

### Written evidence submitted by Dr. Tom Woolley, architect

Despite being chair of the UK Clean Air Steering committee and having previously submitted evidence to the Environmental audit Committee, I was not notified about this consultation and only found out about it by chance, leaving me very little time to submit evidence. As a leading expert on indoor air quality and mould I would like an opportunity to make a presentation to the committee.

I am a semi-retired architect having been Professor of Architect at Queens University Belfast from 1991 to 2007. I am a visiting professor at the Centre for Alternative Technology and chair of the UK Clean Air Steering Committee and chair of the Parliamentary forum on Carbon Monoxide

I have written several books on building materials and Volume 1 of the book Building Materials, Health and Indoor Air Quality: Routledge 2017. I am working on volume 2 which should be ready for publication in 2024

My comments are restricted to the issue of indoor air quality and represent my personal views and not those of the many bodies I am a member of.

- *What are the long-term health impacts of indoor air pollution?*

The long term health impacts of indoor air pollution are extensive and include endocrine disruption, various diseases of internal organs, respiratory and lung problems, asthma and cancer

- *What steps can the Government take to improve indoor air quality?*

The government can fund research that investigate the emissions and health impacts of typical chemicals, materials that are used in conventional homes and buildings by carrying out an extensive range of air sampling and analysis. This research should also investigate mould. They can also fund research into houses that have been constructed with natural non-hazardous breathable materials to see how much better is the indoor air quality in such buildings.

- *What are the differential impacts, geographically, and across socioeconomic groups, of poor outdoor and indoor air quality? Are measures to address poor air quality appropriately targeted?*

The impacts of bad indoor air quality and hazardous emissions from chemicals and standard building products and systems are the same across geographical areas and socio economic groups

- *How well is the Government spreading awareness of the impacts of poor air quality and promoting action being taken to tackle the issue?*

Awareness of the impacts of poor air quality is poor, particularly in the medical community. There has been little action to address this as the focus has been and continues to be on traffic pollution

- *How well is the Government coordinating measures between national and local actors to improve air quality, both outdoors and indoors?*

Very little of evidence of any useful work on this

### **Mould and the death of Awaab Ishak**

*The coroner's report on the death of Awaab Ishak, who was found to have died from a severe respiratory condition caused by prolonged exposure to mould in his home, highlighted the significant impacts of poor indoor air quality.[13] Indoor air pollution has implications for children's respiratory health,[14] but the long-term health impacts of indoor air pollution, and concentrations of indoor pollutants are less well understood.[15][16] The issue of indoor air pollution has received less attention than air pollution outdoors*

It is important to note that the coroner at the inquest into the death of Awaab Ishak, did not call for evidence from a building expert and did not consider the impact of the building materials in Illminster house in terms of the cases of the mould which caused his asthma. I have visited Illminster house and noted the presence of a proprietary insulated render system on the outside of all the blocks. It has not been possible to get full details of when this was installed, or by whom, and what specific materials were used as the landlord, Rochdale Boroughwide has refused to provide this information. The committee should call for this information to be made available.

However, there is little doubt that, as in many other cases, this external wall insulation (EWI) may have sealed up the walls of the buildings and contributed to the mould which led to Awaab's death. The government chief construction advisor Hansford warned of the risks of this in a very far sighted report in **2015** Some councils such as Tower Hamlets have removed similar EWI insulated render due to its being a fire hazard. There have been numerous cases of failed EWI, the best-known being at Fishwick in Preston.)

*3.16 ....., there is an unacceptable risk of unintended consequences, which might include damp, mould, poor air quality and poor building performance. Depending on the extent of the problems, this may cause health issues for occupants together with the possible failure to achieve the predicted improvement in thermal performance required to deliver lower energy bills and reduced greenhouse gas emissions. (1)*

It should be noted by the committee that the issue of building fabric and retrofit measures has received insufficient attention in terms of the cause of mould and damp and that much of the advice given by the Ombudsman and many academics and fuel poverty advisors generally avoids the issue of the building fabric and retrofit measures as a cause of damp. Instead they tend to blame the lifestyle of the occupants and accuse them of not providing

enough ventilation or cleaning off the mould. Once mould is established it is almost impossible to use it through cleaning.

There is extensive evidence of damp and mould throughout the UK as a result of retrofit measures using non-breathable insulation render and plaster materials. A recently publicised and well-illustrated example was by BBC Scotland about mould and damp in East Kilbride following cavity wall insulation. (2)

A number of housing landlords have decided to extract cavity wall insulation for instance only a few years after it was installed (Carmarthenshire for example ) and a report by the Northern Ireland Housing Executive found that 63% of houses where CWI had been installed were non-compliant with industry standards. (3)

The Committee should call for funding for an expert study into the retrofit disaster problem but this work must be done by experts who are independent of the many organisations concerned with retrofit that are either tied to commercial vested interests or have a record of promoting unsuitable retrofit materials and solutions.

### **Building Materials for insulation and retrofit and their impact on indoor air quality and mould**

Vapour permeability is a vital but largely ignored aspect of building physics in main stream construction and renovation. It is often referred to as *breathability*. Building practice over recent decades has moved more and more to the use of non-breathable materials thus sealing up buildings and trapping in moisture. The use of plastic paints, plasters with synthetic additives and plastic insulation materials ensures that moisture levels in buildings are far too high. Ventilation alone is not sufficient to deal with this problem.

It is possible to build or renovate with materials that have a good degree of vapour permeability and are also hygroscopic so that they can manage humidity in buildings keeping the relative humidity (RH) at a satisfactory level. The performance of these materials is proven and there is data to confirm this, but mainstream industry does not use these materials. The committee should allow me an opportunity to present examples of this and to show them the materials as this is the only way to fully understand this issue.

Relative humidity is a central aspect of indoor air quality. RH and Moisture levels over 60% provide ideal conditions for dust mites, mould and other problems which can have serious health effects. Ambient RH can be as high as 90% for much of the year, depending on the climatic conditions in different areas. The negative effects of this can be mitigated by vapour permeable and hygroscopic materials, but conventional building materials only make the problems worse. Mould is largely the result of current building methods and materials, but it is often blamed on the behaviour of occupants. Materials recommended by official bodies to clean off mould are made with hazardous chemicals and can contribute to asthma and respiratory problems.

### **Indoor air quality guidance**

Currently IAQ guidance is inadequate. There are references to VOC emission levels in the building regulation but the recently amended bill in Parliament (“Awaab’s law”) do not provide adequate guidance.

NICE and DEFRA’s Air quality Expert Group, have recently addressed the issue of indoor air quality but have paid insufficient attention to mould and emissions from building materials. Instead indoor air quality problems have been characterised in terms of particulates coming from outside, particulates from wood burning stoves, emissions from cooking and emissions as well as from cleaning and personal hygiene products. While these can have a negative impact on indoor air quality they have been given far too much emphasis leading to the apparent suggestion that the problem of indoor air quality is a result mainly of occupant behaviour.

The implication is that people do not ventilate their houses sufficiently, generate too much moisture, install wood burning stoves as a life style choice and use far too many hazardous cleaning and hygiene products. While there is something to this argument it can be argued that this is a smokescreen (apologies for the pun) to avoid dealing with the issue of emissions from the buildings themselves which occupants have little control over.

Emissions from the building fabric can have far more serious effects in terms of both short term and long-term health but is much more difficult to deal with. In debate with leading academics and scientists in the air quality world, they have told me that there is little evidence of emissions from building materials or their health effects and that emission levels are low and already well regulated. These arguments are wrong. There is a lack of evidence in the UK because emissions from building materials have been ignored as a focus of scientific study. Many of the academic centres concerned with energy efficiency and house buildings receive funds from the manufacturers of building materials that may be a source of problems.

Data about emissions is readily available such as from the EU LCI database and a UK expert Derrick Crump has been one of the main people behind this but the DEFRA AQEG report only mentions off-gassing from building materials once in 142 pages and building materials are only mentioned 9 times in the report (4)

In an effort to be brief it is not possible to give a detailed account of emissions from building materials. The table I am working on for my new book runs to 18 pages listing hundreds of chemicals commonly used in modern building materials today.

However, it is important to mention a few examples of problematic emissions from building materials:

**Flame retardants.** These have already been addressed by the Environment audit cttee though much of the focus was on furnishing s rather than building materials. (5)

Flame retardants are widely used in a wide variety of building materials including insulation, air tightness membranes, sealants and many more substances. A recent paper gives an indication of the health risks due to flame retardants (6)

Flame retardants are largely persistent chemicals and thus remain in the building over many years creating long term exposure with negative health consequence, leading to endocrine disruption and cancer. This was entirely ignored by the DEFRA AQEG report

**Fungicides and pesticides** are increasingly used in many materials such as plasters, plasterboards, paints and finishes and so on. This is because the materials industry has recognised the dangers of mould growth and are trying to inhibit it through the use of hazardous chemicals. Many of these chemicals can aggravate or even cause asthma. Leading scientific experts have been warning of the dangers of chemicals in the indoor environment for many years such as Weschler in 2009.

*Many of the chemicals presently found in indoor environments, as well as in the blood and urine of occupants, were not present 50 years ago. (7)*

The UK Government Air Quality common framework entirely ignores indoor air quality. Despite stating in the document that it

*includes policies and regulations that aim to reduce harmful emissions and concentrations of air pollutants that can damage human health and the environment, including in relation to national emission ceilings and ambient air quality*

The word indoor does not appear once in the 53 pages (8)

### **DEFRA AQEG in more detail**

The UK Government Ministry DEFRA has recognised the problem of indoor air quality through its Air Quality Expert group and producing a report in 2022 but this document tends to play down the risks to health from building materials emissions. It does recognise a problem of off-gassing from formaldehyde and VOCs but refers to these in the context of what they call “everyday products.” Flame retardants, phthalates and SVOCs get a brief mention but are later linked to emissions from combustion products. Building materials are discussed in the context of moisture but the general view seems to be that

*“typical indoor sources (are) skin oils, cooking and cleaning (page 83)”*

As stated above building materials are only mentioned 9 times in the whole report and then hardly at all in terms of emissions. (9)

In another paper Alistair Lewis, the AQEG chair and the Chief Medical officer Chris Whitty provide only 6 indicators of indoor air quality, Wood burning, cosmetics and toiletries, paint, natural gas combustion, Social housing energy efficient rating (which is not an indicator of indoor air quality) and damp problems (mould) in homes. Building materials (only mentioned twice) are not listed as a source of bad indoor air quality, though formaldehyde and VOCs are briefly mentioned. They do acknowledge that indoor air contains a more diverse range of pollutants than does outdoor air. (10)

The 2020 NICE guidance report states that there are regulations on pollutant threshold levels but information on the level of emissions from different materials is limited admitting that few regulations exist to guide the choice of materials according to their effect on indoor air quality. Unlike DEFRA and AQEG they do acknowledge the importance of source control

*Usually the most effective way to deal with indoor pollutants is to either **remove the source** or reduce emissions from it. If these are not possible, the pollutant can be diluted by ventilation (for example, opening windows) to reduce exposure.*

Unfortunately, NICE failed to investigate emissions from materials or seek advice from experts in the field on this issue and so their guidance is very weak. For instance, their guidance to architects and designers on how to avoid sources of pollutants is vague and inadequate.

*(1.7.1) Consider specifying building materials and products that only emit a low level of formaldehyde and VOCs. Use existing labelling schemes or other available information on product emissions (for example, on product labels) to make these specifications. Evidence showed that some building materials can emit high levels of pollutants. **There was no evidence on building materials and products that emit a low level of VOCs and formaldehyde** (11)*

There is considerable evidence on building materials and products that emit low levels of VOCs etc and I attempted to provide this to NICE during their consultation but was ignored. There are certification systems for building materials in Europe that insist on low levels of emissions such as Natureplus.(12)

#### **Ella's law**

The Clean Air Human Rights bill does include far more information about indoor air quality with its Schedule 2 on Indoor air pollutants and Schedule 3 on Pollutants causing primarily environmental harm. (13) The bill lists a set of pollutant-specific guidelines for chemical pollution including Benzene, Butadiene, Carbon Monoxide, Formaldehyde, Hydrogen sulphide. Nitrogen Dioxide

Napthalene, PAHs, Radon. Tetrachlorethylene, Trichloroethylene and Particulates which is a step in the right direction, taking up the NICE advice for greater regulation, but It isn't clear why these particular chemicals were chosen and who set the safe levels shown in a schedule in the bill but Section 3.2.c seems to suggest that they were derived from the World Health Organisation., not necessarily the most appropriate choice. This legislation should be subject to a proper review by experts in the indoor air quality field.

#### **Other chemicals.**

There is considerable scientific literature on chemicals in building materials, most of which are hazardous, and as stated above these will be listed at length in volume 2 of my Building materials and Health book. Dodson et al provide an extensive analysis of exposure to chemicals purely in renovated housing in 2017. They targeted over 100 VOCS

*we collected indoor air and surface wipes from newly renovated “green” low-income housing units in Boston before and after occupancy. The pre- to post-occupancy patterns of the remaining chemicals suggested important contributions from building materials for some, including dibutylphthalate and xylene, whereas others, such as diethyl phthalate and formaldehyde appeared to have both building and occupant sources (14)*

In another recent paper by Huang et al they propose a study based on the Pharos building products data base in the USA

*a mass balance-based and high-throughput suited model for predicting chemical emissions from building materials considering indoor sorption. We identified 55 substances as chemicals of high concern, with actual chemical contents exceeding MACHTS by up to a factor 105, in particular diisocyanates and formaldehyde. (15)*

Hundreds of other scientific studies of the health risks from building materials emissions can be cited, though most are from the USA and mainland Europe. However, the committee will no doubt hear from a range of academics and scientists who continue to argue that emissions levels are low or that materials are sealed up in buildings so that they cannot be released. You will also hear that emissions levels can be high at the start of building works but these rapidly diminish and are no longer a problem.

There is a lack of scientific data on levels of off gassing and how long off gassing continues to be a problem. Some people are hyper sensitive to chemicals even when emissions levels are low, but emissions can continue over many years. Very little research funding has been devoted to gathering data on these issues. While the LCI data base is a useful reference point it is necessary to collect data in real buildings.

*EU-LCI values are used for assessing single product emissions after 28 days during a laboratory test chamber procedure. They are applied within health-related evaluation schemes to assess health risks from indoor product emissions on the basis of life-long exposure. (17)*

Epidemiological data on the health effects of the huge range of chemicals are scarce and research work on this also needs to be funded. There is a significant body of literature on the health effects of damp and mould, particularly from Scandinavia. Schools in Finland have been closed due to excessive mould growth. For example a study in Sweden in 2004 highlights the serious problems of mould and bad indoor air quality in but there have been many more similar studies since, but not in the UK. (18)

Proving full epidemiological data on the health effects of bad indoor air quality is a massive task and the committee needs to propose greater attention by the Medical Research Council to fund studies on this topic.

### Measuring indoor air quality

One worrying development in the last couple of years has been the emergence of numerous companies selling air quality sensors. Many research projects, some funded by UK government bodies and other projects are relying on data from these sensors. While such studies may be useful to show the inadequacy of these sensors as they only harvest, limited TVOC data. The only way to sample indoor air properly adequately, is to use air and dust sampling methods which are then sent for lab analysis. Details of how this is done and companies that can supply this method can be made available. Data from such air sampling methods can provide considerable detail of emissions from building materials. Low cost sensors providing TVOC levels provide no such information. There are also Innovative ways to assess mould levels which are available abroad but funding to develop these in the UK has not been forthcoming

### May 2023

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2. (<https://www.bbc.co.uk/news/uk-scotland-glasgow-west-65543897>)
3. (Cavity Wall Insulation Research Project 2019 :Research study prepared for the Northern Ireland Housing Executive by CIT)
4. ([https://single-market-economy.ec.europa.eu/sectors/construction/eu-lci-subgroup/eu-lci-values\\_en...](https://single-market-economy.ec.europa.eu/sectors/construction/eu-lci-subgroup/eu-lci-values_en...) accessed 4.5.23)
5. (Environmental Audit Committee Toxic Chemicals in Everyday Life Twentieth Report 2019)
6. (Jamie Page , Paul Whaley , Michelle Bellingham , Linda S. Birnbaum , Aleksandra Cavoski , Delyth Fetherston Dilke , Ruth Garside , Stuart Harrad , Frank Kelly , Andreas Kortenkamp , Olwenn Martin , Ana Stec , Tom Woolley **A new consensus on reconciling fire safety with environmental & health impacts of chemical flame retardants** Environment International Volume 173, March 2023, 107782)
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8. (HM Government **Air Quality Common Framework** Provisional Framework Outline Agreement and Concordat February 2022 CP 593 ISBN 978-1-5286-3050-4 )
9. [https://uk-air.defra.gov.uk/library/reports?report\\_id=1101](https://uk-air.defra.gov.uk/library/reports?report_id=1101)
10. (Lewis A.C. Jenkins D. Whitty C.J.M. 14 Feb 2023 — *Hidden harms of indoor air pollution — five steps to expose them. February 2023; Nature 614(7947):220-223. DOI:10.1038/d41586-023-00287-8.*)
11. <https://www.nice.org.uk/guidance/ng149>
12. ([https://natureplus-institute.eu/?page\\_id=36&lang=en](https://natureplus-institute.eu/?page_id=36&lang=en))
13. (<https://bills.parliament.uk/bills/3161>)
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15. (Chemicals of concern in building materials:
16. A high-throughput screening Lei Huang, Peter Fantke, Amelie Ritscher, Olivier Jolliet\* *Journal of Hazardous Materials* 424 (2022) 127574)
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18. Dampness in buildings and health (DBH): Report from an ongoing epidemiological investigation on the association between indoor environmental factors and health effects among children in Sweden. C-G Bornehag<sup>1</sup>, J Sundell, T Sigsgaard *Indoor Air* 2004;14)