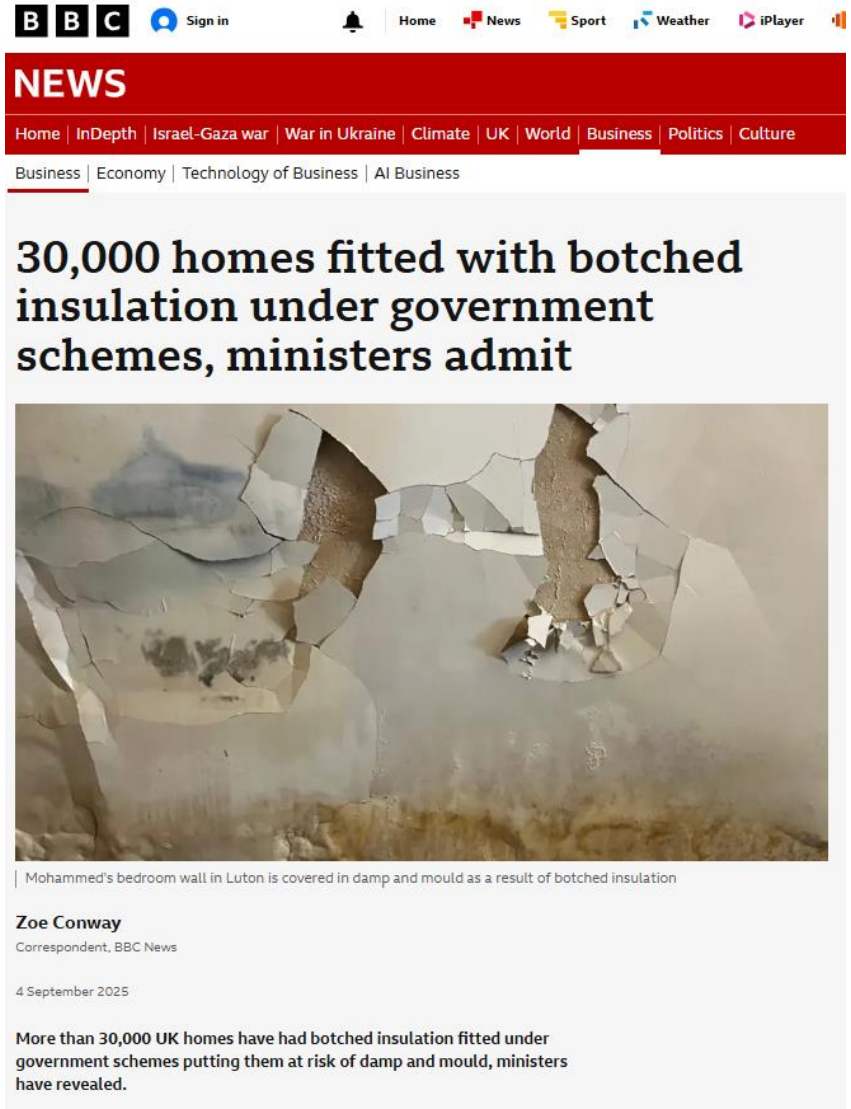


Why are we still making the same mistakes we were 10 years ago?

BRE solid wall retrofit research (2013-2016)

Unintended consequences were related to:

- A lack of design
- Material selection that was compatible with the building and location
- Workmanship
- Quality control on site, with thermal bridging and ventilation assessment ignored
- Failure to understand moisture risk



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30,000 homes fitted with botched insulation under government schemes, ministers admit

Mohammed's bedroom wall in Luton is covered in damp and mould as a result of botched insulation

Zoe Conway

Correspondent, BBC News

4 September 2025

More than 30,000 UK homes have had botched insulation fitted under government schemes putting them at risk of damp and mould, ministers have revealed.

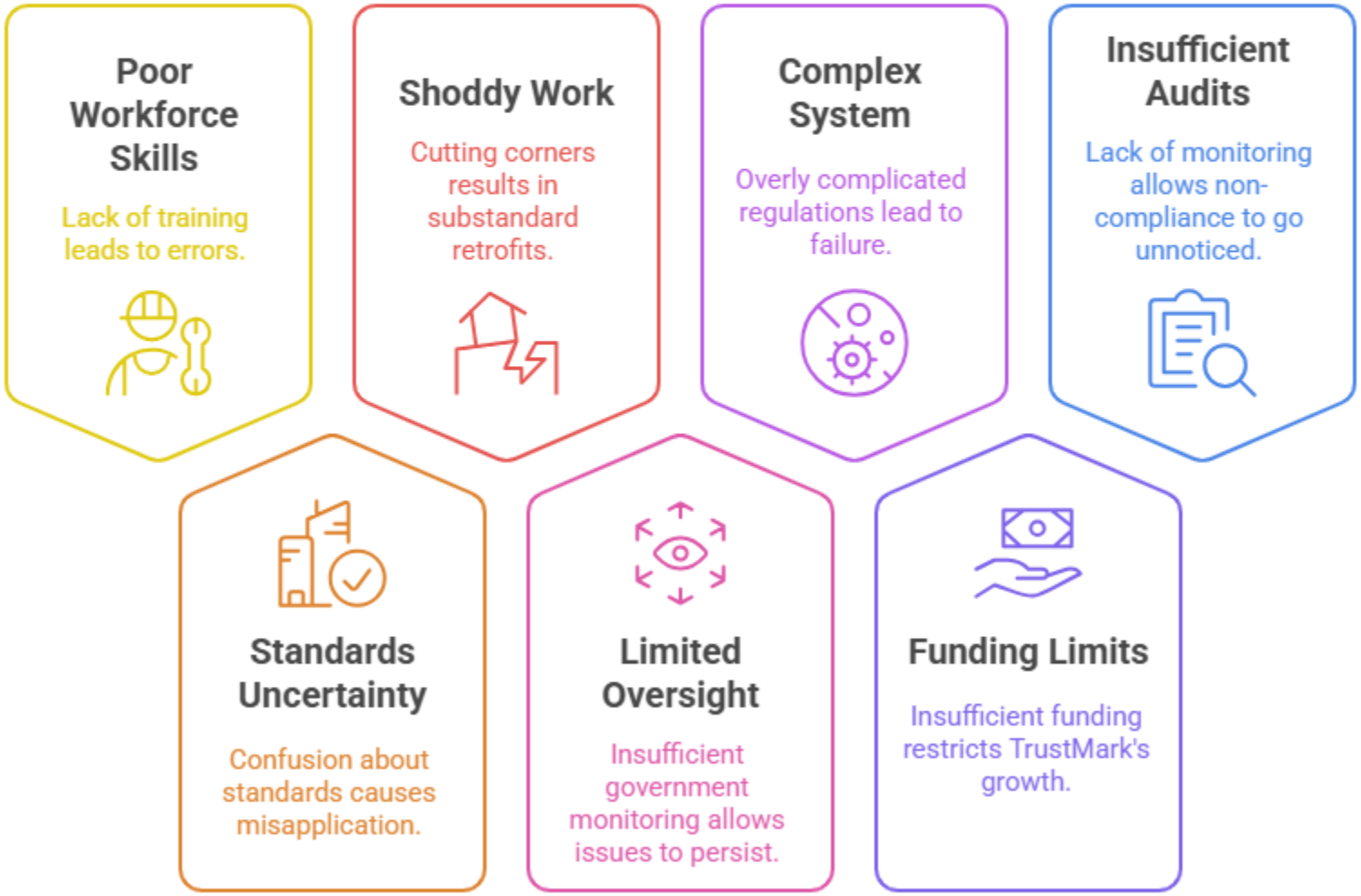
"1% fully met the PAS 2035 standard"

Trustmark raised the concerns

38 installer businesses **suspended**

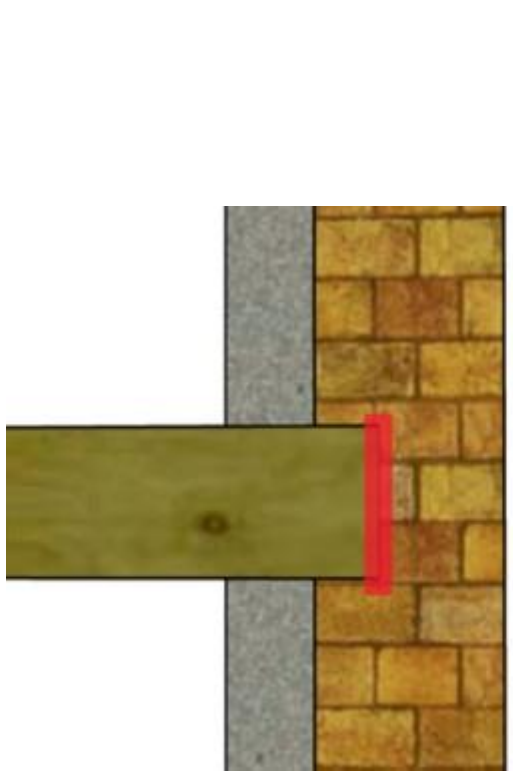
PAS 2035 is there to **protect the consumer** by compelling the industry to deliver **high quality retrofit**

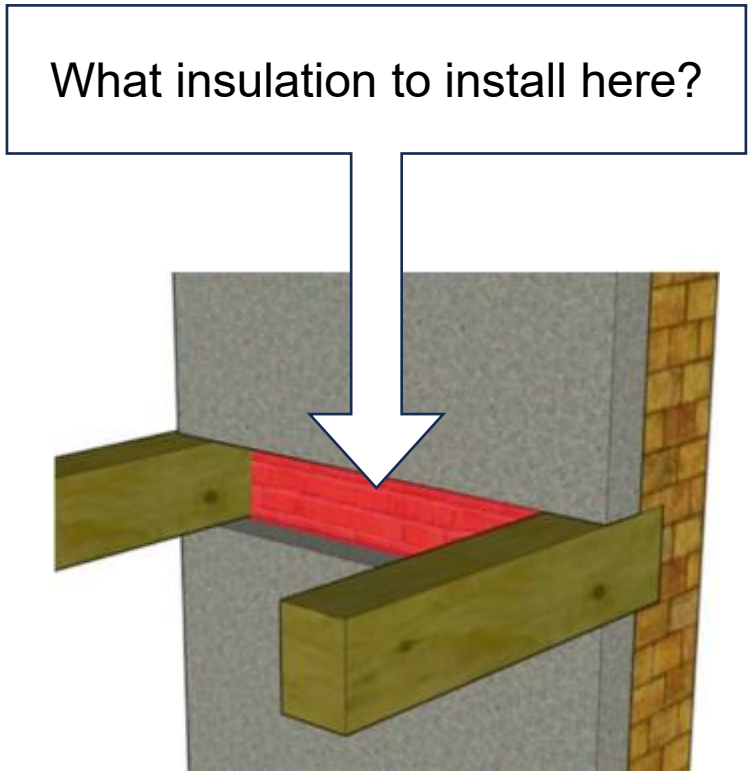
Causes of Non-Compliance



Research interests

IWI and joist ends





Megagiannis, K., Price, S. (2025). Hygrothermal Assessment of the Impact of Different IWI Methods on Intermediate Floor Joist Ends. Moisture in Buildings. ICMB 2025

Ventilation & Infiltration

DESIGN

REALITY

Cardoso et. Al. 2020 The Impacts of Air Leakage Paths and Airtightness Levels on Air Change Rates

Smart ventilation

Find out more…

Thank you
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