



DPC: 22 / 30443082 DC

BSI Group Headquarters

389 Chiswick High Road London W4 4AL

Tel: +44 (0)20 8996 9000

Fax: +44 (0)20 8996 7400

www.bsigroup.com

Date: 30 March 2022

Origin: National

Latest date for receipt of comments: 30 May 2022

Project No. 2021/02350

Responsible committee: CB/401 Retrofitting Energy Efficiency Measures

Interested committees: CB/401/-/3

Title: Draft BS 40102-1 Health and well-being and indoor environmental quality in buildings

Part 1: Health and well-being in non-domestic buildings

Please notify the secretary if you are aware of any keywords that might assist in classifying or identifying the standard or if the content of this standard

- i) has any issues related to 3rd party IPR, patent or copyright
- ii) affects other national standard(s)
- iii) requires additional national guidance or information

**WARNING: THIS IS A DRAFT AND MUST NOT BE REGARDED OR USED AS A BRITISH STANDARD.
THIS DRAFT IS NOT CURRENT BEYOND 30 May 2022**

This draft is issued to allow comments from interested parties; all comments will be given consideration prior to publication. No acknowledgement will normally be sent. **See overleaf for information on the submission of comments.**

No copying is allowed, in any form, without prior written permission from BSI except as permitted under the Copyright, Designs and Patent Act 1988 or for circulation within a nominating organization for briefing purposes. Electronic circulation is limited to dissemination by e-mail within such an organization by committee members.

Further copies of this draft may be purchased from BSI Shop <http://shop.bsigroup.com> or from BSI Customer Services, Tel: +44(0) 20 8996 9001 or email cservices@bsigroup.com. British, International and foreign standards are also available from BSI Customer Services.

Information on the co-operating organizations represented on the committees referenced above may be obtained from <http://standardsdevelopment.bsigroup.com>

Responsible Editorial Project Manager: **Mary Groom**

Direct tel:

E-mail: mary.groom@bsigroup.com

Introduction

Your comments on this draft are invited and will assist in the preparation of the consequent standard.

For international and European standards, comments will be reviewed by the relevant UK national committee before submitting the consensus UK vote and comments. If the draft standard is approved, it is usual for the resulting published standard to be adopted as a British Standard.

For national standards, comments will be reviewed by the relevant UK national committee and the resulting standards published as a British Standard.

UK Vote

Please indicate whether you consider the UK should submit a negative (with supporting technical reasons) or positive vote on this draft. Please indicate if you are aware of any reason why this draft standard should not be published as a British Standard.

Submission of Comments

Annotated drafts are not acceptable and will be rejected.

All comments should be submitted online at <http://standardsdevelopment.bsigroup.com>. You will need to register in order to comment.

WARNING. THIS IS A DRAFT AND MUST NOT BE REGARDED OR USED AS A BRITISH STANDARD. THIS DRAFT IS NOT CURRENT BEYOND 30 MAY 2022.

BS 40102-1:2022

**Health and well-being and indoor environmental quality in buildings
– Part 1: Health and well-being in non-domestic buildings**

DRAFT

Contents

Foreword	4
Introduction	6
1 Scope	6
2 Normative references	7
3 Terms and definitions	7
3.1 automated measuring system (AMS)	7
3.2 building services	7
3.3 calibration	7
3.4 competent person	8
3.5 indoor environmental quality (IEQ)	8
3.6 mechanical ventilation	8
3.7 natural ventilation	8
3.8 non-domestic	8
3.9 occupant	8
3.10 occupied	8
3.11 plant	8
3.12 premises	8
3.13 soundscape	8
3.14 ventilation system	8
4 Assessment methodology	9
4.1 General	9
4.2 Scope assessment	9
4.3 Measurement-based assessment	10
4.4 Occupant survey	10
Table 1 – Category 1: Occupant survey	11
Table 2 – Category 2: Visitor survey	11
4.5 Analysis	11
4.6 Ongoing monitoring	11
4.7 Review process	11
5 Air	12
5.1 General	12
5.2 Particulate matter	12
Table 3 – $PM_{2.5}$	13
Table 4 – PM_{10}	13
5.3 Carbon monoxide	13
Table 5 – Carbon monoxide (CO)	14
5.4 Total volatile organic compounds (TVOCs)	14
Table 6 – Total volatile organic compounds (TVOCs)	14
5.5 Nitrogen dioxide	15
Table 7 – Nitrogen dioxide	15
5.6 Ozone	15
Table 8 – Ozone	16
5.7 Carbon dioxide	16
Table 9 – Carbon dioxide	16
6 Light	17
6.1 General	17
6.2 Illumination level	17
Table 10 – Illumination level	18
Table 11 – Illumination level	18
6.3 Light source	18
6.4 Uniformity of light	19
Table 12 – Uniformity of light: walls and ceilings	19
Table 13 – Uniformity of light: task area	19

<i>Table 14 – Uniformity of light: shadowing</i>	19
6.5 Glare	19
<i>Table 15 – Glare: Field of view</i>	20
<i>Table 16 – Glare: Field of view</i>	20
6.6 Flicker or light modulation	20
<i>Table 17 – Visible flicker</i>	20
<i>Table 18 – Flicker – surface/task</i>	21
<i>Table 19 – Flicker – strobing</i>	21
7 Thermal comfort	21
7.1 General	21
7.2 Naturally ventilated buildings	21
7.2.1 Air temperature	21
<i>Table 20 – Air temperature</i>	22
7.2.2 Relative humidity	22
<i>Table 21 – Relative humidity</i>	22
7.3 Additional considerations for buildings with fan powered ventilation or air-conditioning	22
8 Acoustic and soundscape quality	23
<i>Table 22 – Acoustic and soundscape environment</i>	24
<i>Table 23 – Appropriateness of acoustic and soundscape environment</i>	24
9 Maintenance	24
<i>Table 24 – Maintenance</i>	25
Annex A (informative) Extent of scope assessment template	26
<i>Table A.1 – Company/organizational information</i>	26
<i>Table A.2 – Building and building services information</i>	26
<i>Table A.3 – Maintenance regime</i>	27
Annex B (informative) Evidence and measurement-based assessment template	28
<i>Table B.1 – Measurement-based survey information</i>	28
<i>Table B.2 – Zone, space, area information and measured values</i>	28
Annex C (informative) Occupant IEQ assessment template	30
<i>Table C.1 – Employee or permanent occupant survey</i>	30
<i>Table C.2 – Visiting Occupant Survey</i>	35
Annex D (informative) Evaluation and scoring	40
<i>Table D.1 – IEQ performance score levels</i>	40
<i>Table D.2 – Thermal comfort scoring matrix</i>	42
<i>Table D.3 – Lighting Scoring Matrix</i>	42
<i>Table D.4 – Maintenance scoring matrix</i>	43
<i>Table D.5 – Summary score and weighting</i>	43
<i>Table D.6 – Occupant/visitor survey weighting categories</i>	44
<i>Table D.7 – Total Score & Weighting</i>	45
Bibliography	46

Foreword

Publishing information

This British Standard is published by BSI Standards Limited, under licence from The British Standards Institution, and came into effect on XX MONTH 202X. It was prepared by Technical Committee CB/401, *Retrofitting energy efficiency measures*. A list of organizations represented on this committee can be obtained on request to the committee manager.

Relationship with other publications

This element gives the following information as appropriate:

- the standard's relationship to other standards, incl. Eur. and int. standards;
- list of other parts of this standard;
- reference to relevant international work.

Information about this document

This publication can be withdrawn, revised, partially superseded or superseded. Information regarding the status of this publication can be found in the Standards Catalogue on the BSI website at bsigroup.com/standards, or by contacting the Customer Services team.

Where websites and webpages have been cited, they are provided for ease of reference and are correct at the time of publication. The location of a webpage or website, or its contents, cannot be guaranteed.

Use of this document

As a code of practice, this British Standard takes the form of recommendations and guidance. It is not to be quoted as if it were a specification. Users are expected to ensure that claims of compliance are not misleading.

Users may substitute any of the recommendations in this British Standard with practices of equivalent or better outcome. Any user claiming compliance with this British Standard is expected to be able to justify any course of action that deviates from its recommendations.

It has been assumed in the preparation of this British Standard that the execution of its provisions will be entrusted to appropriately qualified and experienced people, for whose use it has been produced.

Presentational conventions

The provisions of this standard are presented in roman (i.e. upright) type. Its recommendations are expressed in sentences in which the principal auxiliary verb is "should".

Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.

The word "should" is used to express recommendations of this standard. The word "may" is used in the text to express permissibility, e.g. as an alternative to the primary recommendation of the clause. The word "can" is used to express possibility, e.g. a consequence of an action or an event.

Notes and commentaries are provided throughout the text of this standard. Notes give references and additional information that are important but do not form part of the recommendations. Commentaries give background information.

Where words have alternative spellings, the preferred spelling of the Shorter Oxford English Dictionary is used (e.g. "organization" rather than "organisation").

Contractual and legal considerations

This publication has been prepared in good faith, however no representation, warranty, assurance or undertaking (express or implied) is or will be made, and no responsibility or liability is or will be accepted by BSI in relation to the adequacy, accuracy, completeness or reasonableness of this publication. All and any such responsibility and liability is expressly disclaimed to the full extent permitted by the law.

This publication is provided as is, and is to be used at the recipient's own risk.

The recipient is advised to consider seeking professional guidance with respect to its use of this publication.

This publication is not intended to constitute a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.

Introduction

In recent years, regulatory and commercial pressures have led designers, constructors, building owners/landlords, tenants and maintenance teams to focus on minimizing energy costs. This has come at the expense of unintended consequences such as inadequate ventilation and issues with lighting, which can compromise occupant mental or physical health and well-being. Environmental conditions can also be negatively impacted due to incorrect commissioning and operation of systems, leading to inherent poor performance.

With the growing concern over the impact and cost of ill-health and pressures on public services, efforts need to be made to improve the quality of building stock to meet the well-being needs of current and future generations. In so doing, there are tangible benefits to be realised, including the following:

- a) cost savings: local or personalized control and automation of systems not only improves well-being but can enhance energy efficiency and therefore reduce operational expenditure;
- b) improved performance of occupants: increased cognitive function, productivity and reduction in fatigue, tiredness and stress;
- c) employee, tenant, customer retention and loyalty: improved indoor environmental quality (IEQ) creates an environment in which occupants feel comfortable and valued; and
- d) attraction of new staff, customers and tenants to buildings as the “location of choice”.

The building sector requires harmonized standardization of the health and well-being performance of non-domestic buildings. Therefore, this British Standard has been developed to give recommendations for the measuring, monitoring and reporting of the health and well-being factors influenced by the building and the building services. It includes a multi-layered evaluation system that generates an IEQ performance level and helps users to identify areas for improvement.

This British Standard sets out a holistic approach to the evaluation of all indoor environmental quality issues, rather than the evaluation of individual elements in isolation.

1 Scope

This British Standard gives recommendations for the measuring, monitoring and reporting of the well-being and IEQ performance of an occupied building and the associated building services.

This British Standard provides an evaluation and rating system, the aim of which is to enhance indoor environmental quality (IEQ), with the aim of creating healthier buildings and improving the well-being of building occupants; including, but not limited to, staff, visitors, tenants and customers.

The IEQ performance score generated as an outcome of this evaluation provides organizations with a benchmark score that can be used to identify areas of below par performance and enable improvements to be made accordingly.

It is applicable to non-domestic buildings, including existing building stock. It can be used, along with other standards and design guidance, in existing buildings, renovations and new build developments for target setting, evaluation and assessment of health and well-being in buildings. It covers a good practice approach to the evaluation and assessment of the following factors:

- a) air quality;
- b) light quality;
- c) thermal comfort; and

d) acoustic and soundscape quality.

NOTE The indoor environmental characteristics in terms of their definition, evaluation and interpretation are detailed in BS EN 16798-1, PD CEN/TR 16798-2 and BS EN ISO 7730.

It does not cover:

- 1) spaces used for permanent or semi-permanent habitation;
- 2) temporary structures;
- 3) construction methods;
- 4) furniture, fixtures and equipment (FF&E);
- 5) health and well-being not related to the building or the building services;
- 6) medical assessment or evaluation;
- 7) cultural norms and acceptable behaviours;
- 8) life safety systems;
- 9) biophilia;
- 10) water quality; or
- 11) electro-magnetic fields.

This British Standard is for use by any organization of any size and sector. It is for use by design, construction, surveying and facilities management professionals, and also by landlords, employers, employee representatives, occupational health and safety and well-being professionals.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes provisions of this British Standard.¹⁾ For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

[tbc]

3 Terms and definitions

For the purposes of this British Standard, the following terms and definitions apply.

3.1 automated measuring system (AMS)

entirety of all measuring instruments and additional devices necessary for obtaining a measurement result

3.2 building services

engineering systems installed in buildings to make them comfortable, functional, efficient and safe

NOTE These systems can include artificial lighting, heating, ventilation, air conditioning, domestic water services and life safety systems.

3.3 calibration

operation that, under specified conditions, in a first step, establishes a relation between the quantity values with measurement uncertainties provided by measurement standards and corresponding indications with associated measurement uncertainties and, in a second step,

¹⁾ Documents that are referred to solely in an informative manner are listed in the Bibliography.

uses this information to establish a relation for obtaining a measurement result from an indication

NOTE 1 A calibration may be expressed by a statement, calibration function, calibration diagram, calibration curve, or calibration table. In some cases, it may consist of an additive or multiplicative correction of the indication with associated measurement uncertainty.

NOTE 2 Calibration is not to be confused with adjustment of a measuring system, often mistakenly called “self-calibration”, nor with the verification of a calibration.

3.4 competent person

person, suitably trained and qualified by knowledge and practical experience, and provided with the necessary instructions, to enable the required task(s) to be carried out correctly

3.5 indoor environmental quality (IEQ)

composite characterization of performance attributes that collectively describe the quality of an internal environment

NOTE There is no definitive list of performance parameters; however, these can include temperature, humidity, air quality, acoustic attributes, odours, air movement, lighting, glare, and, in some cases, their time derivative.

3.6 mechanical ventilation

ventilation system where air is supplied or extracted from the building or both by a fan using air terminal devices, ducts and roof/wall devices

3.7 natural ventilation

ventilation provided by thermal, wind, or diffusion effects through doors, windows, or other intentional devices in the building designed for ventilation

NOTE Natural ventilation systems can be either manually or automatically controlled.

3.8 non-domestic

building other than a dwelling, flat, house or other place of residence

3.9 occupant

user spending a significant proportion of time in or about a building or premises

3.10 occupied

times when the majority of the building or part of the building being considered is in its intended use

3.11 plant

mechanical and electrical equipment comprising technical building systems

3.12 premises

building, collection of buildings, or part of a building that is under separate occupancy from other parts of the building

3.13 soundscape

acoustic environment, as perceived or experienced and/or understood by a person or people in context

NOTE See BS ISO 12913-1 for further information and guidance.

3.14 ventilation system

combination of appliances or building components designed to supply indoor spaces with outdoor air and/or to extract polluted indoor air

NOTE 1 A ventilation system can refer to mechanical, natural and hybrid ventilation systems.

NOTE 2 The ventilation system can consist of mechanical components (e.g. combination of air handling unit, ducts and terminal units). A ventilation system can also refer to natural ventilation systems making use of temperature differences and wind with facade grills. A combination of mechanical and natural ventilation is possible (hybrid systems).

4 Assessment methodology

4.1 General

An assessment methodology should be applied. This comprises a number of discrete activities and should include:

- a) a scope assessment to determine the extent and scope of the IEQ review and the applicable target parameters;
- b) a measurement-based assessment to record the values of the IEQ; and
- c) occupant-based surveys to ascertain IEQ experienced by the users of the building.

4.2 Scope assessment

NOTE A template for recording the results of the scope assessment is given in Annex A.

4.2.1 A scope assessment should be carried out to determine the extent and scope of the spaces covered by the health and well-being performance review.

4.2.2 All factors identified in the scope assessment, including measurement-based assessments and occupant surveys, should be included in the IEQ performance review, unless there is a good reason to omit them. If any assessment criteria is omitted, full justification should be provided.

4.2.3 The scope assessment should record and define:

- a) company or organizational information;
- b) building and building services information; and
- c) maintenance regimes.

4.2.4 The scope assessment should define the rooms, zones or areas of the building that are intended to be the subject of the assessment, including:

- a) the primary type and function of each space;
- b) the typical number of occupants in each space; and
- c) the time(s) of day applied to the assessments (i.e. the mean occupancy levels).

4.2.5 For each of the spaces identified within the scope assessment, the following should be recorded:

- a) the benchmark parameters that are to be applied to each space (depending on its type and purpose); and
- b) the type of occupancy and type of occupants; these might impact the performance outcomes to be specified.

NOTE For example, people who are neurodivergent are often much more sensitive to some types of light, noise and odours and therefore the requirements for a SEN school or a dementia care setting would require consideration of different performance values.

4.2.6 Employees or advisors who undertake the scope assessment should be competent in the assessment of environmental parameters that constitute IEQ and building services. The organization commissioning the review should determine if it has the correct level of expertise available within the organization or whether it requires an external specialist or consultant to assist.

NOTE A building logbook can be beneficial in completing the necessary information, if available. As a minimum, the scope assessment is expected to cover:

- company information;
- building classification, e.g. education, healthcare, retail, bank, office;
- building occupancy (if known), e.g. general public, patients, elderly people, special educational needs;
- summary of main building services plant and controls;
- summary of maintenance regime; and
- room, zone or area information.

4.3 Measurement-based assessment

NOTE A template for recording the results of the measurement-based assessment is given in Annex B.

4.3.1 A measurement-based assessment should be undertaken to record the parameters, as set out in Clause 5 to Clause 8, which include air, light, thermal comfort and acoustic and soundscape quality.

4.3.2 Measurement should be carried out by means of an automated measuring system (AMS). A data collection and analytics tool should be utilized to allow for feedback and reporting purposes.

4.3.3 The minimum period of measurement should be 12 months to account for seasonal variations in external environmental conditions, which have a subsequent impact on a building's performance.

4.3.4 The maximum sampling period should be at 15 minute intervals.

NOTE Shorter sampling periods can provide more accurate results.

4.3.5 All equipment used to measure the parameters defined in this British Standard should be suitably calibrated in accordance with the relevant British Standard and be complete with up-to-date calibration certificates and details recorded in the report.

NOTE See BS EN ISO 16000 (all applicable parts), BS EN 16798-1 and PD CEN/TR 16798-2 for further information and guidance when undertaking measurement and collection of data.

4.4 Occupant survey

COMMENTARY ON 4.4

The details of this process and the results are given in Annex D.

4.4.1 An occupant survey should be carried out to determine the personal experience of the occupants on the IEQ of the building.

NOTE There are certain factors that need to be evaluated from an occupant perspective. This might be important when considering health and well-being on an individual basis and understanding the particular needs of occupants, for example, medical conditions or disabilities and relevant circumstances (such as specialist education, recovery from surgery or medical treatment).

4.4.2 Occupants should be engaged in and informed of the IEQ review process and provided with an understanding of the assessment intent. Two-way information flow should be encouraged and all participants provided with feedback.

4.4.3 Occupant surveys should be sub-divided into two categories.

- a) Category 1: for employees or other permanent occupants such as commercial residential tenants.

All occupants should be surveyed in the initial assessment with subsequent assessments being carried out at least twice per annum to allow for any seasonal variations in personal experience.

- b) Category 2: for visitors, such as leisure or retail customers who might use the building on an ad-hoc basis.

Visitors should be surveyed on a representative sample basis.

NOTE 1 Where a building has a number of different uses, such as a community hall accommodating a range of sports, leisure and community needs, or a school hall used for a different purpose outside school hours, then more than one representative sample might be needed to ensure the needs of different occupancy types are assessed.

NOTE 2 See Table 1 and Table 2 for occupant and visitor surveys rating the number of responses received.

Table 1 – Category 1: Occupant survey

Level	Description	Value (% of surveys returned vs number of occupants)
0	Very poor	0 – 10
1	Poor	11 – 25
2	Moderate	26 – 40
3	Very good	41 – 60
4	Excellent	61 – 80
5	Outstanding	81 – 100

Table 2 – Category 2: Visitor survey

Level	Description	Value (% of surveys returned vs number of occupants)
0	Very poor	0 – 10
1	Poor	11 – 25
2	Moderate	26 – 40
3	Very good	41 – 60
4	Excellent	61 – 80
5	Outstanding	81 – 100

4.5 Analysis

On completion of the scope assessment, measurement-based assessment and occupancy surveys, the outputs, results and measured values should be entered into an analysis model to provide an IEQ assessment score that represents the status of the areas under evaluation.

4.6 Ongoing monitoring

The IEQ process is an iterative process and should be carried out on a regular or continuous basis as detailed in the scope assessment.

4.7 Review process

The review process should be repeated if significant changes are made to any of the factors that determine the assessment score (this includes both measurement-based assessment and occupant survey).

If ongoing monitoring is not provided, as a minimum reassessment should take place for all or part of the building where any material change in the M&E services installation, or a significant enduring change in the type of activity or occupancy density occurs, or where the building is impacted by external factors, such as increased traffic or other external noise, daylight affected by the erection of new buildings nearby, etc.

5 Air

5.1 General

5.1.1 For some measurements, the quality of outdoor air and the level of contaminants introduced via mechanical or natural ventilation can affect the indoor conditions; therefore, both outdoor and indoor measurements should be monitored and recorded for certain air quality pollutants.

5.1.2 Where outdoor monitoring of air quality is required, the monitoring should take place as close as is reasonably practicable to the indoor location being monitored for naturally ventilated systems, or as close as is reasonably practicable to the intake position for a mechanically ventilated system.

NOTE This might be at a safe location directly outside the area under assessment for natural ventilation, or in the vicinity of supply air intake for mechanical ventilation.

5.1.3 Air quality values should be measured indoors and/or outdoors as detailed in **5.2** to **5.7**.

5.1.4 External influences, such as traffic density, time of day and weather conditions, should be taken into account when carrying out sampling.

5.2 Particulate matter

COMMENTARY ON 5.2

Particulate matter (PM) is a generic term used to describe a complex mixture of solid and liquid particles of varying size, shape and composition. Some particles are emitted directly (primary PM); others are formed in the atmosphere through complex chemical reactions (secondary PM). The composition of PM varies greatly and depends on many factors, such as geographical location, emission sources and weather.

The main sources of manufactured PM are the combustion of fuels (by vehicles, industry and domestic properties) and other physical processes such as tyre and brake wear. Natural sources include wind-blown soil and dust, sea spray particles and fires involving burning vegetation.

PM is often classified according to aerodynamic size and referred to as:

- coarse particles (PM_{10} ; particles that are less than 10 microns (μm) in diameter); and
- fine particles ($PM_{2.5}$; particles that are less than 2.5 μm in diameter).

The size of particles and the duration of exposure are key determinants of potential adverse health effects. Particles larger than 10 μm are mainly deposited in the nose or throat, whereas particles smaller than 10 μm pose the greatest risk because they can be drawn deeper into the lung. The strongest evidence for effects on health is associated with fine particles ($PM_{2.5}$).

There is an extensive body of evidence that long-term exposure to PM increases mortality and morbidity from cardiovascular and respiratory diseases. Outdoor air pollution, particularly PM, has also been classified by the International Agency for Research on Cancer (IARC) as carcinogenic to humans (a Group 1 carcinogen) and causing lung cancer. There is some experimental evidence, however, that ultrafine particles can also pass through the lungs into the bloodstream.

For further information, see www.gov.uk/government/publications/health-matters-air-pollution/health-matters-air-pollution.

5.2.1 Particulate matter (PM_{10} and $PM_{2.5}$) should be measured and recorded indoors for each room, zone or area forming part of the assessment, and outdoors. The height that the measurement should be taken and should be determined in relation to the activity being undertaken within the space.

5.2.2 The level of particulate matter should be assessed in accordance with the values given in Table 3 and Table 4.

Table 3 – PM_{2.5}

Level	Description	Value (µg/m ³ – 24 h running mean)
0	Very high	(≥32)
1	High	(16 – <32)
2	Acceptable	(10 – <16)
3	Low	(5 – <10)
4	Very low	(<5)

NOTE The information in this table is based on the DEFRA Daily Air Quality Index [1] and the WHO Air Quality Guidelines 2021 [2].

Table 4 – PM₁₀

Level	Description	Value (µg/m ³ – 24 h running mean)
0	Very high	(≥68)
1	High	(46 – <68)
2	Acceptable	(30 – <46)
3	Low	(10 – <30)
4	Very low	(<10)

NOTE The information in this table is based on the DEFRA Daily Air Quality Index [1] and the WHO Air Quality Guidelines 2021 [2].

5.3 Carbon monoxide

COMMENTARY ON 5.3

Carbon monoxide (CO) is a colourless, tasteless, odourless, non-irritating gas produced during incomplete combustion of fuels due to there being insufficient oxygen present. Complete combustion occurs when sufficient oxygen is present and leads to the production of carbon dioxide. Most combustion processes (natural or man-made) produce some carbon monoxide.

When inhaled, carbon monoxide enters the blood through the lungs and attaches to the body's oxygen carrier, haemoglobin. This reduces the amount of oxygen that can be carried round the body. A brief exposure to small amounts of carbon monoxide can cause headaches, flushing, nausea, dizziness, vertigo, muscle pain or personality changes. Exposure to higher amounts can cause movement problems, weakness, confusion, lung and heart problems, loss of consciousness and death.

Exposure to small amounts of carbon monoxide for a long time can lead to flu-like symptoms with tiredness, headaches, nausea, dizziness, personality changes, memory problems, loss of vision and dementia. It can be hard to tell the difference between the effects of being exposed to carbon monoxide at low levels for a long time and other common illnesses. See the PHE document for further information [3].

5.3.1 Carbon monoxide levels should be measured and recorded indoors for each room, zone or area forming part of the assessment. The height(s) that the measurement is to be taken at should be determined in relation to the range of activities likely to be undertaken within the space.

5.3.2 The level of carbon monoxide should be assessed in accordance with the values given in Table 5.