

Tex reference	Comment	Consultation response
Acknowledgements	Edwin Wealend spelt wrong	Apologies for the mistake. This has been amended.
Cover	It is a bit hard on the eyes due to most of the picture being blurred. Could a nicer picture be used	The cover has been redesigned for the publication draft.
Title	Could the title include prevention as design suggestions can be preventive of IA pollution in many instances. These can be tabulated in an Appendix for clarity. Consider "IAQM Indoor Air Quality Guidance: Prevention, Assessment, Monitoring, Modelling and Mitigation"	Adding the word prevention does not fit with the rest of the title (implying prevention of air quality which does not make sense). Some amendments have been made and references added in relation to your comment on prevention.
General Comments	The document reads very well, is of very good standard and extremely useful for relevant Practitioners. Well done to the drafting team.	Thank you for your positive comments.
General Comments	It would be good if the IAQM could send a communication to the Royal Institute of British Architects and other relevant associations when publishing the guidance recommending IAQ practitioners are involved at early design stages so that preventive design options and measures can be identified and accommodated and an holistic approach considered.	These will be considered in our publication release strategy.
General Comments	Suggest considering the inclusion of indoor personal exposure measurements which can complement monitoring and modelling assessments specially for home bound sensitive receptors - if people go out they can take the kit off. Even if it just collects readings for a week it has proven to be very useful in understanding Total indoor personal exposure with people filling in a simple 1 page questionnaire describing (in average) the time they think they spend in each indoor location.	Para 5.5.1 has been amended to include mention of personal exposure measurements.
General Comments	I suggest a recommendation is made to the Architects Association that IAQ practitioners are involved at earlier stages of design so that Preventive measures can be identified and accommodated.	These will be considered in our publication release strategy.

<p>General Comments</p>	<p>Very pleased to see this guidance come together and overall it looks very useful and a great starting point for a systematic approach to this issue. Well done to all involved. I have had some experience in the buildings service sector, studied sustainable building design and worked in an Austrian built Passive House office that was far and away the most comfortable office building I have worked in (just as comfortable in the middle of winter as it was during 40 degree summer days and had a heating/cooling energy consumption of 19kWh/m2). In my experience Mechanical Ventilation and high air tightness have earned a poor reputation in the UK thanks to the cutting of corners that results in a building that doesn't perform as it should or is operated incorrectly (e.g. people opening windows in summer). Seeing how some buildings that exceeded the Air Quality Objectives were finished, with sealed windows and MVHR, but without the air tightness, shading, thermal mass etc.. was very disappointing and it is unsurprising many people have a poor opinion of mechanical ventilation. A properly designed Passive House standard building with a high thermal mass (i.e. not plastic insulation) will have higher air change rates than a naturally ventilated building. It will be cool in summer (by keeping the windows closed on the hottest days) and warm in winter. Overall will use far less energy than a naturally ventilated building. The guidance should emphasise that design of the building envelope is important and not simply assume corners will be cut and that proven technologies will not work (the reason for most naturally ventilated buildings).</p>	<p>Thank you for your positive comments. Various additions relating to your comments have been added in response to other comments received.</p>
<p>General Comments</p>	<p>The drafting of the guidance itself is welcomed, particularly as it attempts to collate and streamline current guidance/methodologies that are presently published across various documents. Overall, we do see this as becoming the 'go-to' document for indoor air quality assessments and find the case studies and hierarchy of mitigation/improvement measures particularly useful. The document is well-written, easy to follow and, for members of the IAQM, the document structure feels familiar. On the other hand, one of our primary observations is that the guidance seems to be focussed on IAQ assessments undertaken at design stage, rather than for existing buildings, where a slightly different methodology would be more suitable. Questions/ Recommendations (1) We feel it would be useful to seek consultation from the British Occupational Hygiene Society – have views been sought from this organisation?</p>	<p>Thank you for your positive comments. IAQM did not consult with BOHS as occupational exposure and health is excluded from the guidance. Some of the drafting committee are involved in occupational exposure and their experience has been included in the Guidance where we felt appropriate.</p>
<p>General Comments</p>	<p>(2) We would suggest that solely being a member of the IAQM does not necessarily indicate competence in IAQ and that maybe this point should be highlighted more readily within the guidance document.</p>	<p>IAQM are currently working on a competence framework with the possibility of assessing and awarding competency to individuals. Definitions of a competent and suitably experienced person have been added to Appendix A.</p>

General Comments	(3) For existing buildings, we would recommend that the assessment methodology be altered to account for differences in the approach between IAQ assessments for new (at design stage) and existing buildings.	IAQM consider that the methodology can work for both situations and amendments to the text (4.1.11) have been made to make this clearer.
General Comments	(4) For existing buildings, the use of monitoring is of primary importance, to gather 'baseline' data, similar to using background concentration data in a standard AQA.	Para 4.2.1 has been amended to address this point.
General Comments	(5) Similarly, site work is often required for an IAQ assessment of an existing building. This would allow, for example, 'quick fixes' to be identified and implemented that may not be apparent through desk-based studies, such as identifying if a specific vent is particularly problematic.	Para 4.2.3 has been amended to address this point.
General Comments	<p>We are very much of the opinion that longer term measurements are essential to give meaningful data and would urge the authors to consider inserting annual mean levels into the table as suggested.</p> <p>With the world moving towards a post pandemic stage, with one eye very much still on mitigation measures against future outbreaks and variant strains subjecting building occupants to transmission of infectious particulate, it is essential that any assessment of IAQ going forward has to be founded on the most stringent testing regimes built upon long term measurement to avoid short term spikes, either improving or deteriorating pollutant levels, caused by one-off incidents creating reactions that may be counter-productive to the bigger picture aims of controlling and improving IAQ.</p>	<p>Table 3.1 amended: NO₂ / Annual / 40 (WHO, 2010) PM₁₀ / Annual / 20 (WHO, 2005) PM_{2.5} / Annual / 10 (WHO, 2005)</p>
	<p>This draft guidance should be amended to clearly separate approaches applicable to a new building at design stage and an existing building where an issue has been identified. The proposed risk assessment approach does not apply to either new or existing buildings, and should, in my opinion, be discarded. For a new building, as is mentioned in the guidance, the focus should be on good design, and the risk rating is obsolete (design of ventilation system will be best on adopted standards and guidance, rather than on a risk rating). For an existing building, any requirement for an indoor air quality assessment would arise following a complaint or identified issue, and thus again, the risk assessment would not be relevant. This is made clear in all the case studies where following an initial desktop study and review of information, monitoring is undertaken in order to confirm/identify the cause of the issue.</p>	

General
Comments

Overall, my opinion is that this guidance should not cover new buildings, or at least separate the approach to ensure it is appropriate. The focus at design stage should be on

- (1) Siting of a proposed development and consideration of baseline air quality conditions in the area of interest;
- (2) Requirement for mechanical ventilation on the basis of ambient concentrations and proposed use(s);
- (3) If mechanical ventilation is envisaged, consideration should be given to the proposed location for air intakes in relation to ambient pollution levels, but also other sources of odour/pollution such as kitchen or toilet extracts, combustion plant extract and any other existing source that may affect the quality of air drawn into the new building;
- (4) The type of materials and decorating products used in the building, and the requirement to proceed to a flush out of the building before occupation.

The first three points are typically covered within the air quality assessment undertaken in support of planning application, with mechanical ventilation systems designed by M&E engineers with both the advice provided by the air quality practitioner and any applicable design standards in mind.

The last point is covered by BREEAM accreditation, the preparation of an indoor air quality plan and postconstruction monitoring.

The text (para 4.3.2) makes clear that for existing buildings where there are complaints Stage 2A would not be used, but the assessor would go straight to Stage 2B. It may be appropriate for an existing building assessment (as IAQ gets greater visibility) to undertake a Stage 2A assessment to check if anything can be done to improve building conditions. Chapter 4 mentions that there may be other methods (4.3.8) and that it is difficult to be too prescriptive (4.3.1).

Mechanical ventilation may be the solution to many issues but it is not always the case (e.g. recirculation can lead to overheating in their homes).

On balance IAQM considers that when professional judgement is correctly applied the methodology can work in all cases. This will be kept under review for

On that basis, I would feel it more appropriate that the IAQM guidance reiterates these points and provides a list of items that should be considered at design stage by the architects and air quality practitioner for new buildings, rather than requiring a risk assessment is undertaken. The approach, in its current form, is not tailored to new buildings, and would lead to alarming conclusions and the requirement to undertake work that is either not possible (i.e. monitoring) or disproportionate (i.e. modelling). This is, in my view, confirmed by the fact that all case studies presented in Appendix E and H include monitoring and concern existing or newly built buildings, with no case study focusing on a proposed development.

The most important aspect to avoid the build-up of pollutants indoor and reduce exposure is the design of the mechanical ventilation scheme. If designed and maintained appropriately, and in any setting considered within this guidance (which excludes workplace exposure regulation where PPE can be used where mechanical ventilation is not sufficient to reduce pollutant levels to below the adopted standard), a good ventilation system would ensure that no occupant is exposed to unacceptable levels of pollutants indoor. The design of such systems falls outside of the scope of the air quality practitioner, and it would thus not be appropriate to expect this guidance to cover this topic in great length (which is accepted and mentioned in the draft guidance). The guidance should thus, for new buildings, focus on a series of general advice to consider at design stage by both the air quality practitioner and the architects, with no requirement to proceed to an assessment.

future updates of the guidance and would welcome comments or examples of how the method has been applied.

<p>General Comments</p>	<p>Overall, the draft guidance seems to have focused on BREEAM/LEED when it comes to existing buildings, with the proposed approach not targeted at identifying the cause of a complaint or issue related to indoor air pollution. The draft guidance mentions in paragraph 4.2.3 a CIBSE guidance which covers this (i.e. KS17). As mentioned earlier, good ventilation is the key to ensure good air renewal rates in buildings, and thus avoid the build-up of pollutants and associated health effects. However, poor maintenance of such systems, the lack of mechanical ventilation altogether, or the inappropriate use of a room within a building can sometimes lead to discomfort and health effects for the buildings' occupants. Although this guidance could include a section on how to carry out and IAQ assessment in the context of BREEAM/LEED, it would be much more beneficial to air quality practitioners if it included a section with a proposed approach (or at least useful pointers) to determining the cause of an issue within an existing building. This is attempted in Box 4.1, however, this should be extended to include further details. An approach to a complaint on indoor air quality, for example, should include general steps to follow when attempting to identify the probable cause. Section 2 of the draft guidance provides useful information with regards to the main pollutants of interest and their health effects. Presenting this in table form as part of the approach to determine the probable cause of a reported issue would be useful.</p>	<p>The Guidance tries to introduce topics and point the expert to further guidance. For this reason we have not included all the possible checklist, rather made references if there is a good secondary source. We have added a reference to a useful document (USEPA, 2014) which includes a flowchart on how to conduct IAQ Assessments and other useful tools.</p>
<p>General Comments</p>	<p>Although the draft guidance focuses on gaseous pollutants and particulate matter (paragraph 1.3.4), consideration of comfort parameters (T, HR) and mould would also be recommended, as these can play a big part in reported discomfort and symptoms. These parameters are cited later in the draft guidance, including in the case studies. For clarity, and due to their importance in identifying indoor air quality issues, they should be fully incorporated within the proposed approach.</p>	<p>IAQM considered whether to include these in the Guidance and decided that they should be scoped out as there are many other guidance documents that consider this in more detail than would be possible in this Guidance.</p>
<p>General Comments</p>	<p>The guidance touches on the subject of ventilation, and suggests measuring levels of CO₂ as a proxy of the renewal rates within the building. This is appropriate and allows for a simple and quick way of identifying a faulty ventilation system. This could, however, be supplemented by a more in-depth check of the ventilation system to verify the levels of fresh air supplied to the building against the number of occupants, but also to ensure that the systems are well maintained and do not introduce further pollutants or biological agents in the air supplied to the building. This is, however, a topic in itself, and I would not expect the IAQ guidance to cover this.</p>	<p>Additions about using CO₂ as a measure of ventilation rates have been added in response to specific comments from others.</p>
<p>General Comments</p>	<p>"For new buildings, it is important that IAQ is considered at an early stage in the design process...", thus it is assumed that "new buildings" refer to a proposed development, rather than to a newly constructed building.</p>	<p>Guidance has been amended to clarify requirements for proposed, new and existing buildings.</p>

<p>General Comments</p>	<p>This is in general a very useful background source reference document for IAQ issues. It was good to see mention of the WHO as the primary source for guidance on exposure levels for the most common hazardous pollutants of concern. Given the current situation with Covid19 and traffic air pollution then fine particles PM₁, PM_{2.5} and PM₁₀ are of primary concern indoors.</p>	<p>Thank you for your positive comments.</p>
<p>General Comments</p>	<p>Combustion pollutants from traffic and burning of fossil fuels can enter indoors by movement of ventilation supply air. Nitrogen dioxide is a pollutant that is associated in extremely high concentration from traffic, trains and other sources. It was referenced as the cause of death in the coroners report for Ella Roberta Adoo Kissi-Debrah and has no doubt had similar health damaging effects in countless other schoolchildren and vulnerable people in cities around the UK. These pollutants need to be properly referenced to WHO guidance exposure levels. For these pollutants it should be not just for short 24hour periods but longer term time periods which is where the annual mean level becomes so important as a comparator. I am surprised that your table in the draft does not included these levels for the above pollutants. These annual mean levels should be included in the table.</p>	<p>Table 3.1 amended: NO₂ / Annual / 40 (WHO, 2010) PM₁₀ / Annual / 20 (WHO, 2005) PM_{2.5} / Annual / 10 (WHO, 2005)</p>
<p>General Comments</p>	<p>COVID-19 is now increasingly being shown to be mainly transmitted by smaller droplet / aerosol particles for which air filtration and air displacement are being recommended as part of the solution. Mechanical ventilation is being found much more effective at reducing levels of CV19 infection inside occupied city buildings such as offices, schools, hospitals, as opposed to natural ventilation installed solutions.</p>	<p>IAQM feel that since research into how to manage exposure to pathogens such as SARS-COV-2 is still in early development and as an emerging field of research it could not be covered in a general guidance document such as this. Pathogens were also scoped out at an early stage of the development of the IAQ Guidance. IAQM feel that if this is an issue of concern to the professional they would be better following the up to date research on the matter.</p>
<p>General Comments</p>	<p>There should also be clear identification of the difference between industrial emissions/accident levels and the everyday background ambient air pollutants that people are exposed to on a long term basis. Hence the need for annual mean levels.</p>	<p>Table 3.1 amended: NO₂ / Annual / 40 (WHO, 2010) PM₁₀ / Annual / 20 (WHO, 2005) PM_{2.5} / Annual / 10 (WHO, 2005)</p>
<p>General Comments</p>	<p>The WHO were already supposed to have published new guideline levels for PM and NO₂ amongst others but this has now been delayed to September. As this review cycle only happens every 5 to 10 years I encourage you to wait until September before publication of your guide so that it can be up to date. Otherwise it would be out of date almost immediately.</p>	<p>IAQM have incorporated the new WHO guidelines once they were published.</p>

General Comments	I am more than happy to communicate further on any issues I have raised and also regarding air filtration and mechanical ventilation. My experience of about forty years in the air movement industry tells me this is an important time for balanced, well informed guidance.	Thank you for your offer. IAQM would be happy to hear of any additional comments you have once you have reviewed the published IAQ Guidance and the responses to all consultation comments.
General Comments	<p>We consider the document provides a good review and summary of the existing knowledge on indoor air quality.</p> <p>We feel that much of the assessment methodology could however be summarised in a more succinct format from a practitioner use point of view, as we feel is too long for assessment guidance. We suggest drawing out the key methodology sections in a clear table format would be helpful for both air quality and non-air quality practitioners with the indoor air quality assessment.</p> <p>Further use of visual aspects (such as guidance boxes, bullet points and tables) would make the guidance easier to follow and understand, as opposed to sections of text for a range of experience levels.</p>	Thank you for your positive comments. The recent special edition of Environmental Scientist (IES, June 2021) on IAQ contains a good summary of the document. Much of the IAQ Guidance is background and reference material for those new to the field and is an important part of the document. Information has also been placed in Appendices to minimise the length of the main text.
General Comments	The summary of legislation is useful to have all in one document and from a practitioner level having the guidance layout similar to other IAQM guidance is helpful.	Thank you for your positive comments.
General Comments	It is useful to have the guidance by a professional body to reference in assessments and as a compilation of information on indoor air quality, however as practitioners we would encourage a greater emphasis on solutions and proposed mitigation.	As part of IAQM's response to other consultation comments additional information has been provided on mitigation in the text and in an additional appendix detailing measures that might be considered in design, construction and operation.
General Comments	The tone of the document appears to vary across the sections and does not read as a single 'author' publication.	The IAQ Guidance was indeed written by many authors and the editors have tried to standardise text style as far as possible without changing the meaning and context of the text written by others.
General Comments	Bullets points across the document are inconsistent in whether they start with a capital letter or not and what punctuation they end with.	Amended.
General Comments	<p>The overall impression among the team is that this is going to be a helpful resource for air quality practitioners new to the world of indoor air quality as a background/reference document.</p> <p>We do have some concerns that it is trying to cover too many topics, all the way up to CFD modelling, and that it may be more successful if more detail is provided on the approach to take for just a few areas i.e. those where assessment is most likely to bring tangible benefits.</p> <p>We feel there could be more emphasis on the benefits of undertaking monitoring at scoping or simple assessment stage, where buildings are already built, to understand the baseline.</p>	Amended Para 4.2.1 "and may include a walkthrough of the building. Where a building is already built (including a new build where IAQ has not been considered) monitoring may be appropriate in order to understand the baseline."

General Comments	Little real change in design can be undertaken at pre-occupation stage so for new build, we thought the guidance could do more to bring out the potential for cost and programme benefits by involving AQ practitioners at the early design stages, well before planning (in a similar way that we did for the ecological impact assessment guidance re. early engagement with ecologists).	The IAQM feels that Paras 1.1.3, 4.1.3 & 4.2.3 makes this point.
General Comments	There are clearly some substantial uncertainties in the scoring matrices e.g. the potential magnitude of emission, and we think there is potential for these to be more carefully explained to the reader so that they are not misapplied or misinterpreted i.e. taken too literally – while other professionals may have different opinions that are valid.	The Guidance relies on professional judgement and IAQM is not able to document such judgement in guidance. This may be considered in updates of the Guidance if diverse and conflicting interpretations need some standardisation.
General Comments	As you are probably aware, the WHO was due to publish its new Air Quality Guidelines in the week of 12-16 July but has delayed publication to September 2021. Please incorporate the new AQGs fully into your guidance so that it is not immediately out of date. For example, new WHO guidance will include 'guidance' for ultrafines.	IAQM are aware of the proposed publication of the guidelines later in 2021 and will review them once published to determine if the IAQ Guidance should be updated.
General Comments	Indoor air quality needs to be judged first against the WHO's AQG for short *and* long term concentrations of pollutants. As you identify, the order of preference should be WHO indoor air guidelines followed by their ambient air guidelines. Defra DAQI bandings are not intended for indoor air.	Table 3.1 amended: NO ₂ / Annual / 40 (WHO, 2010) PM ₁₀ / Annual / 20 (WHO, 2005) PM _{2.5} / Annual / 10 (WHO, 2005)
General Comments	As the WHO explains, no-one should ever be exposed to air pollutants exceeding the guidelines. Those affected are likely to have a plausible case for expecting those responsible for IAQ in buildings or public spaces to ensure full compliance with WHO guidelines.	Noted and we hope you feel that the Guidance makes this point.
General Comments	IAQ guidance needs to address COVID-19. Please see the WHO's April 2021 guidance for IAQ: https://www.who.int/publications/i/item/9789240021280	IAQM feel that since research into how to manage exposure to pathogens such as SARS-COV-2 is still in early development and an emerging field of research it could not be covered in a general guidance document as this. Pathogens were also scoped out at an early stage of the development of the IAQ Guidance. IAQM feel that if this is an issue of concern to the professional they would be better following the up to date research on the matter.

General Comments	IAQ guidance needs to reference 'duct' cleaning. For example, I have seen open cement bags found in ducting in occupied buildings.	The Guidance tries to introduce topics and point the expert to further guidance. For this reason we have not included all the possible checklist, rather made references if there is a good secondary source. We have added a reference to a useful document (USEPA, 2014) which includes a flowchart on how to conduct IAQ Assessments and other useful tools.
General Comments	The location of the air intake can be critical e.g. is it close to traffic or other sources of pollutants?	It is assumed by IAQM that experts will take this into account and it was not considered within the scope of a high-level Guidance document to include such detail.
General Comments	Buildings can have ventilation, air conditioning and/or air filtration or none of the above. Ventilation may be mechanical or 'natural'. Buildings can also use standalone air filtration. You will appreciate that air filtration removes contaminants on each 'pass' e.g. 80% of particles each time air is circulated. Supply air should be about 20% of air circulating. Air cleaning is more comprehensive than air treatment. The key question to ask is "What testing and official standards does an indoor air quality system comply with?"	It is assumed by IAQM that experts will take this into account and it was not considered within the scope of a high-level Guidance document to include such detail.
General Comments	Planning policies are now addressing IAQ. See the Knightsbridge Neighbourhood Plan Policy KBR34 and para 10.7 and Policy KBBR40: https://www.knightsbridgeforum.org/media/documents/knp_made_version_december_2018_131218_website.pdf	Reference to planning policy and this example added to para 1.5.1
General Comments	CAL has collected a large number of useful IAQ articles here: https://cleanair.london/indoor-air/	Reference is made to CAL in para 1.2.5
General Comments	Please see CAL's presentation to IAQ professionals in March 2021: https://cleanair.london/app/uploads/HVN-230321_Final.pdf .	Reference is made to CAL in para 1.2.5
General Comments	Testing standards are available for WHO AQGs, ISO standards etc.	Para 5.4.1 mentions ISO, reference to WHO has been added.
General Comments	The Report to Prevent Future Deaths re Ella Roberta Adoo Kissi-Debrah is also highly relevant: https://www.judiciary.uk/wp-content/uploads/2021/04/Ella-Kissi-Debrah-2021-0113-1.pdf .	IAQM and AQ experts will be aware of this report and its implications for Government and other agencies. The report and responses largely focus on outdoor ambient air quality and public awareness but can of course be applied to indoor exposure.
General Comments	A very good document that will be invaluable for future reference.	Thank you for your positive comments.
General Comments	I believe that a lot more attention is needed on the issue of building materials and emissions but to do justice to this would mean considering the work done in Europe, particularly on the LCI database which does not get mentioned.	As you state this is a large topic and an area that IAQM felt could not be covered in detail in guidance of this type. Text and several references to materials selection etc have been added to the text.

General Comments	I was disappointed that the book Building Materials, Health and Indoor Air Quality does not appear in the bibliography.	Paras 4.1.4 and 4.3.11 amended and reference added.
General Comments	There are some good things in this document but the major problem is the complete absence ion properly trained professionals able to provide guidance and advice when buildings are being designed and renovated	Thank you for your positive comments. We hope that in time this situation will improve and that this Guidance goes some way to assisting air quality professionals gain understanding of IAQ.
General Comments	As with so many other documents in this field, too much hope is invested in mechanical ventilation rather than source control	Other responses to comments received have addressed this point to some extent.
General Comments	I was puzzled why the issue of mould growth is overlooked as this is one of the biggest problems in terms of IAQ	At the early stage of drafting it was decided by the IAQM Sub-Committee that mould and other pathogens should be scoped out of the Guidance as they are largely covered by other documents (see Para 1.3.4.)
General Comments	I hope you find my comments useful and I would be happy to provide more information on the points I have raised	Thank you for your offer of further help. If you feel that the revised publication draft would benefit from your input your suggestions would be welcome.
General Comments	I have been fortunate to carry out some work advising architects on specification problems to reduce emissions. This is a hugely time consuming activity as the majority of materials in standard NBS specifications contain hazardous emissions. Persuading architects to specific healthy alternatives (that are not in NBS) Is a difficult job. The best project we did where we did get encouraging IAQ data is sadly not available for publication as the client wished to keep it confidential.	Thank you for your comments.
General Comments	We have been monitoring indoor air quality for over 10 years, but the scope of monitoring is usually limited by the reference values available for exposure limits, we have the WHO, Guidelines, and some occupational values from HSE MDHS96 and that's about it. Would be good if we could get a list for wider variety of indoor pollutants. Perhaps some data could ne drawn from exposure routes / tox values in CLEA as this relies on tox values for various ground borne vapours / gases, but actually values are buried in workings.	The Guidance provides assessment values for some pollutants and guidance on how to source/derive them for others.

1	<p>Consider adding a final subsection in the introduction setting out the structure of the report, referring in summary what each chapter will address. Content is referred to for the first time in page 26 para "4.3.28. The monitoring of IAQ is covered in detail in Chapter 5, and computer modelling is described briefly in Chapter 6". Other bits at 4.3.30. (Chapter 5 describes instruments for measuring IAQ) and 4.3.34. (Chapter 6 includes a brief review of the types of models used. Choice of assessment technique will depend on the project. Both techniques have advantages and limitations) can be brought forward to the additional proposed subsection "guidance structure". It helps the reader to set the structure of the guidance and content at the outset.</p>	<p>The report is reasonably short and so the table of contents is enough to guide the reader, adding a summary of the rest of the report as a guide in section 1 would be repetition.</p>
1	<p>For new developments, aside from where developers proactively consider IAQ for BREEAM, WELL or LEED, how can consultants actually be competent and apply this guidance to new developments? as most developers will be unwilling to pay for it unless there is a requirement for planning. It would be useful to clearly answer this question in the introduction.</p>	<p>Para 1.5.1 has been amended.</p>
1.1.1	<p>qualified practitioners – may be we need to add somewhere (perhaps in glossary) the definition of what qualified practitioners entail and what requisites members need to be quality. This is important due to the complexity that certain monitoring and modelling situations may entail.</p>	<p>IAQM are currently working on a competence framework with the possibility of assessing and awarding competency to individuals. Definitions of a competent and suitably experienced person have been added to Appendix A.</p>
1.1.2	<p>why were community facilities (e.g. care homes) excluded – may be a footnote to explain reason would be helpful so practitioners / users know where to go to for indoor guidelines for these premises</p>	<p>Para 1.1.2 amended to be clearer. The exclusion only applied to that text within the brackets (i.e. operating theatres) but the sentence has been amended to remove any ambiguity.</p>
1.1.2	<p>Industrial as well?</p>	<p>Para 1.1.2 amended.</p>
1.2.2	<p>Demand control ventilation using carbon dioxide (CO₂) as a proxy for general IAQ – is it suffice given that IAQ depends on various factors? Also the degree of ventilation may not exclude deposited indoor pollutants which may get resuspended during certain periods of the day/night when the use of ventilation may be (intentionally or not) reduced. This statement is not followed up nor further expanded in the reminder of the guidance so perhaps a bit more clarification on this is needed.</p>	<p>Your comment was not fully understood but Para 2.4.1 has been amended based on our interpretation.</p>

1.2.2	<p>Repetition here on the negatives of ventilation increasing greenhouse gas emissions. In general, there is a lot of repetition in the initial sections on the negative effects of poor indoor air quality which is useful for knowledge but not necessarily for practitioners using this document as guidance for assessment. Details of effects could be summarised (e.g. in a table) or moved to an appendix for the main focus of the document to be guidance</p>	<p>As ever it is a balance and some comments requested more emphasis and so we hope we have struck a balance acceptable to most.</p>
1.2.4	<p>The text “may be evidence of such competence and experience” – may need to specify what skills and experience are required - may need a bit more specification here for reference. This is important for quality control. The document would benefit from a summary table with all the indoor pollutants mentioned in this section, associated health implications, and main sources and make a clear link to Appendix C (to limits / target values and or ranges) where applicable.</p>	<p>IAQM are currently working on a competence framework with the possibility of assessing and awarding competency to individuals. Definitions of a competent and suitably experienced person have been added to Appendix A.</p> <p>IAQM considered it useful to have a single paragraph for each pollutant rather than try and summarise in a table. There are many other references where summary tables are provided. This Guidance only seeks to highlight key issues for some of the relevant pollutants and does not aim to be exhaustive.</p> <p>Reference to Appendix C is present in Section 3 which was felt the most appropriate place.</p>
1.3.2	<p>This paragraph states “...Control of Substances Hazardous to Heath” however this typographical error should be amended to “...Control of Substances Hazardous to Health”.</p>	<p>Amended.</p>
1.3.4	<p>Consider adding at the end: It is recommended that IAQ Practitioners are involved at the design stages of a development so that a holistic approach is secured.</p>	<p>Amended.</p>
1.4.3	<p>Amend references to the end of the sentence or include ‘and’ in the brackets.</p>	<p>Amended.</p>
2	<p>Could the chemical species be typed in bold at the beginning of each paragraph? This would make it easier to find, i.e. VOCs, Nitrogen Dioxide etc.</p>	<p>Amended.</p>
2.1	<p>There is a lot of useful information in this section for a variety of pollutants. It would be useful to provide a table summarising all pollutants mentioned, main sources and associated health impacts for reference. The use of ‘bolding’ as with the references to tables etc. in the document or subheadings could be used here to highlight pollutants.</p>	<p>Bold has been added to the pollutant names. IAQM considered it useful to have a single paragraph for each pollutant rather than try and summarise in a table. There are many other references where summary tables are provided. This Guidance only seeks to highlight key issues for some of the relevant pollutants and does not aim to be exhaustive.</p>

2.1	Is there no mention of micro / nano plastic particles / fibres? These emanating from carpets and clothing (internally) and car tire particles, and laundry (externally), are ubiquitous in the environment, what with emerging evidence on Phthalates, perhaps should have a mention.	Para 2.1.4 amended to include reference to other indoor sources of particles. Tyre wear is already mentioned in Para 2.1.4. Phthalates have been added to the list in para 2.1.7.
2.1 (Box)	Last bullet - font needs fixing.	Amended.
2.1 (Box)	I don't think that the existence of the threshold is a factor; rather, the concentration at which effects occur	Amended.
2.1 (Box)	5th bullet point: The phrasing of this bullet point is difficult to read. We would also recommend the change of language from "pregnant women" to the more inclusive "pregnant people".	Amended.
2.1.1 and 2.1.2	There seems to be repetition here from earlier sections of the document. As this is guidance the introduction paragraphs could be removed. As practitioners we would welcome a summarised table of the pollutants and main health impacts for information rather than a long section of text.	IAQM considered it useful to have a single paragraph for each pollutant rather than try and summarise in a table. There are many other references where summary tables are provided. This Guidance only seeks to highlight key issues for some of the relevant pollutants and does not aim to be exhaustive.
2.1.12	Terpenes go on to form particulates (as mentioned later in more detail) but it would be useful to mention why they are a risk here. (The reference given should be 'Foxall' not 'Foxhall', this typo is on page 38 too).	2.1.11, 2.1.12 and p38 amended.
2.1.15	CO ₂ is also an indicator of viral infection risk, and this should be made clear in the document. It is the only measure of such risk as it relates directly to people breathing out.	Amended.
2.1.16	There is research from Harvard 2016 have found cognitive function decline with higher CO ₂ levels, well below 2000ppm - https://ehp.niehs.nih.gov/doi/10.1289/ehp.1510037 - extract " Cognitive function scores were 15% lower for the moderate CO ₂ day (~ 945 ppm) and 50% lower on the day with CO ₂ concentrations of ~1,400 ppm than on the two Green+ days" This research should be included, and results mentioned for the reader.	Amended.
2.1.16	I don't think it is relevant to mention background concentrations of carbon dioxide in this paragraph, to avoid confusion between global warming and IAQ. The rest of the text seems to frame carbon dioxide toxicity as ambiguous or uncertain, while you go on to show in Table 3.1 the WHO guidelines for CO ₂ exposure who seem more sure. People do die from CO ₂ poisoning (albeit in enclosed spaces) and I think we need to be careful not to underplay the potential risks that could arise from CO ₂ exposure.	Amended.
2.1.17	Remove the word adequate before exposure	Amended.

2.1.5	It might be useful to state that radon is a radioactive gas. It can be inferred from the context, but stating specifically would remove any doubt.	Amended.
2.2.5	I think it should be clarified that SOAs are in themselves particulates, so will contribute to the overall particulate loading in a building. Some may not realise that SOAs are particulates.	Amended.
2.4.1	Text (e.g. see this guide to energy efficiency and ventilation systems (Liddament, 1996)) – it would benefit from a footnote with web link	The full reference is available in Section 8 and a search online will reveal several locations where the document can be downloaded.
2.4.2	I'm not sure what point is being made here with respect to IAQ	The paragraph is making the point that we spend a lot of time indoors and that healthy buildings, including good IAQ is important for a variety of factors.
2.4.3	An Innovate UK funded project has recently finished, which shows that areas which rely on natural ventilation alone experience >2500ppm readings 50% during time of use. Mechanically ventilated areas performed better than naturally ventilated ones. One reason for this is that opening windows depends entirely on people.	Amended in relation to comment from others.
2.4.3	Is natural ventilation preferred because mechanical ventilation has historically been done badly? Good that insulation materials and shading mentioned.	Amended in relation to comment from others.
2.4.3	Mechanical Ventilation and Heat Recovery is not necessarily a way to ensure good indoor air quality. Filters are rarely changed frequently enough and only deal with a limited range of particulates. Air can be contaminated by toxic chemicals emitted from plastic duct materials.	Amended.
2.4.4	The sealing of building facades can lead to unacceptably high internal building temperatures only if the building has not been designed properly.	Amended.
2.4.4	I would think that its more to do with energy efficiency than noise or pollution	Amended.
2.4.4	Reference should be Cheng (not Chang)	Amended.
2.4.4	Could also add references on overheating – if you think appropriate (although this, of course, an IAQ rather than overheating document!). If so, possibly include the following: - Zero Carbon Hub (2016). Solutions to Overheating in Homes: Evidence Review. www.zerocarbonhub.org - NHBC (2012). Overheating in new homes: a review of the evidence. NHBC Publication NF46.	IAQM considered overheating a separate topic and not within the scope of the Guidance.
2.4.5	MVHR works to maintain the internal temperature. In summer, a correctly designed building will exhaust cool air which will cool incoming air to the office.	Thank you for your comments.
2.4.7	Filtering outdoor air will be a result of an ambient air quality assessment rather than considering IAQ	IAQM consider that and IAQ assessment will take into account outdoor AQ and outdoor AQ assessment may also be part of the overall assessment.

3.1 (Figure)	I don't think is needed and looks messy.	Opinion was divided as to whether this figure was useful or not. On balance IAQM considered it a useful addition, it can be ignored if not helpful. A better quality version has been included in the publication version.
3.1 (Figure)	This figure is very confusing and doesn't add anything to the guidance. I would remove it.	Opinion was divided as to whether this figure was useful or not. On balance IAQM considered it a useful addition, it can be ignored if not helpful. A better quality version has been included in the publication version.
3.1 (Figure)	On screen this figure is quite blurry which makes it difficult to read. Although it contains a lot of detail it is not completely clear what the figure is representing. This could be split into similar figures with less detail/labels for ease, such as split out into statutory limits or into indoor/outdoor limits or optional/legal limits. There is no annotation on what the scale bar is meant to represent. Figure could be very useful however needs to be in a clearer more concise format.	Opinion was divided as to whether this figure was useful or not. A better quality version has been included in the publication version. The figure is taken directly from a CIBSE document and so was not edited. Each pollutant has its own scale and the left side indicates the units.
3.1 (Figure)	Higher resolution needed.	A better quality version has been included in the publication version.
3.1 (Table)	In text it discusses contradictory guidelines for pollutants however this is not clear from the table	The aim of the table is to give a clear set of guidelines. Contradictions are discussed elsewhere in the Guidance e.g. between occupational exposure limits and where they are relevant and others in the same place to which they may not apply.
3.1.1	Consider replacing 'types' of people' by "different sensitive receptors to exposure levels (i.e. children, elderly, diseased, etc)'	Amended.
3.2.3	This seems to go against 3.3.1 where it is suggested to contact the PHE rather than just give up	Para 3.2.3 amended.
3.3.1	Consider replacing "The hierarchy is that (WHO, 2010) and (PHE, 2019) for IAQ take priority followed by WHO for outdoor air" by " The hierarchy is that WHO (WHO, 2010) and PHE (PHE, 2019) guidelines for IAQ take priority followed by WHO guidelines for outdoor air.	Thank you for your comment. Amended.
4.1 (Figure)	Consider adding fireplaces and wood burning stoves under Pollutant sources "Indoor sources (e.g. building works, gas cookers, maintenance, decoration, cleaning, use of toiletries, candles, fireplaces and wood burning stoves)"	Many suggestions were made to change this diagram and not all could be accommodated. It is not meant to be exhaustive, and hopes to illustrate examples of some of the types of sources and routes to exposure.
4.1 (Figure)	Is this meant to state all usual factors to consider? At the moment it is missing key factors.	Many suggestions were made to change this diagram and not all could be accommodated. It is not meant to be exhaustive, and hopes to illustrate examples of some of the types of sources and routes to exposure.

4.1 (Figure)	Due to the size of the writing it is difficult to read the captions on the figure. Paragraph 1.1.2 states that "...The Guidance is not designed to be applicable to other internal spaces (e.g. underground car parks..." however car parks are included in this figure. It is a nice simple visual however the 'wiggly' lines clutter the figure slightly and are not needed to understand the pathways.	Many suggestions were made to change this diagram and not all could be accommodated. Text has been enlarged.
4.1 (Table)	As workplaces in the UK are smoke free, this would only be relevant to smoking huts external to the building?	Smokers can be anywhere outside, including huts but also cars, homes, outdoor streets etc.
4.1.2	Appendix E is referenced before Appendix D – suggestion to reorder	Amended.
4.1.4	There is a complete lack of qualified consultants in this area. Most standard specifications recommend the use of materials with hazardous emissions. Architects and surveyors have almost no knowledge of these topics apart from some surveyors who know about mould growth and dampness	IAQM are currently working on a competence framework with the possibility of assessing and awarding competency to individuals. Definitions of a competent and suitably experienced person have been added to Appendix A.
4.2 (Box)	Looking at Table 4.2, any new buildings will be newly painted/varnished and house new furniture/fittings, and will thus likely come up with a magnitude 4 or 5 for potential harm. Finally, Table 4.3 identifies the frequency/duration of exposure. For most developments (i.e. residential, care home), this will come up as high or very high. Based on Table 4.4, the proposed approach would lead to most if not all new developments being classified as having a high risk of impacts from exposure to pollutants indoor. The guidance suggests that for high-risk developments, immediate action(s) to reduce harm/exposure should be taken, and a Stage 2B Detailed Assessment should be undertaken. Although paragraph 4.3.1 cited above clearly suggested that a 'simple assessment' would be sufficient for a new building, the proposed approach does not provide any guidance as to what steps should be taken if a new building comes up with a high risk of impacts. If I follow the proposed approach, the first suggestion does not apply and is thus discarded, and we shall thus proceed to a Stage 2B assessment.	Para 4.3.1 suggest a simple assessment may (not would) be sufficient. Professional judgement should be used in all cases. Box 4.2 amended to be clear.
4.2 (Figure)	As we do for roads, we suggest the "receptor" stage is the first step not last in screening?	It is acceptable to screen out based on receptors, sources or pathways and in any order .e.g. if the specialist is able to determine there are no receptors then there is no need to consider the sources or the pathways. Para 4.1.10 amended to reflect this.
4.2 (Table)	I think it ought to also include the following: <ul style="list-style-type: none"> > Personal care, dry-cleaned clothing, and hobby supplies > Human borne dust > Human breathing > Plants/soil 	Thank you for your suggestions. Para 4.3.15 guides the reader to include new sources if relevant. Para 4.3.15 amended to include some of your suggestions.

4.2 (Table)	When undertaking an assessment for multiple sources as listed in Table 4.2. Should the magnitude of potential harm be considered separately or are source for the same pollutant additive?	The method assumes the maximum value is taken forward although separate assessments for each can be undertaken if appropriate. Para 4.3.16 amended to this effect.
4.2 (Table)	It is appreciated that it may just be the way it is worded but 'In same building as receptor, no managed ventilation and no obvious direct route' sounds worse than 'In same building (or connected building) as receptor and managed ventilation". It is assumed this is not the intention due to the magnitude of potential harm scores.	Table 4.2 headings have been changed to clarify.
4.2 (Table)	Footnote a of Tables 4.2 states that professional judgment may be used to revise scores upwards. Should it be inferred therefore that the scores in Table 4.2 represent the minimum that should be used and that professional judgment cannot be used to revise the scores downwards? If so it may be useful to make this explicit.	Table 4.2 footnote amended.
4.2 (Table)	I'm not sure how NOx, CO etc are going to get out of a sealed boiler into a room in which is located unless there is a fault with it. The reference to manufacturing suggests industrial settings where I don't see this guidance being applied - Occupational Health Standards would be applied there. Tobacco smoke would only be relevant to residential properties and I don't see this guidance being used for tobacco in that scenario. Fresheners/scented products: we are effectively saying that there is a high risk from any of this type of product if it is used in a room.	Table 4.2 has been amended to remove reference to gas boiler
4.2 (Table)	This table provides a clear easy to use methodology for the estimation of magnitude.	Thank you for your positive comment.
4.2.11	Not sure if this first sentence is complete	IAQM didn't see a gap but the sentence has been amended to be clearer.

4.2.11	<p>This is very good in theory, however there are only a handful of IAQ professionals who can do this sort of work. There is a need for training and certification of professionals able to do this kind of work. (and this does not mean WELL consultants)</p> <p>The emission and toxicity content of most building products is not labelled but this information can be found from COSSH health and Safety Data sheets and the European LCI database. However the LCI database deals with generic materials and increasingly UK manufacturers hide the emission information or remove it entirely from COSSH data sheets.</p> <p>The EU Construction Products Regulations may be amended to include emissions data but for the time being avoidance of products is a very time consuming exercise. Most architects and specifiers refuse to propose the use of low emission alternatives as they are prejudiced against natural non-toxic materials.</p> <p>The best way to explain this issue is to give specific examples of materials and products which contain hazardous chemicals and may give rise to polluting emissions. The document should also give examples of alternative materials which do not contact hazardous chemicals</p>	<p>We have added a relevant reference to the book <i>Building Materials, Health and Indoor Air Quality No Breathing Space?</i> where this and much more useful information can be found. IAQM did not consider this level of detail was appropriate for this Guidance.</p>
4.2.4	<p>Suggest edit to say all “potentially significant” sources... (rather than “all sources” which could be an impractical if not impossible task)</p>	<p>It is important to consider all sources in order to determine if they are significant and without a definition of what is significant IAQM prefer not to enter that debate.</p>
4.2.5	<p>Consider replacing “including filtration if needed” by “including suitable filtration if needed (please note: the type of filters required vary according to the pollutant of concern; please note that when outdoor NO₂ concentrations are high specific NO_x/NO₂ filters are required; this must be ascertained at design stage).</p>	<p>Amended.</p>
4.2.7	<p>It is a frequently promoted myth that indoor pollutants sources in new buildings (and renovated ones) are only an issue immediately after construction. Off gassing can continue for many years after construction</p>	<p>Amended para 4.2.7 and H2.14</p>
4.3 (Figure)	<p>This is a clear figure explaining the process of assessment. It could be combined with Figure 4.2 to include the three questions for determination and then the flowchart if any of the question requirements are met to simplify the process and to be used in reports.</p>	<p>On balance IAQM considered it better to keep the two items separate.</p>

4.3.1	Paragraph 4.3.1 states that “It should be noted that for some projects a Stage 2A Simple Assessment may be sufficient, particularly for new build, where voluntary accreditation is not being sought. Where voluntary accreditation is being sought the first step will be a Stage 2A Simple Assessment followed, post completion of the building (new or refurbishment/retrofit), with a Stage 2B Detailed Assessment.” The Stage 2A assessment would again not be appropriate for an existing building, as the interest is not in determining a theoretical risk of harm, but instead in identifying the cause behind the issue raised by occupants, and where possible advising the building’s managers or owners on possible routes to resolve the issue.	Para 4.3.1 amended.
4.3.10	It is referred to in this paragraph that tobacco smoke should be included if there is a “very local source” could ‘very’ local be defined in distance.	Amended.
4.3.13	Text: “This Guidance and method of assessment for pollutants known to be carcinogenic (e.g. benzene) is not recommended as guidelines are generally risk based, with no safe limit.” This needs to be made clear at earlier sections of the report (either introduction or Background sections)	Para 4.3.13 is moved to Section 1.3.
4.3.15	<p>Apologies if we have interpreted the assessment guidance incorrectly but it appears that it will result in a huge number of Stage 2B Detailed Assessments at existing building locations. Examples provided below:</p> <p>Is our interpretation of the Assessment approach correct that any building with openable windows or doors on the roadside will result in a Magnitude of potential harm of at least 2, even where NO₂/PM concentrations are less than 50% of the objective (Table 4.2). Further if these buildings are occupied for more than 8 hours per week (Table 4.3) this will result in and IAQ Risk of at least ‘Medium Risk’ (Table 4.4), necessitating a Stage 2B Detailed Assessment including monitoring/modelling? Will this not necessitate a Stage 2B Detailed Assessment including monitoring at every building with openable windows and doors in roadside locations regardless of the outdoor NO₂/PM concentration?</p> <p>Is the interpretation correct that if a printer/copier and air fresheners/scented products were positioned in an air conditioned office environment where receptors spent around 40 hours a week, that an IAQ Risk of ‘Medium Risk’ would be appropriate? Should this then necessitate a Stage 2B Detailed Assessment including monitoring/modelling?</p>	Your interpretation was correct although it is stated that scores can be changed and professional judgement is needed. Para 4.3.15 amended to clarify the approach. Table 4.4 has been amended.
4.3.18	It seems a bit of a waste of time as this is the individual user choice and if not illegal pointless as not going to specify mitigation against it	There are indoor locations where smoking is permitted (e.g. some airports have smoking rooms) and this may be a source. It can be excluded if not relevant.

<p>4.3.22</p>	<p>In Table 4.3 do the exposure hours relate to:</p> <ul style="list-style-type: none"> > The amount of time an individual is in the building; > The amount of time a source is directly emitting; or > A combination of both? <p>For example, if I work 40 hours a week in an office with a photocopier is that 40 hours exposure or only the period when the photocopier is on?</p> <p>If I use a gas hob in a domestic setting is the exposure period greater than 80 hours a week (as I may spend that many hours within the building), or less than 8 hours (as I am likely to have my hob on for less than 8 hours). Or somewhere in between as pollutants are likely to remain in the building for a period after the hob has been turned off?</p>	<p>Para 4.3.22 amended to make it clear that professional judgement is needed to assess both the duration of the source emission and the exposure potential.</p>
<p>4.3.27</p>	<p>Stage 2B: This type of assessment seems to focus either on monitoring or modelling. The first option is, again, not applicable for a new building. With regards to the second suggestion to model indoor pollution, it is both unrealistic and inappropriate. At design stage, and considering that any consideration of indoor air pollution should inform the detailed design of a scheme, the information that would be required to set up a model would not be available (for example details about the proposed mechanical ventilation system, specifications for the materials used in building and decorating etc.). Nevertheless, such an approach is, in my opinion, not justified for a future building where no issue with regards to indoor air pollution has been identified. It would be an extremely complex and costly exercise that would provide no benefit to the design team.</p>	<p>Para 4.3.27 amended.</p>

4.3.27	<p>Stage 2B: Paragraph 4.3.27 states that “The Stage 2B Detailed Assessment will generally include computer modelling and/or measurement (e.g. pollutant concentrations, temperature, relative humidity and airflow (N.B. ventilation rates can be determined by measuring CO2 concentrations). This is a benefit as they contribute, with the pollutant concentrations, to understanding the quality of the indoor environment.”</p> <p>The two suggestions for Stage 2B can apply to an existing building. However, the suggestion to model indoor pollution is again, in my opinion, not appropriate. A site visit followed by a monitoring survey would be the best course of action after a complaint has been made. Modelling is a complex and costly exercise, and is associated with uncertainties. For an indoor environment, I would expect such uncertainty to greatly exceed that seen with ambient air dispersion models. On that basis, I would take out the suggestion to model from that aspect of the guidance. I would expect such an exercise to only be appropriate and relevant under very specific circumstances, for example where air flows within a building are paramount to people health and safety. This would, for example, be the case in hospitals operating theatres where the direction of airflows within the room is directed either from the patient towards the staff, or the other way around, depending on the risks of contamination from the patient/staff. This is, however, clearly left out of this guidance document (paragraph 1.1.2). In addition, even in such settings, modelling would, I suspect, only be used at the design stage to test the proposed system. Once operational, even such systems are tested by accredited laboratories through measuring air flows. The suggestion to model indoor air quality should therefore be taken out of this guidance.</p> <p>The suggestion to proceed to a site visit and monitoring is the right course of action</p>	<p>We have reconsidered and decided the best way to address the comments is to identify different types of building (existing, new/existing but refurbished and proposed) and made it clearer that monitoring is likely to be more appropriate than modelling where it is possible (i.e. in all but a proposed building). IAQM considered the inclusion of proposed buildings an important part of the Guidance and so modelling may well be the only solution in this case.</p>
4.3.9	<p>Stage 2A: Step 1 of Stage 2A allows to identify the magnitude of hazard from ingress of outdoor air. As this is based on WHO Air quality guidelines, it is worth noting that in the Greater London area as well as a series of other urban areas in the UK, ambient PM2.5 concentrations will be >90% of the WHO AQG, meaning that most new buildings will fall under the magnitude 4 or 5 category.</p>	<p>Para 4.3.9 amended.</p>
4.3.9	<p>The end of the first sentence has a typographical error “...someone is exposed in the indoor environment being assessment” should be amended to “...someone is exposed in the indoor environment being assessed”</p>	<p>Amended.</p>
4.3.9	<p>Regarding the “ambient air” mentioned in this paragraph is the expectation of Defra background or local background monitoring sites to be used. An inclusion of recommended data sources would be useful.</p>	<p>Para 4.3.9 amended to indicate professional judgement should be used to determine the most appropriate ambient air quality data source.</p>

4.4 (Figure)	Scoping: The approach starts with Figure 4.4 which indicates whether there is a need to proceed to an IAQ assessment. A new building will automatically house a range of sources of indoor pollution, through new materials/fittings/furniture, newly painted walls etc. In addition, by default, there would be a pathway and receptors for most if not all new buildings. As such, this table seems redundant when it comes to new buildings, with all classifying for an IAQ assessment	It is a valid point and professional judgement can be used to reach the outcome you suggest. The aim of the Guidance was to have a common method of assessment for all types or proposed and existing buildings.
4.4 (Figure)	Scoping: Figure 4.4 is also redundant for an existing building, with, as mentioned above, any requirement to proceed to an assessment of indoor air quality driven by an identified issue. This stage is therefore, considering both the new and existing building route, not necessary. Figure 4.4 could be discarded from the guidance	It is a valid point and professional judgement can be used to reach the outcome you suggest. The aim of the Guidance was to have a common method of assessment for all types or proposed and existing buildings.
4.4 (Table)	Please can the table include risks for a magnitude of zero (assume they would all be Negligible risk). When doing assessments we need to consider a variety of building areas and want to calculate the risks for each pollutant. There will very often be situations where a certain area has no pathway to a certain pollutant and the magnitude would be zero, but other areas have a pathway and magnitude. For the purposes of reporting, it is useful to demonstrate that some areas have zero magnitude and thus negligible risk. Although it is implied within the text of the guidance, most consultants are likely to refer to this table, which does not demonstrate this point. This is a bit of a pet hate for me regarding most guidance documents. If you could add a row for zero magnitude, or add a footnote, I would be very grateful.	Thank you for your comment. Table 4.4 and para 4.3.24 have been amended to clarify.
4.5.1	Note: For Scoping reports at design stage, include section on recommended design related preventive measures and offer summary table in Appendix – place in text where deemed suitable.	Paras 4.2.13 and 4.5.1 amended.
5	Consider including monitoring indoor personal exposure methods as an alternative or complementing activity for occupied premises specially when very sensitive receptors are involved and replace 5 Monitoring Indoor Air Quality By 5 Monitoring Indoor Air Quality and Personal Exposure	Title of Section 5 and para 5.5.1 amended.
5.1	Appendix G provides examples of monitoring equipment (Kukadia & Upton, 2019)	Reference to these are given in Para 5.6.1.
5.2 (Table)	I think it would benefit from a footnote stating that the number of sampling points may be altered based on professional judgement. The reason being that the number will also depend on the different uses of the building and concentrations need to be appropriately sampled at multiple locations for each of the uses.	Amended.
5.4.2	Penultimate line: orders of magnitude??	Amended.

5.4.4	<p>Suggest adding new subsection under 5.5 as follows: Very large buildings can often have more than one air handling unit (mechanical ventilation systems) that draw in air for ventilation purposes from different locations around the building (and can thus be affected by different local outdoor air pollution sources). In these cases, sampling should be carried out at sufficient locations within the building to ensure that ventilation air being supplied by all of the different air handling units is monitored.</p>	Amended.
5.5	<p>Section 5.5 on 'where to sample': the approach detailed here is that recommended for a BREEAM or LEED assessment. However, where an indoor air quality assessment is required following a complaint or issue, the monitoring strategy should focus on the area of concern within the building, with no requirement to monitor in each type of room. I would suggest the guidance is amended to reflect this. The requirements specific to BREEAM and LEED certification assessments are already covered in relevant guidance documents, and there is no need for this guidance to reiterate these methods.</p>	Para 5.5.1 amended.
5.5.3	<p>Paragraph 5.5.3 suggests that "Duplicate/replicate measurements should be taken to investigate the homogeneity of the indoor atmosphere; especially in large rooms/open plan offices.". Again, this is specific to BREEAM assessments, however, suggesting that sampling is undertaken in an area where no complaint has been made and/or outside the building to allow for a comparison with the area of concern would be appropriate. • On the basis of these comments, paragraphs 5.5.4 and Table 5.2 are not relevant/appropriate and should be taken out of this guidance document. Otherwise, if the guidance also aims at providing an approach to indoor air quality monitoring for BREEAM/LEEDS purposes, then this should be set in a separate section from that covering the approach to an assessment following a complaint/issue.</p>	Amended.
5.6	<p>You might also like to consider a further subsection (5.6??) along the lines of: Consideration should be given as to who should store any monitoring data collected and where. This is because it could be required many years later to prove/disprove subsequent claims about possible health effects arising from occupants that worked in certain buildings/areas.</p>	Para 5.1.1. amended.
5.6.1	<p>Consider rephrasing to Specific monitoring methods and performance criteria are set out in the guidance and voluntary building assessment/certification schemes equipment (Kukadia & Upton, 2019).</p>	Amended.
5.6.4	<p>This is true of the overall assessment and not just monitoring. The paragraph needs to be moved to the front of the document</p>	Text has been moved and para 5.6.4 amended.

6	My opinion is that this gives the impression that modelling is better than monitoring. I could be wrong, but my understanding is that modelling rarely takes account of all the obstacles within buildings or the movement of people. This is especially the case for new buildings yet to be constructed, where these details are not known. I think this whole section needs to include more sentences throughout on the uncertainties.	The guidance has been amended in response to other comments to stress that monitoring is at least as valid as modelling and in which circumstances each is appropriate.
6.1 (Box)	Inconsistency of bullet points within the box. 1st batch end with "." second with ";" but may be ok since one ends the intro sentence and the rest are sentences?	Amended.
7	Is this supposed to provide details of measures? As currently the guidance is very limited to the user. Has consideration been given to providing something similar to the list set out in the construction dust guidance document? When doing assessments, I have a long list of measures which I've categorised and put forward each of these to clients as being either 'required', 'highly recommended', 'desirable', or 'not applicable'.	Appendix J has been added based on your suggested measures.
7.1	Figure 7.1 (hierarchy of improvement measures) is a useful schematic, but for existing buildings, item 5 'remove receptors' is often not a viable option.	Buildings usage can be redesigned to move people around within a building so it was thought useful to include this as an option. Professional judgement should be used to determine which measures are appropriate and practical.
7.1.4	This is a very weak section of the document. Ventilation only has limited impact. There are a range of materials which can be installed in a building that can absorb VOCs and formaldehyde. Also the use of hygroscopic materials can improve humidity levels and reduce mould growth Mould: This very significant VOC is one of the biggest causes of health problems in the UK and is almost entirely ignored in this report	Amended to some extent. As an introduction IAQM did not want to include too much detail. Many of the references have a lot more detail than considered appropriate for this Guidance. Para 1.3.4 makes it clear that comfort factors (humidity) and mould is scoped out of this Guidance for the reasons stated.
7.2.5	Mechanical ventilation will increase energy use if used on a leaky building. However, implemented in the correct way it significantly reduces energy consumption.	Amended.

8	<p>Your references could be more complete and up to date. For example:</p> <p>A. Current standards (see bottom of webpage) https://www.feta.co.uk/associations/hevac/specialist-groups/filter-group</p> <p>B. WHO Housing and Health 2018 World Health Organisation Housing and Health guidelines (see pages 90-95). Note: Paragraph 8.2.2 (page 94-95) states:</p> <p>“In the absence of updated or indoor-specific guideline values, the air quality guidelines are considered applicable for indoor exposure as well. An update of these guidelines is under way.” https://cleanair.london/app/uploads/WHO-Housing-and-Health-guidelines_28-November-2018_Para-8-2-2-pages-94-to-95.pdf</p> <p>C. WHO COVID guidance re IAQ (as above).</p> <p>D. HTM-03-01 https://www.england.nhs.uk/publication/specialised-ventilation-for-healthcare-buildings/</p> <p>E. There is excellent guidance on IAQ by Ashrae, BESA (with new guidance due imminently) e.g. https://www.thebesa.com/media/1409355/indoor_air_quality_guide.pdf.</p> <p>F. The BSI is also updating its standards for IAQ.</p> <p>G. A number of excellent reports have been published on IAQ e.g. by Professor Holgate and others.</p>	<p>Thank you for the references, they have been added where IAQM considered them appropriate. COVID-19 is largely scoped out of the Guidance (see responses to other COVID-19 related comments).</p>
8	<p>Cheng, H etc WHO (2002) 'Organization'</p> <p>If decided to include the overheating references in 2.4.4, then add the following also:</p> <ol style="list-style-type: none"> 1. Zero Carbon Hub (2016). Solutions to Overheating in Homes: Evidence Review. www.zerocarbonhub.org 2. NHBC (2012). Overheating in new homes: a review of the evidence. NHBC Publication NF46. 	<p>Thank you for your comments. Amended and added.</p>

Appendix A	Very old reference - is it used? Her majesty's inspectorate of pollution	This is a reference that is used frequently by members and is often required by certain bodies (e.g. local councils) and so has been included.
Appendix E	I think the case studies are poor. It would be much more useful to actually include some diagrams showing the building layout, detailing where the sources and pathways are, then going on to explain all of them, rather than showing a limited number in a table. Currently the case studies are very brief and give the impression to the reader that only brief assessments are needed, which will lead to poor IAQ assessments being produced with little consideration given to all sources and pathways. It would be much better to give a very detailed case study to demonstrate to the reader what level of competence is expected. For example, I've found that most assessments typically include all (or more) of the emission sources around set out in Table 4.2 and six building areas and five key pollutants resulting in twenty risks assessed and lots of discussion.	The case studies were provided by Sub-Committee members. If you would like to provide additional materials suitable for inclusion in a subsequent update IAQM will consider them for inclusion.
Appendix E	The tables are under the heading of the next case study (i.e. Table E1 for the Prison Wing comes after the subheading for the Primary School). Suggestion to start each case study on a new page so the text and tables align for ease of reference.	Amended.
Appendix G	Replace title Appendix G. Example Monitoring Equipment by Appendix G. Examples of Monitoring Equipment	Amended.
Appendix H	It is unclear what the full set of results adds to this case study. Could they be included in a summarised format?	The author of the case study preferred to keep the data as presented.
Appendix H	This is very good. However it is surprising that the formaldehyde levels were so low as we always find them very high in any testing we have done. It's not surprising that the TVOC and VOC levels were high as this is normal in mofs buildings. However there is no analysis of the materials source of VOCs etc	Thank you for your comment.
D1 (Table)	This table is very useful to understand when and how the air quality input fits into the RIBA stages that are more widely acknowledged by the engineering design community.	Thank you for your positive comment.
E2 (Table)	I thought that the pollution was road traffic - where is the internal NO ₂ coming from?	Amended.
E3 (Table)	I'm not sure that the example follows the text as the text is all about external traffic pollution and the harm in the table is from internal sources!	Amended.
H1 (Figure)	Figure H1 label axis so clear to read.	Amended.
H2 (Figure)	Figure H2 insert days of week on X axis	Amended.
H3 (Figure)	Figure H3 insert days of week on X axis	Amended.

H4 (Figure)	<p>Short term radon measurements 1-7 days. - We have been advised by UK radon that these give poor / misleading results. The use of the space (windows open, windows closed, summer, winter, ventilation settings, frequency of use) are not represented over a short period to give accurate result. Hence UK Radon insisting on 3 month period (they are very talkative bunch if you ring them at Harwell).</p> <p>. By extension I would predict that any pumped short term sampling (unless repeated) will give poor, unrepresentative results. Figure H4 demonstrates these fluctuations over the course of 1 week. You would need to monitor for a whole working days as a minimum I suggest . . as proxy; for day time sound levels we monitor (BS 5228) 0700 - 1900hrs.</p>	<p>Thank you for your information. Para 5.3.2 makes the point you mention and it is for the professional to determine the appropriate period.</p>
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