

Indoor Air Quality Assessment Levels

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The IAQM issues Position Statements on matters that could affect the way in which Members carry out their professional tasks and on air quality topics and issues where the IAQM can provide a unique perspective from which to give a professional opinion.



Definition

This Position Statement considers the legislation, guidelines and commonly used voluntary assessment/certification schemes in force and commonly used in the UK for indoor air quality. These will jointly be referred to in the document as “assessment levels”.

The issue

Assessment levels for outdoor air quality are well established and have clarity with regard to the relevant time period and location of exposure. By contrast, assessment levels for indoor air quality are not comprehensive in their applicability, which leads to gaps and contradictions between different people in the same location and between indoor and outdoor assessment levels, as discussed below. This problem is accentuated by the fact that there is substantial variation between the values of assessment levels used for the same pollutant.

Assessment levels

The current assessment levels in the UK are:

Legislation

- Health and Safety Executive (HSE) Control of Substances Hazardous to Health (COSHH) Occupational/Workplace Exposure Limits (WELs);¹ apply to employees in all workplaces. Long-term exposure limits (LTEs) are given as 8-hour averages and short-term exposure limits (STELs) generally as 15-minute averages. EH40/2005 provides a method for converting the 8-hour averaging time WELs to other periods and even to continuous exposure (for continuous exposure divide the WEL by 5²)

Regulations and statutory guidance

- Building Regulations Approved Documents F1, C, D^{3, 4, 5, 6, 7, 8}

Guidelines

- Building Bulletin for Schools 101⁹: requires compliance with HSE WELs, Approved Document F1, and has CO₂ concentration limits; and recommends WHO guidelines as best practice¹⁰
- World Health Organization (WHO)¹⁰
- Public Health England (PHE)¹¹

Voluntary schemes include:

- Building Research Establishment Environmental Assessment Method (BREEAM), “BREEAM Hea 02 Indoor Air Quality”¹²
- Leadership in Energy and Environmental Design (LEED)¹³
- WELL Air Quality Standards (WELL V2)¹⁴

Table 1 summarises the pollutants covered by each assessment level, the averaging times and applicability. The following issues have been identified:

- The legislation and regulations do not apply to all people in all indoor environments; for example, people in their home (occupied dwellings) and users of a facility run by volunteers which is not, therefore, a workplace.
- COSHH Regulation 6(1) states that an employer “...should carry out a suitable and sufficient assessment of the risks to the health of your employees and any other person who may be affected by your work, if they are exposed to substances hazardous to health.” This clearly applies to a visitor to industrial premises or a member of the public passing roadworks. It is not clear whether, in a care home or healthcare premises, non-employees, such as residents and patients, are covered by the same legislation even though they are exposed to the same indoor air quality, and sometimes over the same or a longer period. Furthermore, for nitrogen dioxide, a care home employee would be covered by an 8-hour limit of 960 µg/m³, equivalent to a continuous exposure² to a concentration of 192 µg/m³, which is almost five times higher than the UK Air Quality Objective (AQO) for outdoor air¹⁵ and the WHO guideline of 40 µg/m³. A long-term average concentration of 192 µg/m³ would correspond to the concentration experienced in the roadway of an extremely busy road.
- In schools, employees are covered by the COSHH workplace legislation whereas the pupils are covered by regulations and statutory guidance pertaining to schools.⁹
- COSHH workplace exposure limits (WELs) apply to healthy individuals working in industrial settings.¹⁶ They should not therefore be used to assess exposure of more vulnerable demographics, or people who occupy buildings on a more permanent basis. Workplaces such as offices may have a workforce that represent a wider distribution of society; for example, those with underlying health conditions that makes them more susceptible to the effects of polluted air.
- Where legislative and regulatory values have the same averaging time as an outdoor air AQO, the regulatory value is often higher than the AQO, providing less protection to an employee at work than to a member of the public outdoors:

Indoor Air Quality Assessment Levels

- o The 8-hour WEL for carbon monoxide is 35mg/m³ compared to the UK AQO of 10mg/m³
- o Approved Document F1 gives two values for 8-hour carbon monoxide concentrations in a non-dwelling: 10mg/m³ (implied that this value applies in offices) and 35mg/m³ for “occupational exposure” (implied that this value applies in industrial settings)
- Both WHO and PHE guidelines apply to all indoor atmospheres. They only include, however, a small fraction of the substances listed in COSHH EH40 and do not include assessment levels for all substances that can be found in indoor environments; for example, terpenes, perfluoroalkyl substances and phthalates.

Further information on the assessment levels and averaging times can be found in the appendix to this Position Statement, which is available as a standalone document.¹⁷

IAQM’s position on this issue

Comprehensive guidance for assessment of indoor air quality is required and IAQM will be developing such guidance. Until this work is completed, IAQM recommends that for those settings and user groups not covered by legislation or regulation, indoor air quality be assessed against the following hierarchy:

1. **WHO and PHE Guidelines for indoor air quality**^{10,11}
for pollutants not covered by these guidelines:
2. **WHO Guidelines for outdoor air quality**^{18,19}
for pollutants not covered by these guidelines:
3. **EH40/2005 WELs** should be used, with WELs reduced by an appropriate factor to account for continuous exposure and that those exposed may have underlying poor health that makes them more susceptible to the effects of polluted air.

References

- ¹ Health and Safety Executive EH40/2005 Workplace Exposure Limits (Fourth Edition 2020)
- ² Occupational exposure limits for hyperbaric conditions: Hazard assessment document Environmental Hygiene Guidance Note EH75/2 HSE Books 2000
- ³ Ministry of Housing, Communities and Local Government, Approved Documents www.gov.uk/government/collections/approved-documents
- ⁴ Scottish Government, Building standards technical handbook 2019: domestic
- ⁵ Scottish Government, Building standards technical handbook 2019: non-domestic

⁶ Department of Finance and Personnel, Building Regulations (Northern Ireland) 2012, Guidance, Technical Booklet K, Ventilation, October 2012

⁷ Department of Finance and Personnel, Building Regulations (Northern Ireland) 2012, Guidance, Technical Booklet C - Site preparation and resistance to contaminants and moisture, October 2012

⁸ Department of Finance and Personnel, Building Regulations (Northern Ireland) 2012, Guidance, Technical Booklet B - Materials and workmanship, July 2013

⁹ HM Government Education and Skills Funding Agency (2018) – Building Bulletin (BB) 101: Guidelines on ventilation, thermal comfort and indoor air quality in schools (Version 1)

¹⁰ World Health Organization (2010) – WHO guidelines for indoor air quality: selected pollutants

¹¹ Public Health England (2019) – Indoor Air Quality Guidelines for Selected Volatile Organic Compounds (VOCs) in the UK

¹² Building Research Establishment Environmental Assessment Method Hea 02 Indoor air quality

¹³ US Green Building Council, Leadership in Energy and Environmental Design

¹⁴ International WELL V2 Building Institute Air Quality Standards

¹⁵ Defra, National air quality objectives for the protection of human health https://uk-air.defra.gov.uk/assets/documents/National_air_quality_objectives.pdf

¹⁶ Ridley J, and Channing J. (2003) Safety at Work (Sixth Edition), ISBN 978-0-08-047429-8

¹⁷ https://iaqm.co.uk/wp-content/uploads/2013/02/Interim-PS-IAQ-Assessment-Levels-Appendix_20200617-1.pdf

¹⁸ WHO Europe (2000) Air Quality Guidelines for Europe, Second Edition

¹⁹ WHO Europe (2005) Air Quality Guidelines, Global Update

About the Institute of Air Quality Management (IAQM)

The IAQM aims to be the authoritative voice for air quality by maintaining, enhancing and promoting the highest standards of working practices in the field and for the professional development of those who undertake this work. Membership of the IAQM is mainly drawn from practising air quality professionals working within the fields of air quality science, air quality assessment and air quality management.

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Indoor Air Quality Assessment Levels

Table 1: Summary of Indoor Air Quality Assessment Levels in Force and in Use in the UK

| Assessment level | Pollutants | Averaging times | Applicability | Comment |
|---------------------------------------|---|--|--|--|
| WELs | 426 substances listed | Generally, LTELs: long-term (8 hours), STELs: short-term (15 min). Exposure for other time periods, including continuous exposure, can be calculated. ² | Workers in any place of work | Generally based upon Indicative Occupational Exposure Limit Values (IOELVs), which are health-based limits set under the Chemical Agents Directive (98/24/EC). STELs are set to help prevent effects such as eye irritation, which may occur following exposure for a few minutes. |
| WHO | 9 pollutants: benzene, carbon monoxide, formaldehyde, naphthalene, nitrogen dioxide, polycyclic aromatic hydrocarbons (especially benzo[a]pyrene), radon, trichloroethylene and tetrachloroethylene | From 15min to 1 year and concentrations associated with life-time risk of morbidity or mortality | Any indoor space; protection of public health | Pollutants selected were on the basis that all had a potential indoor source, and were known as being hazardous to health |
| PHE | Acetaldehyde, α -pinene, benzene, d-limonene, formaldehyde, naphthalene, styrene, tetrachloroethylene, toluene, trichloroethylene and xylene (mixtures) | From 30min to 1 year and concentrations associated with life-time cancer risks | All indoor spaces | |
| Approved Documents F1 | Nitrogen dioxide, carbon monoxide, Total Volatile Organic Compounds (TVOCs), ozone | 1 hour and 1 year | New buildings, residential and non-residential | Securing reasonable standards of health and safety for persons in or about buildings (and any others who may be affected by buildings or matters connected with buildings) |
| Approved Documents C | Activity level set for radon (in Bq/m ³). Methane and Volatile Organic Compounds (VOCs) considered – no levels set | Typically 3-months or longer | | |
| Approved Documents D | No specified concentration criteria. Sets out criteria for insulating materials and their installation to avoid exposure to excessive formaldehyde fumes | Not applicable | | |
| Building Bulletin 101 Guidance | Requires compliance with HSE WELs, Approved Document F1 and CO ₂ concentration limits; recommends WHO guidelines as best practice ¹⁰ | From 15mins to 1 year | New buildings and refurbishments, workers and students | |
| BREEAM | Formaldehyde and Total Volatile Organic Compounds (TVOC) | Formaldehyde: 30 minutes TVOC: 8 hours | New buildings, post completion, pre-occupancy | |
| LEED | New buildings: Particulates, ozone, carbon monoxide, TVOCs, formaldehyde, 35 specific VOCs. Existing buildings: carbon dioxide | Minimum of 4 hours | Range of schemes for new construction and occupied buildings | Indoor air quality assessment credit in the LEED v4 Building Design and Construction (BD+C) rating system. |
| WELL | All spaces: formaldehyde, TVOC, carbon monoxide, PM _{2.5} , PM ₁₀ , ozone. Regularly occupied spaces: also radon. Commercial kitchen space: carbon monoxide, PM _{2.5} , nitrogen dioxide, formaldehyde | Same as Californian, US and WHO standards referenced in the WELL requirements | Space where someone spends 1 hour continuously or 2 hours cumulatively per day | A01 feature Fundamental Air Quality A05 Enhanced Air Quality contains tighter standards for a subset of the pollutants and benzene. |