Integrated with comments from the European Ventilation Industry Association (EVIA)

EUROPEAN
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COMMISSION STAFF WORKING DOCUMENT

on supporting Indoor Air Quality

Integrated with comments from the
EUROPEAN VENTILATION INDUSTRY ASSOCIATION (EVIA)
February 2025

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1. Background

Europeans spend, on average, 85-90% of their time in buildings. Good indoor air quality (IAQ) is therefore essential for our health and wellbeing. Due to industry's improved expertise and familiarity with this field, prices for specific technical systems that improve air quality have decreased, which is making technical improvements more affordable. As a result,architects, contractors, and facility managers have been increasingly addressing indoor air quality in their projects. In parallel, authorities at EU, national and regional level have been increasing their efforts to provide an appropriate regulatory framework as well as reliable instruments to define, measure and improve IAQ.

The Commission's Zero Pollution Action Plan[1] suggested taking a comprehensive approach towards cleaner air: the Commission committed to analysing knowledge and policy gaps and assessing pathways and policy options to improve indoor air quality. This commitment focuses on key determinants and pollution sources and exploring ways to raise greater public awareness and reduce risks.

In addition, the Renovation Wave[2] has introduced an opportunity to improve the performance of the existing building stock by using the synergy effect of taking measures for both energy efficiency and IAQ at the same time. This can reduce costs for building owners, managers, and occupants.

Commented [A1]: This is essential. Sufficient but controlled air renewal should be ensured in the frame of every renovated building.

This document describes the contribution of existing and planned EU policies and instruments (regulatory and technical) as well as research work to focus and address challenges faced by national or regional authorities, professionals, including SMEs, and occupants of buildings to achieve good indoor air quality. It also provides a structured overview on current activities that should support developments at national and regional levels. This will underpin and assist long-term policies at national and EU level.

This document should also be seen as complementary to the Commission Staff Working Document "Scenarios for a transition pathway for a resilient, greener and more digital construction ecosystem"[3], which covers a wider range of challenges of the construction sector and the Commission's role in providing solutions for them.

2. What exactly is good indoor air quality?

Good indoor air quality means that indoor air meets the necessary requirements ~~parameters~~ to ensure that activities within the indoor space concerned can be carried out in a safe and comfortable manner. In general, this means that indoor air is at comfortable temperature and humidity levels (linked to indoor environmental quality - IEQ)[4], that there are no uncomfortable CO_2 levels, that the air is free of significantly disturbing odours and that the level of harmful

Commented [A2]: Humidity is not just a question of comfort but also of health. It is fully part of the IAQ dimension. The development of mould leads to the spread of respiratory diseases among building occupants.
An air too dry also favours airborne infections. Thus, it should be kept in the range of 30 to 70%

[1] COM(2021)400.
[2] A Renovation Wave for Europe - greening our buildings, creating jobs, improving lives', COM (2020) 662 final
[3] https://ec.europa.eu/docsroom/documents/53854
[4] Indoor environment quality (IEQ means the result of an assessment of the conditions inside a building that influence the health and wellbeing of its occupants, based upon parameters such as those relating to thetemperature, humidity, ventilation rate and presence of contaminants.

chemicals, dust, air pollutants such as particulate matter, microbes or other pathogens and allergens meet minimum standards. The requirements for indoor air quality will vary according to the activity, but it should be kept in mind that good indoor air quality also depends on how individuals experience their indoor environment.

3. How could good indoor air quality be achieved?

The most important elements to achieve good indoor air quality: apply at the level of individual buildings occupant behaviour, supportive design, and professional construction.

At the national or regional level, national requirements, either as obligations laid down in building codes or as (voluntary) guidelines – addressing specific regional climatic, technical and cultural considerations – are decisive elements to steer, influence and support occupant behaviour and professional contributions during the different life-cycle stages (e.g. in design, construction, maintenance, deconstruction).

The EU level provides relevant policies, regulations, technical instruments (standards) and research. Their role is to support the exchange of expertise gained at national, regional, and building level, and therefore to raise the overall awareness, knowledge, and performance in construction.

Good indoor air quality can be achieved by reducing the concentration of pollutants in the room through prevention, removal, or dilution. Chemicals and biological pollutants could be in gaseous, vapour, liquid, or solid states (the last two emitting from products).

In addition, high temperatures and humidity also affect the well-being of occupants and can cause health problems and the indoor air is then perceived as stale. High humidity in cold rooms will result in condensation on the colder surfaces of the room – in particular the corners – which increases the risks of mould development in these places.

Keeping in mind the rise of global temperatures, measures to reduce indoor temperatures by design (e.g. adjusting the orientation of facades to reduce direct sunlight, using external shutters, and using natural ventilation) will become more important. Even though theseelements are outside of the direct management of indoor air quality, they have an important effect on indoor conditions and therefore, indoor air quality. Therefore, a balanced design and the most effective use of heat conductive materials and non-conductive materials is essential. This needs to include regular inspections of the accessible parts of heating systems, ventilation systems and air-conditioning systems, including any combination thereof.

There are multiple ways to modify indoor conditions, be it through user intervention (e.g. opening windows) or through different building services (e.g. heating, mechanical? ventilation or airconditioning systems).

A mechanical ventilation system or a Heating, Ventilation and Air Conditioning system (HVAC) can bypass continuous adjustments by occupants. However, increasingly automated systems to regulate indoor air quality need not only proper design and installation but also maintenance, such as cleaning/exchanging filters at regular intervals. The more complex the systems, the more maintenance they require, including cleaning and replacement of parts such

Commented [A3]: Does this refer to occupants' behaviour, building's environment or adapted/non-adapted individuals? The sentence should be clarified.

Commented [A4]: Mechanical ventilation systems should be clearly identified as an effective solution.

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Commented [A6]: The contribution of occupants shall not be overestimated. Experience shows that building occupants' interaction with technical building systems is rather limited.

Commented [A7]: Following EN16798-1.3 : "Indoor air quality shall be controlled by the following means : Source control, ventilation, and possible filtration and/or air cleaning. "

Commented [A8]: What is meant exactly by natural ventilation? Freecooling/ventilative cooling should rather be mentioned: it consists in using mechanical ventilation systems to cool buildings when the outside temperature is lower than the one inside.

Commented [A9]: This is essential.

Commented [A10]: A mechanical ventilation system is not the same as a HVAC system

Commented [A11]: This is true but ensuring a good IAQ comes at a cost. Simple mechanical ventilation systems exist and require limited maintenance. Automation can bypass continuous adjustments by occupants. Automated systems to regulate indoor air quality are available on the market for mechanical ventilation.

as filters at regular intervals. Raising awareness and providing guidance to keep complex but also simple systems well maintained can significantly improve their overall performance.

Keeping all these elements in mind, interventions that improve IAQ can include:

- effective ventilation
- extraction ventilation (e.g., a ventilation hood over a stove)
- ventilation and cleaning as measures to avoid moisture, dust and particulate impurities, measures to help keeping the right level of humidity (to avoid the development of damp and moulds growths, accumulation of dust)
- selection of low-emission products – starting from building materials to furniture, other household/office equipment and cleaning supplies
- Minimisation or avoidance of indoor emissions of substances, particles, or microbes with a health impact
- Avoidance of smoking indoor
- correct thermal insulation of buildings
- - installation of measuring and control devices for the monitoring and regulation of indoor air quality
- - installation of self-regulating devices for the separate regulation of the temperature in each room or, where justified, in a designated heated or cooled zone of the building unit

These different measures already indicate that actions can be taken by different professionals and occupants over the whole life cycle of a building:

- Design:
  - Client of the building project: choices in trade-off between budget and functionality, selection of products/materials; respect to bio-climatic architecture principles
  - Designers: architects and indoor designers with choices made (e.g. building design, orientations, materials/products, technical installations, possibilities for maintenance, refurbishment and deconstruction) and the trade-offs presented to the client of the building project
- Construction: general contractors/contractors for specific building elements ensuring correct installation
- Installation: Heating, ventilation, and air conditioning (HVAC) professionals ensuring correct installation
- Occupation, building exploitation
  - Occupant behaviour
  - Facility management of buildings/apartments
  - Data monitoring and feedback loops towards occupants and facility managers.

As IAQ depends on decisions taken by different actors across the lifecycle of buildings, regulators and public authorities need to steer these actors with different instruments, ranging from voluntary guidance to obligations laid down in regulations and administrative acts. The main actors from a legislative point of view are national and regional authorities who could

Commented [A12]: This wording should be clarified.

Commented [A13]: We propose to substitute this wording with "centralised mechanical ventilation systems". Moreover, the example given (ventilation hood) is not very representative.

Commented [A14]: A clear reference to mechanical ventilation systems should be made.

Commented [A15]: What is ment by cleaning?

Commented [A16]: This is essential.

set requirements in design, installations and the selection of products, and authorities that are charged with enforcing them.

Some EU Member States, such as France, Portugal, Finland, Austria, Belgium, Germany, the Netherlands, and Lithuania, have started, through a series of actions, to adopt specific IAQ related policies, guidelines, and reference values. In some cases these were enforced in the legislative acts of these countries, including:

- definition and imposition of reference concentration values on selected pollutants, in line with those developed by the World Health Organisation for some time;
- national plans on IAQ;
- legislative acts for indoor environments;
- setting up and planning mandatory indoor air quality monitoring activities;
- training and information programs dedicated to technical experts, occupants and facility managers on IAQ issues;
- protocols and guides for IAQ self-diagnostic and self-management activities based on scientific knowledge and practical experience on indoor air quality.

In general, regulators and authorities are either focusing on minimum air flow/exchange requirements (including setting requirements for distances between air intakes and air exhausts) or on "source control", by setting requirements on the emission (or the content) of harmful substances from construction products. This has resulted in national lists of substances for which Member States have defined threshold limits for content or emissions. Comparison, however, is difficult at the level of architects, engineers, and contractors becausethe lists differ in their range of substances. In addition, the current approach allows only for a "pass or fail" of individual products and not for regulating and thereby limiting their *combined* impact in the final installation. It also assigns the responsibility of maintenance (e.g., cleaning), the selection of low-emitting furniture and other equipment either to professional facility managers or to the individual occupants. Depending on the country, information about individual products could be available about items ranging from construction products to furniture, home and office equipment and detergents used by professional cleaning services. Less is known about the effects of combining different substances emitted from different products.

Therefore, regional, and national **building codes** can – and should - play a major role in defining:

- buildings and spaces within buildings that need specific protection levels due to the higher risks for certain groups of occupants and users (e.g., hospitals and other medical facilities, schools, sports facilities, homes for elderly people), as well as the definition of low-risk buildings and spaces within them, such as storage buildings and spaces, to allow construction professionals and building owners to focus their resources based on specific risk scenarios
- the location of certain types of indoor spaces in the building with regards to sources of air pollution, and ways to protect relevant indoor spaces from air pollutant sources

Commented [A17]: It should be both. Not one or the other as the two are needed.

Commented [A18]: This would be very difficult to achieve through window airing.

- buffer zones between inside and outside that can help reduce the contribution of ambient air pollution to indoor air pollution
- easy access to installations for maintenance and replacement
- sufficient natural ventilation or ventilation systems (which could also help to tackle summertime overheating as well as air circulation and humidity levels)
- information requirements for occupants/users to allow them to easily manage systems that improve IAQ (how to operate heating, ventilation and air conditioning (HVAC) systems), with a view to ensuring both sufficient ventilation and high energy efficiency
- requirements for quality and quantity of information and/or minimum performance levels on design, materials/products used during all life cycle stages and (technical) installations, respected over the whole lifecycle of the building (e.g. reducing the complexity of long lists of chemicals by introducing classes as a reporting format)

Most of these measures are aiming at aspects in design, construction, renovation, and maintenance which – to be effective - are at a level of detail which cannot be sufficiently covered at the EU level. Addressing them at national or regional level would allow for more precise measures, adapting to geographical, climatic, cultural, and economic specificities as well as to the characteristics of the national/regional building.

To support these measures, the European Commission provides supporting regulatory, administrative, and technical instruments for Member State authorities, professionals, and occupants. The Commission also initiates EU policies that improve determining factors of indoor air quality, such as product standards, energy efficiency requirements for buildings and related products, and ambient air quality standards.

4. How is the European Commission contributing to good indoor air quality?

4.1. Policies – streamlining goals at EU and national level

The European Commission has proposed several strategies and action plans related to buildings that can have direct or indirect effects indoor air quality:

- Renovation Wave Strategy
  The **Renovation Wave**[5] aims to at least double the annual rate of building renovation in the EU. In practice, this would result in 35 million buildings being renovated by 2030. For the achievement of this ambition, a mix of policy instruments, funding and technical assistance is available. Delivering on these goals stands for an opportunity tomodernize the operation, human capital, and technological basis of the construction ecosystem as well as the health-related performance of the EU building stock.
- As another policy supporting renovation of buildings, the **EU Climate Adaptation Strategy**[6], sets out how the EU can adapt to the unavoidable impacts of climate change and become climate neutral and resilient by 2050. Extreme weather and climatic events can damage buildings and hamper their mitigation potential. Buildings

[5] A Renovation Wave for Europe - greening our buildings, creating jobs, improving lives', COM (2020) 662 final
[6] COM (2021) - EU Climate Adaptation Strategy

Commented [A19]: This cannot guarantee sufficient nor controlled airflows. This is either detrimental to IAQ in the first case or to the heating and cooling needs of buildings in the second case.

Commented [A20]: Again, the contribution of occupants should not be overestimated.

Commented [A21]: For this, it is essential that the IAQ requirements for existing buildings are set by member states as asked by the revised EPBD.

can contribute to large scale adaptation, for example through local water retention, and mitigation of the urban heat island effect with green roofs and walls. The Strategy announces that the Commission will explore options to better predict climate-induced stress on buildings and to integrate climate resilience considerations into the construction and renovation of buildings through relevant pieces of EU policy.

- The **New Circular Economy Action Plan (CEAP)**[7] proposes actions along the entire life cycle of products. It targets how products are designed, promotes circular and clean economy processes, encourages sustainable consumption, and announces a review of EU waste legislation with a focus on waste prevention. Additionally, the resources used should be kept in the EU economy for as long as possible. The CEAP focuses on the sectors with greatest potential for circularity, including construction and buildings.
- The vision of the **Zero Pollution Action Plan**[8] for 2050 is for air, water, and soil pollution to be reduced to levels no longer considered harmful to health and natural ecosystems, that respect the boundaries with which our planet can cope, therebycreating a toxic-free environment. It thus complements the drive for decarbonisation by addressing pollution. The plan also addresses healthy indoor environments, including temperature and humidity levels in buildings, as well as tackling the issue ofavoidance and decontamination of toxic substances.
- The **Chemicals Strategy for Sustainability** aims to better protect citizens and the environment, and boost innovation for safe and sustainable chemicals, including in construction where chemicals are omnipresent.
- The **Pact for Skills for the construction sector**[9], presented in February 2022, aims at upskilling and reskilling of workers in the construction ecosystem. An important part includes improving the digital skills of active and entering construction workers,which also contributes to the availability of workers in the highly digitized Heating, ventilation, and air conditioning (HVAC) sector[10]

4.2. Regulatory instruments (obligatory or voluntary) – to improve comparability of monitoring and reporting

Several pieces of EU legislation are covering specific elements of IAQ:

- According to the revised **Energy Performance of Buildings Directive** (COM(2021) 802 final - EPBD) Member States will retain the competence for regulating indoor environmental quality, and they will need to define the indoor conditions to be maintained in buildings in order to ensure healthy conditions. The revised EPBD supports high indoor environmental standards by requiring that new non-residential zero-emission buildings are equipped with measuring and control devices for monitoring and regulating indoor air quality. This is also the case for buildings undergoing major renovations, where technically and economically feasible.

[7] COM (2020) 98 final EUR-Lex - 52020DC0098 - EN - EUR-Lex (europa.eu)
[8] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2020%3A98%3AFIN
[9] https://ec.europa.eu/social/main.jsp?langId=en&catId=89&newsId=10160&furtherNews=yes
[10] https://constructionblueprint.eu/wp-content/uploads /2020/12/D3.-StatusQuo-Report-on-Sectoral-Skills.pdf

Field Code Changed
Field Code Changed

These devices will monitor and regulate the operation of the building's technical building systems to ensure that they operate optimally and provide the required indoor environmental quality conditions, while maintaining high efficiency levels.

The energy performance certificates and smart readiness indicator will provide visibility to the buildings that have control and monitoring systems for indoor environmental quality installed. The EPBD also requires MS to set up regular inspection schemes, which cover the inspection of the ventilation systems.

- The **Ecodesign Directive** (2009/125/EC – ED) and Energy Labelling Regulation((EU) 2017/1369 – EL)[11] regulates many heating and cooling products by setting mandatory energy efficiency and other environmental requirements to be fulfilled when placing those products on the EU market, such as air pollutant emissions from space heaters and boilers[12].
- The Commission proposal for an **Ecodesign Regulation of Sustainable Products**[13] revises the Ecodesign Directive to expand its scope of almost all non-food products and to reinforce the type of requirements set on products in relation to their durability, reparability, recyclability, recycled content, presence of substance of concern.
- The **Construction Products Regulation** (COM(2022) 144 final - CPR)[14] is alsounder revision. Already under the current regulation emissions (or content) of harmful substances can be declared. Harmonised assessment methods have been developed as European standards and European technical specifications.
  The focus on "source control" by Member States has resulted in different national lists on relevant Volatile Organic Compounds (VOC). To create a more common and simplified reporting format which could be used by all professionals and common citizens, the Commission is preparing a proposal for two specific VOC classes (EU-LCI values and formaldehyde emissions);
- The **Registration, Evaluation, Authorisation and Restriction of Chemicals** (1907/2006/ECD - REACH)[15] is setting specific limitations on substances. While this law is in general not aiming at products, in specific cases the restrictions of specific substances are linked explicitly to the content in defined (construction) products.
- **Green Public Procurement criteria** for furniture[16] and paints[17] also include requirements for the reduced emissions of Volatile Organic Compounds (VOCs) from

Commented [A22]: The monitoring and regulation of IAQ is more effciently done at the level of the ventilation systems which have a long experience in this field. Here, the technological approach should at least be neutral.

Commented [A23]: This should be "indoor **air** quality", not "environmental".

Commented [A24]: A text was under preparation 18 months ago. Has it been published?

[11] https://single-market-economy.ec.europa.eu/single-market/european-standards/harmonised-standards/ecodesign_en
[12] For example, Commission Regulation (EU) 2016/2281 implementing Directive 2009/125/EC on ecodesign requirements for air heating products, cooling products, high temperature process chillers and fan coil units include requirements limiting the emissions of nitrogen oxides of these appliances.
[13] COM(2022) 142/2
[14] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32011R0305&from=EN
[15] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32006R1907R(01)&from=EN
[16] SWD(2017) 283 final/2
[17] SWD(2017) 484 final

these products. Green Public Procurement criteria for office building design, construction and management also address indoor air quality[18][19].

- **EU Ecolabel criteria**[20], among several requirements aiming to award the best products on the market from an environmental point of view, fix stringent limits to the presence of harmful chemicals (Volatile Organic Compounds and Semi-Volatile Organic Compounds – VOC and SVOC) for a wide range of products (including paints, furniture, or detergents)[21].
- The **Ambient Air Quality Directives** (2008/50/EC and 2004/107/EC) set EU standards for the concentration of key pollutants in ambient air. As part of the European Green Deal and the zero-pollution ambition, the Commission has publisheda proposal to revise the Ambient Air Quality Directives. This includes aligning the EUambient air quality standards more closely with WHO recommendations. Since ambient air is the primary source for ventilation, this can also help improve indoor air quality.[22]
- The Directive on **Workplace** (89/654/EEC) lays down minimum safety and health requirements for the workplace, such as the maintenance of ventilation systems of enclosed workplace specified in Annexes I and II and the removal of deposits and dirt that could create an immediate danger to the health of workers by polluting the atmosphere.
- **Tobacco control measures and actions to reduce Environmental tobacco smoke (ETS)**

  Tobacco consumption and Environmental tobacco smoke (ETS) are major contributors to indoor air pollution with a negative impact on health.

  In 2009, on proposal of the Commission, the Council issued Recommendation 2009/C 296/02 on smoke-free environments. It advised the Member States to provide protection from tobacco smoke in indoor workplaces, indoor public places, public transport and, as appropriate, other public places.

  In line with Europe's Beating Cancer Plan, by 2023, the Commission will propose to update the Council Recommendation on Smoke-Free Environments both extending its coverage to emerging products, such as e-cigarettes and heated tobacco products (HTPs), and generically covering outdoor and quasi-outdoor spaces in the definition of smoke-free environments.

4.3. Databases & technical instruments/guidance – facilitating the exchange of expertise

Over the last decades, the availability of data about the design of buildings and their performance has significantly increased. While such information gathering requires an investment of time at the first design and construction phase, it can provide very useful

[18] SWD(2016) 180 final
[19] https://ec.europa.eu/ecat/
[20] https://environment.ec.europa.eu/topics/circular-economy/eu-ecolabel-home/product-groups-and-criteria_en
[21] https://data.europa.eu/data/datasets/eu-ecolabel-products?locale=en
[22] https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12677-Air-quality-revision-of-EU-rules_en

information for any follow-up activities like maintenance, refurbishment, renovation, and demolition.

There are already many different types of software on the market that allow easy calculations and simulations for IAQ and energy efficiency. Since energy efficiency and indoor air quality are linked to each other when assessing the building's overall performance, different design solutions and different choices of building materials can influence the outcome for both targets.

The Commission is supporting the development of several overarching systems to combine the needs of different stakeholders as well as all phases of the lifecycle of buildings. The aim is to avoid additional burden of different data collection requirements and the lack of data comparability.

- The Commission is running multiple initiatives aimed at a higher uptake of **Building Information Modelling (BIM)** in construction projects. Examples are the co- operation with the EU BIM Task Group[23], and initiatives for awareness raising and upskilling of workers. Increased use of BIM ensures that the digital framework is in place for monitoring systems during the operational phase, which can optimize indoor air quality.
- The Commission is working towards a template for a **European Digital Building Logbook**. Logbooks serve as registries and/or gateways of all building related data, including data on material use, performance of products and techniques as well as interventions made in during the lifecycle. The digitalisation and centralisation of allthis information will allow to better estimate the performance of a building in terms of indoor air quality, and to take more informed decisions across the entire life of a building e.g. on renovation, maintenance or demolition.
- The revision of the **Energy Performance of Buildings Directive** includes the introduction of databases for the energy performance of buildings, which shall allow data to be gathered from all relevant sources related to energy performance certificates, inspections, the renovation passport, the smart readiness indicator and the calculated or metered energy consumption of the buildings covered. Some of these might also contain, amongst other, information on IEQ (e.g. recommendation forimprovement, information on the presence of sensors and controls of IEQ)
- Design for sustainable buildings – **Level(s)**[24]:
    - Level(s) is a scheme for calculating the performance of buildings based on six "macro-objectives" - one of them with the indicator "indoor air quality" which focusses on air exchange in design, construction, and operation.
    - As technical support, the Commission has developed the "Calculation and Assessment Tool (CAT)" to help you create Level(s) assessments for building projects during the different phases of building design, construction and maintenance or de-construction.
- Technical specifications at EU level:
    - The first steps were already taken mandating to CEN the development of assessment tools for emissions and content of dangerous substances from/in

Commented [A25]: Information on the monitoring of IAQ and ventilation systems should be consolidated at the European level and made available in the Building Stock Observatory framework.

[23] http://www.eubim.eu/
[24] https://environment.ec.europa.eu/topics/circular-economy/levels_en

construction products into indoor air (mandate M/366). A set of standards and technical reports has been developed. To allow the conversion from product performance data to indoor air concentration, the concept of a "referenceroom" has been developed within this set of technical specifications. Compared to other international standards, the CEN standards have undergone a stricter robustness testing to ensure comparable results of assessments by notified bodies under the CPR. They will be introduced in harmonised product standards under the framework of the Construction Products Regulation (305/2011/EU). The **assessment methods** are also used in EC policy projects like Level(s)[25].

  - To facilitate the conversion from emissions to indoor air concentrations in the room, a "reference room" was defined by this standardisation work. In addition, standards for the measurement of radiations from construction products are right now in their last phase of their development (finalisation foreseen for late 2023).
  - The recommended average air exchange rates are detailed in the European technical standard EN 16798-1.

- Information Platform for **Chemical Monitoring (IPCHEM)**[26] is the reference access point for discovering chemical monitoring data collections which are managed by and are available to the EC bodies, MS, international and national organisations, and research communities. It has four thematic modules, one of which is on "Products and Indoor Air Monitoring Data". It supports:
  - policy makers and scientists to discover and access chemical monitoring data on existing, new, emerging and less-investigated chemicals covering a range of matrices and media;
  - the hosting data currently not readily accessible (e.g. outcomes of research projects, off-line stored monitoring data, etc.) that will be searchable and accessible through the platform;
  - providing chemical monitoring data and information of defined quality interms of spatial, temporal, methodological and metrological traceability.
- Based on the **ECA report No 29** "Harmonisation framework for health-based evaluation of indoor emissions from construction products in the European Union using the EU-LCI concept", the Commission and national experts have been developing a detailed protocol for producing a list of compounds and their "Lowest Concentrations of Interest" as maximum level of the concentration of specific substances (EU-LCI values)[27]. It comprises four main sections: a) general information,
  b) toxicological database (values derived from the data collection process), c) assessment factors, and d) the derivation of the EU-LCI value. At the end of the factsheet the rationale for the derivation of the EU-LCI is given[28].

[25] https://environment.ec.europa.eu/topics/circular-economy/levels_en
[26] https://ipchem.jrc.ec.europa.eu
[27] https://single-market-economy.ec.europa.eu/sectors/construction/eu-lci-subgroup/about_en
[28] https://single-market-economy.ec.europa.eu/sectors/construction/eu-lci-subgroup/eu-lci-values_en

- The EU funded **HEALTHVENT project**[29] developed a framework for health-based ventilation guidelines for public and residential buildings in Europe and assessed the consequences of implementing these guidelines, bearing in mind future trends in the built environment, including energy efficiency and environmental sustainability issues. These guidelines are based on two fundamental prerequisites: (1) The airindoors must fulfil the requirements of the air quality (AQ) guidelines defined by the World Health Organization (WHO, 2010; WHO; 2005); and (2) The priority is givento source control as the strategy for controlling indoor air quality and reducing the health risks associated with indoor exposures. Ventilation is only used as a supplementary strategy to control exposure in support to the source control strategy.

Commented [A26]: WHO 2022 to be added

Commented [A27]: Ventilation is needed in all buildings as some of the pollutant concentrations cannot be kept low enough without it. The HEALTHVENT project clearly recommends the establishment on the European level of adequate ventilation rates: "This clearly suggests that Europe needs a common regulation on ventilation rates, which would harmonize calculation practice among countries and ensure that the required ventilation rates are among others not only comfort but also health based, which is not the case in many of the existing regulations". It is to be noted that some pollutant sources are directly linked to the presence of people in buildings and cannot be controlled at the source.

Again, the national/regional building regulations will play a major role in setting the framework of the quantity and quality of data needed. In particular, they might influence the preciseness of these tools if and when they are including regional climatic conditions, the availability of materials and products and the possibilities to use, reuse or recycle them.

4.4. Supporting studies & research work – improving quality and quantity of background information

To set useful regulatory requirements and to develop useful supporting technical instruments, robust data on specific physical and chemical effects are essential. In recent years the Commission has carried out coordinating and supporting research work. In the framework programme Horizon Europe seven projects have been selected for “indoor air quality and health“ with an EU contribution of close to 55€M. These projects involve participants from more than 25 countries and 100 research groups. The projects have formed a cluster (IDEAL CLUSTER) which was kicked off in October 2022. This cluster is organised in different working groups to harmonise collection of data and facilitate communication of results to policy makers, building professionals and the wider public.

IDEAL Cluster: 7 Horizon Europe projects on indoor air quality and health
INCHILDHEALTH: Identifying determinants for indoor air quality and their health impact in environments for children: measures to improve indoor air quality and reduce disease burdens
SynAir-G: Disrupting noxious synergies of indoor air pollutants and their impact in childhood health and wellbeing, using advanced intelligent multisensing and green interventions
K-HEALTHinAIR: Knowledge for improving indoor air quality and health
INQUIRE: Identification of chemical and biological determinants, their sources, and strategies to promote healthier homes in Europe
LEARN: Development of novel assessments for indoor air quality monitoring and impact on children’s health
TwinAIR: Digital twins enabled indoor air quality management for healthy living
EDIAQI: Evidence driven indoor air quality improvement

In addition,

[29] ECA (European Collaborative Action “Urban Air, Indoor Environment and Human Exposure“). Report no. 30. Framework for health-based ventilation guidelines in Europe. European Commission. Joint Research Centre. EUR 27640 EN (2015)

- the Commission has been supporting the creation and the work of the EU-LCI group with experts from Member States authorities and industry experts (see: 4.3.).
- some of the projects from the European Human Exposome Network (e.g. LongITools - Exposome application LongITools) and the Urban Health Cluster are monitoring indoor air quality.

The Commission also leads the Horizon Europe Co-programmed European Partnership on People-centric sustainable built environment (Built4People). This partnership addresses, among other aspects, healthier indoor and outdoor environments (in terms of air quality, safety, and comfort).

5. Conclusion

Achieving high levels of indoor air quality depends on several decisive factors at the building level. National and regional regulation are relevant instruments to increase the efficiency of these factors. Steps in that direction have already been taken by several Member States and provide examples of targeted approaches.

At EU level, the Commission has developed several instruments and is continuously adding supportive elements for these national approaches. The main EU contributions were made

- in research, which allows for a better and scientifically well-founded identification of indoor pollutants and their potential risks. The function of the Commission as coordinator has facilitated the exchange of expertise and a higher level of cooperation between experts of different Member States.
- At the same time, standardisation at EU level, initiated by the Commission, has been using this expertise and has developed assessment methods for construction products. They will provide important information for their users and increase the reliability of the declared performance for CE marked products.

By creating a common understanding of risks and a common technical “language” introduced by EU technical specifications, European authorities, professionals, but also the general public are in a better position to exchange experience and best practice even beyond their national borders. These two main fields, supported by the other policies, as well as the regulatory and technical instruments described above, are a solid basis for Member States to introduce measures in their national building regulations to increase the protection of their citizens.

Therefore, the Commission services encourage Member State authorities as well as professionals in the construction sector and researchers to use these instruments and topromote further exchange of experiences with their peers in other Member States of the EU.

Commented [A28]: How could EVIA be involved?

Commented [A29]: The conclusion should mention the key role of sufficient but controlled air renewal, independently from the occupants’ action, to maintain a good IAQ in buildings while limiting energy losses to what is strictly necessary to do so.

Annex I: EU policies, regulations, and scientific/technical support activities (by Directorate-Generals)

Definition IAQ	Specific IAQ target	Life Cycle stage	(Proposed) actions	Target groups	Voluntary/ mandatory	Implementing authorities	Target dates	Comments/Links
CPR (current version) (DG GROW)								
- Defined by national building codes (potentially: EU-LCI values) - Emission limits/ content limits of dangerous substances from/in construction products	Limit of emissions of VOCs in EU-LCI list (and other EU/MS regulations)	- Manufacturing product - use phase of building	- Assessment methods developed in CEN for harmonised European standards for construction products (Delegated act establishing EU-LCI list as mandatory) - Assessment method and declaration of performance in product standards	- Manufacturers - Notified Bodies - Retailers - Market surveillance -Building control - Designers/architects	- Assessment method mandatory; - Which substances to declare remains voluntary – based on requirements at MS level;	- implementing authority: market surveillance - building control authorities could use the provided information	- assessment standards available - first product standards should be available in 2024/2025	https://single-market-economy.ec.europa.eu/sectors/construction/construction-products-regulation-cpr_en CEN/CENELEC database
EU-LCI values (DG GROW)								
Defined in ECA report No 29	Maximum concentration of specific substances in IA	Use phase of building	Voluntary group of experts (subgroup of the Advisory Group)	- Building/health authorities - manufacturers	Use of EU-LCI values voluntary	- national/regional regulators could use the limit values for setting regulatory requirements to be enforced by building control	- list available	https://single-market-economy.ec.europa.eu/sectors/construction/eu-lci-subgroup/eu-lci-values_en
Building logbook (DG GROW)								
Non specific definition	None	All life cycle stages	None	- owner - authorities - construction professionals - finance institutions - facility managers	Voluntary at EU level (MS can decide individually)	- national/regional regulators	Proposal & guidelines should be available in Q4/2023	Not yet
Guideline IAQ (not yet published)								

Commented [A30]: How can EVIA be involved?

Integrated with comments from the European Ventilation Industry Association (EVIA)

Definition IAQ	Specific IAQ target	Life Cycle stage	(Proposed) actions	Target groups	Voluntary/ mandatory	Implementing authorities	Target dates	Comments/Links
Defined in ECA report No 29	*Provide technical solutions for all actors*	*All Life Cycle stages*	*Publication?*	*designers/architects* *- contractors* *- building control* *- facility managers* *- occupants*	*voluntary*	*none*	*???*	*none*
REACH (DG GROW/ENV)								
No specific definition but health related limit values	None	- Manufacturing	Listing of substances in annex XVII	- manufacturers - health authorities	mandatory	- ???	Annex XVII in force	https://single-market-economy.ec.europa.eu/sectors/chemicals/reach_en
IDEAL Cluster (DG RTD)								
Effect of synergy of chemical and biological (allergens, viruses) pollutants on health outcomes (general, respiratory, mental); Indoor air quality is defined by the depiction of concentrations of pollutants and thermal conditions that may negatively affect the health, comfort, and	Assessment of synergies Measurements of key pollutants, NO, NO2, CO, CO2, VOC, Microplastics, PAHs, PM and Ultrafine Particles (UFP). Indoor hazardous chemical and biological determinants not yet covered by	School/child care operation; Operation Phase of Buildings, Vehicular mobility Households Hospitals	Real time detection of synergistic health effects; Mitigation interventions; Contribute to the EC Open Research Data pilot by encouraging sound data management through the project lifecycle and beyond, by following the ethical and security standards. Identification/prioritization of indoor hazardous determinants not yet covered by IAQ standards and regulations – based	- School students; - Health care professionals; -Workers; -Passengers/drivers; -Infants and young children (homes and child-care). -Elderly, -High-risk out patients; -Pregnant women.		-Ministries of Education; - Ministries of Health; - Consumer protection entities and patient associations; - Building constructors & maintenance management; -Manufacturers and producers; -Technical Standardization Committees - Chemical managers.	2025-2028	IDEAL CLUSTER Inchildhealth Synair-G KHealthInAir learnproject TwinAIR INQUIRE EDIAQI

Definition IAQ	Specific IAQ target	Life Cycle stage	(Proposed) actions	Target groups	Voluntary/ mandatory	Implementing authorities	Target dates	Comments/Links
performance of a building's occupants. The determinants of IAQ are more numerous and complex than current IAQ guideline parameters.	IAQ standards and regulations Genetic sequencing of indoor microbiome Develop and deploy novel technologies to improve indoor environment		on broad screening and toxicological effect analyses Identification/mapping of sources Investigate filtration An Integrated Risk Assessment Tool, targeted for researchers, policy					
Workplace requirements (Directive 89/654/EEC) (DG EMPL)								
General reference to the need for sufficient fresh air in enclosed workplaces and indication that if a forced ventilation system is used, it shall be maintained in working order.	None	All the time at the workplace	Work on a possible update of the Directive is ongoing	- national authorities - employers - workers	Mandatory	- national/regional enforcement authorities	tbd	https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:31989L0654
Tobacco free environment (DG SANTE)								
Tobacco free generation	less than 5% of the population uses tobacco by 2040, compared to around 25% today.	All Life Cycle stages	update the Council Recommendation on Smoke-Free Environments (2009/C 296/02)	The scope of the existing Council Recommendation will be extended to outdoor spaces and emerging products, such as Heated Tobacco	Use and uptake of the provisions in the Council Recommendation remains voluntary for Member	National/ regional competent authorities to introduce relevant bans in relevant locations (indoor/ outdoor)	2023	https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/13333-Smoke-free-environments-updated-recommendation_en https://ec.europa.eu/newsroom/sante/items/730225/en

Commented [A31]: What kind of technologies?

Commented [A32]: How can EVIA be involved?

Definition IAQ	Specific IAQ target	Life Cycle stage	(Proposed) actions	Target groups	Voluntary/ mandatory	Implementing authorities	Target dates	Comments/Links
				Products and e-cigarettes	States			
Ambient (outdoor) air (DG ENV)								
EU standards for **ambient** (outdoor) air	Ensure quality of ambient (outdoor) air (which is a main source of air for ventilation)	N.a.	Revision of Ambient Air Quality Directives (2008/50/EC and 2004/107/EC), including to align EU ambient air quality standards more closely with WHO recommendations	Member States competent authorities (for ambient air quality management)	Mandatory	Member States public authorities	Commission proposal published on 26 October 2022	Have your Say portal: https://europa.eu/!JJuV4N