Conference

First WHO Europe Conference on Indoor Air Quality

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Geneva Health Forum

World Health Organization
European Region

Authors and Acknowledgements

The First WHO Europe Conference on Indoor Air Quality was jointly organized by:

- Antoine Flahault, Director of the Institute of Global Health, Faculty of Medicine, University of Geneva, Switzerland
- Hans Kluge, World Health Organization Regional Director for Europe, Denmark
- Catherine Noakes, Professor of Environmental Engineering for Buildings, University of Leeds, United Kingdom
- David Vernez, Head of Department of Occupational and Environmental Health, Center for Primary Care and Public Health (Unisanté), University of Lausanne, Switzerland

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- Esther Friedli, Member of the Council of States, Democratic Union of the Center, Switzerland
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Executive summary

On September 20, 2023, the Geneva Health Forum, in collaboration with WHO Europe, held a conference in Bern aimed at drawing the attention of Swiss policymakers to indoor air quality, which is a major public health issue, exacerbated by the fact that we spend approximately 80% of our time indoors. Beyond the transmission of COVID-19, it was emphasized that the air we breathe at home, at school, at work, or in public places has a direct impact on our health, well-being, and public finances.

Scientific session

The first session featured several experts who presented an overview of current scientific knowledge on IAQ:

David Vernez discussed the scientific dimensions of IAQ, including pollutant sources, health impacts, and epidemiological findings. He emphasized the prevalence of indoor pollutants originating from outdoor air, human activities, and building-related factors. David Vernez underscored the need for comprehensive IAQ standards, pollution control measures, and economic arguments to support investments in improving IAQ.

Pawel Wargocki expanded on the health and well-being implications of IAQ in buildings. He outlined the economic costs of poor IAQ and proposed pragmatic strategies for improvement, such as enhanced ventilation standards and pollution controls. Wargocki advocated for a shift toward healthier building objectives aligned with sustainability principles.

Corinne Mandin provided an overview of IAQ across different settings—homes, schools, and offices. She discussed the various sources of indoor pollutants and the challenges of maintaining adequate IAQ. Her presentation highlighted the need for ongoing research and monitoring to identify high-risk pollutants and evaluate intervention effectiveness.

Hossein Gorji presented the findings of an observational study examining the relationship between IAQ and infection risk in schools during the COVID-19 pandemic. The study identified a significant correlation between classroom CO_2 levels and the likelihood of outbreaks, reinforcing the importance of IAQ management in infection control.

Andreas Prenner presented EU initiatives and funding opportunities for pandemic preparedness through pathogen transmission control in buildings. He outlined HERA's mission to enhance the EU's resilience to health emergencies and emphasized the role of technological foresight projects in identifying innovative indoor air quality solutions.

Key notes

The second session featured keynote addresses from political leaders:

Hans Kluge, WHO Regional Director for Europe, emphasized the substantial impact of poor IAQ on public health, especially within the European region. He called for evidence-based policymaking, global guidelines, and practical measures, noting lessons learned from the

COVID-19 pandemic—particularly the importance of ventilation.

Ambassador Nora Kronig highlighted the crucial role of IAQ in combatting respiratory diseases and improving public health. She stressed the importance of cross-sectoral collaboration and described Switzerland's commitment to mitigating environmental health risks, including the transformation of public buildings into healthier environments.

Sir Jeremy Farrar, WHO Chief Scientist, discussed the broad impact of air quality on human health beyond airborne pathogen transmission. He emphasized the need for interdisciplinary collaboration, empirical research, and recognition of air as a shared public good, stressing the importance of a unified language and collective effort.

Franck Vandenbroucke, Belgium's Federal Minister of Social Affairs and Public Health, proposed a structural national approach to systematically address IAQ. He referenced recent legislative progress defining baseline IAQ standards, support for research, and the role of certification in ensuring transparency and public trust.

From science to policy

The third session featured presentations on translating scientific evidence into political action:

Catherine Noakes delivered a comprehensive analysis of IAQ, addressing its complex relationship with regulation, building materials, climate, and human behavior. She provided empirical evidence and policy recommendations, emphasizing the need for proactive IAQ improvement strategies.

Roger Waeber shared insights on ventilation strategies to improve IAQ, underlining the importance of effective air exchange in reducing indoor pollutant concentrations. He stressed informed policymaking and preventive action to ensure healthy environments.

Jelle Laverge outlined Belgium's systematic approach to IAQ, focusing on informed consent, transparency, and certification. He presented a framework integrating monitoring, risk assessment, and regulatory compliance to improve IAQ in public buildings.

Claude-Alain Roulet presented Swiss priorities for IAQ improvement, emphasizing the critical role of ventilation systems and regulatory compliance. He stressed the need for effective communication, technical expertise, and strategic planning to optimize IAQ management.

Round table

The fourth session, moderated by Kamran Abbasi, Editor-in-Chief of The BMJ, gathered three members of the Swiss Parliament (Esther Friedli, Gabriela Suter, Martin Bäumle), along with Catherine Noakes and David Vernez. The discussion focused on balancing risks, managing change, and overcoming barriers to implementing effective IAQ policies.

Esther Friedli emphasized the pandemic's role in raising IAQ awareness and advocated for education and training for building owners.
Gabriela Suter called for national-level regulation to reduce cantonal disparities.
Martin Bäumle promoted compatibility between climate goals and IAQ, supporting industry-led initiatives and flexible reference values.

Catherine Noakes highlighted opportunities to integrate IAQ improvements with climate mitigation strategies, calling for tailored solutions.
David Vernez emphasized the influence of building occupants on IAQ, particularly in rented spaces, and stressed the importance of public awareness.

A debate followed regarding regulation. While Gabriela Suter advocated for national laws or mandatory air filtration in classrooms, Martin Bäumle favored voluntary industry initiatives. Catherine Noakes stressed the need for comprehensive solutions, and David Vernez reiterated the role of public engagement.

The panel concluded with a shared acknowledgment of the need for awareness, individual responsibility, and robust data collection to address IAQ challenges. Their diverse perspectives underscored the necessity of collaborative, multidisciplinary approaches.

Conclusion

The conference underscored the strong interconnection between indoor air quality, public health, environmental sustainability, and societal development. It called for collaboration across disciplines, evidence-based policymaking, and practical, scalable solutions to effectively tackle IAQ challenges at both national and international levels.

Introduction

On September 20, 2023, the Geneva Health Forum, in collaboration with WHO Europe, organized a conference in Bern aimed at drawing the attention of Swiss policymakers to indoor air quality, a major public health issue, exacerbated by the fact that we spend approximately 80% of our time indoors.

The analysis of indoor air quality is based on three complementary and interconnected axes. First, scientific studies have clearly demonstrated that pollutants present in buildings have a negative impact on respiratory, cardiovascular, and neurological health.

Second, it is necessary to develop a structured regulatory framework, both nationally and internationally. This system must be based on solid technical references, accompanied by transparent certification procedures and regular monitoring. For this framework to be truly effective, it is essential to mobilize all stakeholders (public institutions, building owners, scientific experts, the private sector, and citizens).

Finally, concrete actions must be developed. A multidisciplinary approach combining health, climate, engineering, and behavior is therefore necessary. Awareness, training, and civic responsibility are essential levers for creating healthy and sustainable indoor spaces.

These three axes (science, governance, and action) form a coherent continuum. They allow public policies to be based on evidence, solid regulatory frameworks to be structured, and society's key forces to be mobilized to achieve sustainable indoor air quality, with positive impacts on health, the economy, and the environment.

This conference is the first in a series of conferences that will aim to advocate for indoor air quality to be as high a priority as drinking water and to become a universal standard to protect public health.

Indoor environment as a determinant for health

David Vernez
Head of Department of Occupational and Environmental Health, Center for Primary Care and Public Health (Unisanté), University of Lausanne, Switzerland

David Vernez began by emphasizing the crucial importance of indoor spaces, which constitute our primary living environment. He pointed out that in industrialized countries, individuals spend up to 90% of their time indoors, whether at home, at work, or in public spaces such as cinemas and shops. The implication was simple: indoor air quality is essential to human health. Paradoxically, the so-called sanctuaries that are homes often harbor more pollutants than outdoor environments, necessitating a more in-depth analysis of the associated health risks.

To better understand the prevalence of indoor pollutants, the presentation distinguished three main categories: outdoor pollutants that enter homes, pollutants linked to human activity in homes, and pollutants associated with the buildings themselves.

- Outdoor pollutants, derived from air pollution, particulate matter, and pollen, enter buildings due to the inherent airtightness of buildings, which allows for natural ventilation. Outdoor pollutants such as radon, a natural gas emanating from certain soils, also contribute to indoor air contamination.
- Human activities, from breathing to the use of cleaning products, generate pollutants, leading to increased humidity and promoting the growth of harmful biological species.
- Persistent indoor air quality problems have been linked to building-related pollutants, including PCBs, lead, volatile organic compounds, formaldehyde, and asbestos. Contrary to popular belief, asbestos remains a concern due to renovations of buildings constructed before its ban in the 1990s.

Three contemporary challenges are exacerbating the situation:

- The progressive insulation of buildings, induced by energy crises, has reduced air exchange rates, concentrating pollutants indoors, a trend exacerbated by contemporary energy considerations.
- Climate change is leading to rising temperatures, which promotes the emergence of certain biological species and increase the emissions of harmful chemicals called volatile organic compounds.
- Viral outbreaks like COVID-19 (COVID-19, etc.) have been identified as factors affecting indoor air quality.

The complexity of understanding the effects of indoor pollutants on health was highlighted. Epidemiological studies were cited, including a 2017 French study by Boulanger et al., which highlighted the health impact of pollutants such as radon, fine particles, and secondhand smoke. The resulting diseases, including lung cancer and cardiovascular problems, showed alarming prevalence rates. Swiss examples, such as the radon risk map and the prevalence of mold, highlighted the universality of indoor air quality problems and their real-world consequences.

The presentation also addressed the role of indoor air quality in the context of superspreader events (choirs, cruise ships, restaurants, etc.), particularly evident during the COVID-19 pandemic. The message converged around a clear message: improving indoor air quality is essential to mitigate these situations and safeguard public health.

This presentation examines in detail the links between indoor air quality and human health. Drawing on scientific data and concrete examples, it helps to better understand the issues related to indoor air pollution.

What do we need to achieve in buildings? What is realistic vs what is ideal?

Pawel Wargocki
Associate Professor, International Center for Indoor Environment and Energy, Technical University of Denmark, Denmark

Pawel Wargocki emphasized the goals, realism, and ideals associated with achieving optimal indoor air quality (IAQ) in buildings. He raised crucial questions about how to set realistic goals.

The critical importance of indoor air was emphasized from the outset, given that individuals spend approximately 85% of their time indoors. In numbers, this corresponds to the inhalation of 10,000 liters of indoor air per day.

Poor indoor air quality (IAQ) leads to:

- a reduced comfort and a reduced quality of life
- an increased prevalence of acute symptoms (headaches, irritations, etc.)
- a decreased work performance and learning capacity
- an increased absenteeism.

Furthermore, new data suggests a negative impact on sleep quality.

Although only 1% of the thousands of chemicals tested are known, a number of hazardous exposures are known:

- Chemical pollutants: CO, NO_2, benzene, formaldehyde, radon, fine particles (PM2.5/PM10), ozone, etc.
- Airborne pathogens (e.g., viruses)

Pawel Wargocki proposed integrating efforts to improve indoor and outdoor air quality, emphasizing the need for a unified approach.

To dispel potential skepticism about the cost of improving indoor air quality, compelling economic arguments were presented. He illustrated the considerable economic losses associated with poor indoor air quality :

- More than 2 million years of healthy life lost in Europe due to poor IAQ.
- An estimated cost of €200 billion/year (EU), comparable to road traffic accidents.
- COVID-19 has caused 30,000 years of healthy life lost in Denmark, partially linked to indoor air.

Pawel Wargocki emphasized the need for comprehensive indoor air quality standards, suggesting that they should not only establish minimum requirements but also take into account various events, including pandemics.

There is a need to better control pollution sources and better regulate the materials and products used in buildings (e.g., emissions labeling).

He advocates monitoring on known pollutants (CO_2, NO_2, PM2.5, formaldéhyde, ozone, radon…).

The presenter discussed the importance of humidity, warning that high humidity levels can lead to condensation and mold risks.

An IAQ rating system must be implemented with tools such as IEQ-Compass or TAIL to inform, compare, improve, and reassure occupants.

In response to the fundamental question of what should realistically be achieved in buildings, a paradigm shift was proposed. He envisioned buildings that are both ecological and healthy, compliant with sustainability principles while promoting health. He encouraged a shift from an approach focused on reducing risks to one focused on creating positive indoor sensations.

In conclusion, Pawel Wargocki reiterated the need to approach clean air with the same uncompromising approach as clean water. He emphasized the need to act on existing data rather than wait for additional evidence. The development of indoor air quality rating systems, ongoing monitoring, and the integration of health promotion elements were highlighted as essential elements for achieving high indoor air quality.

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What do we know about the current state of IAQ in buildings?

Corinne Mandin
Head of the Laboratory of Epidemiology, Institute for Radiation Protection and Nuclear Safety, France

Corinne Mandin presented an in-depth overview of indoor air quality, focusing on homes, schools, and office buildings.

She began by discussing the complex nature of indoor air pollution. A key point was the diversity of pollution sources, from building materials and renovation practices to occupant behavior. Main pollution factors are smoking, outdoor pollution, new furniture, cleaning products, incense. Poor ventilation and humidity could increase the pollutants. Indoor pollution is also correlated with the socioeconomic status of the occupants.

A French study (2003–2005) on 567 homes show a high presence of volatile organic compounds (VOCs) and aldehydes. The most common pollutants: formaldehyde, toluene, benzene, xylenes, etc. This studay showed that indoor air is often more polluted than outdoor air, reflecting a now well-established concern.

Corinne Mandin then discussed the school context and presented the results of the SINPHONIE project, a multicenter study conducted in 337 classrooms in 23 countries. This research revealed that pollutants such as formaldehyde and PM2.5 often exceeded recommended values in schools, despite the absence of activities such as cooking or smoking. Proximity to traffic emerged as a key factor in indoor pollution levels. These observations highlighted the distinct dynamics at work in educational environments and the challenges they pose for maintaining healthy air.

The presentation then moved on to office buildings, where specific factors such as the density of electronic equipment, frequent cleaning, and restricted window ventilation in high-rise buildings come into play. Corinne Mandin drew on the OFFICAIR project, which examined forty buildings across eight European countries, to illustrate the seasonal variability of indoor pollution. These results highlighted the importance of taking seasonal variations into account when making assessments.

OFFICAIR provided a particularly compelling example: replacing scented cleaning products with fragrance-free alternatives significantly reduced aldehyde levels in indoor air. This simple change demonstrated that improving air quality does not always require major investments and that concrete interventions can have measurable effects.

The presentation also explored changes in indoor air quality over time. French and German studies have shown encouraging trends, with decreasing concentrations of certain pollutants. However, Corinne Mandin cautioned against complacency, highlighting the emergence of new sources of pollution linked to changing habits, emerging technologies, and events such as widespread disinfection during the COVID-19 pandemic.

She cited examples such as compact fluorescent lamps, vaping, 3D printing, and the increased use of air fresheners, all contributing to the emergence of new pollutants. The dynamic nature of indoor air pollution—some sources decreasing, others increasing—was well illustrated through quantitative data and observations.

As analytical techniques evolved, Corinne Mandin introduced the concept of non-targeted methods, which allow the detection of unknown or unexpected substances not detected by conventional techniques. This represented a major development in indoor air quality research, expanding the scope of monitoring.

The Norman Project, a European initiative studying emerging substances, was a notable event. An analysis of household dust revealed nearly 2,350 previously unknown compounds. This highlighted how advances in detection are revealing the hidden complexity of indoor air pollution and how technology can help bridge the gap between research and real-world applications.

Corinne Mandin also discussed the impacts of climate change on indoor air quality. A detailed diagram showed how factors such as heat waves, floods, and wildfires can increase levels of mold and fine particles inside buildings. These phenomena, often overlooked in climate discussions, are gaining in importance.

She warned that energy efficiency measures, such as better insulation, can unintentionally degrade indoor air quality if not combined with adequate ventilation. A study of radon levels in over 3,000 French homes highlighted the importance of integrating indoor air quality into energy renovation policies.

In conclusion, Corinne Mandin emphasized that this knowledge is not purely theoretical. It constitutes a toolbox for action, identifying levers for improving air quality, both through understanding and action. Continuous measurement, research, and evaluation of public policies are essential to identify hazardous situations, monitor the effectiveness of solutions, and ensure healthier indoor environments.

Infection risk and IAQ in Swiss schools of canton Grisons

Hossein Gorji
Scientist, Laboratory of multi-scale studies in building physics, Empa, Switzerland

Hossein Gorji presented a collaborative project conducted during the pandemic, in partnership with Alexa Caduff and Ivan Lunati. The initiative, a collaboration between EMPA and the canton of Grisons, Switzerland, aimed to empirically explore potential links between indoor air quality and infection risk in schools through an observational study.

Launched in the context of the Covid-19 pandemic, this study aimed to understand the dynamics of infection risk in schools. This exploration gained importance in the context of the rise in cases attributed to the Delta variant and the emergence of Omicron. Switzerland, faced with a surge in cases and high intensive care unit occupancy rates, highlighted the need for measures to reduce virus transmission. The canton of Grisons responded by launching a repeated screening campaign targeting employees and students, offering free PCR tests every week. Statistical analysis of these data suggests a significant reduction in incidence, prompting consideration of additional measures to further reduce virus transmission.

Recognizing the established link between air renewal and the transmission of respiratory pathogens, attention was focused on schools, considered potential sources of contamination. The idea was to target schools in the canton of Grisons, measure indoor air quality in terms of CO2 concentration, and analyze correlations with infection risk. The study involved 150 classrooms in nearly 60 schools, equipped with two measuring devices per class to detect potential differences between the devices.

The meticulous approach involved rigorous validation processes for the measuring devices. Tests in climate chambers at EMPA ensured their accuracy and response time, in line with the data reported by the sensor manufacturers. Teachers were instructed not to interfere with the devices during the observational study to preserve data integrity. The data collected lasted two months and served as the basis for subsequent epidemiological analysis.

Initial analysis indicated that the majority of classrooms exceeded 2,000 ppm, while the limit recommended by the Federal Office of Public Health was 1,400 ppm.

The results of this study are consistent with those of studies conducted in Switzerland and Italy during the Covid-19 pandemic. A Swiss study conducted by the University of Bern and the Federal Office of Public Health also reported elevated CO2 concentrations in classrooms. Similarly, an Italian study found a more than 70% increase in the risk of infection in naturally ventilated classrooms compared to those with mechanical ventilation.

In conclusion, the study highlights two key messages:

1. Hossein Gorji advocates for extensive, long-term, and large-scale field studies correlating indoor air quality with infections. This requires increased coordination between public health agencies, educational institutions, and research organizations.
2. The study clearly demonstrated that CO2 concentrations in classrooms were often unacceptable. Improvements could be achieved by better regulating natural ventilation, switching to mechanical ventilation, and implementing other viable solutions.

Pandemic management through indoor pathogen transmission suppression. EU innovation funding & technology mapping

Andreas Prenner
Policy Officer at HERA (European Health Emergency Preparedness and Response Authority)

Andreas Prenner presented the mission of the Health Emergency Preparedness and Response Authority (HERA). He also outlined the funding available for innovation aimed at suppressing the transmission of pathogens indoors. He also presented an ongoing mapping project on pandemic response measures.

HERA, created in 2021 in response to the Covid-19 pandemic, aims to strengthen the EU's resilience and response to future health emergencies. HERA's key objectives are:

- Anticipate emerging health threats.
- Promote research and development of medical countermeasures (vaccines, treatments, diagnostics) , including support for CEPI.
- Ensure the supply and distribution of these countermeasures in the event of a crisis.
- Coordinate efforts between EU Member States.

HERA is therefore a central pillar of the European Health Union, aiming to better protect European citizens against future health emergencies. Its budget of €6 billion over six years supports the entire value chain, including research and development, stockpiling, and manufacturing.

Andreas Prenner presented a €65 million Horizon Europe initiative focused on pandemic management through indoor air interventions. The current call for proposals targets the development and commercialization of solutions for aerosol capture, pathogen deactivation, and air circulation management. Targeted at EU-based companies, this program offers grants of up to €2.5 million and equity investments of up to €15 million.

Andreas Prenner presented a technology foresight project led by the European Commission and the Joint Research Centre. This project maps potential interventions to suppress the transmission of indoor pathogens and to detect pathogens in real time. Participants were invited to contribute via an online survey and an upcoming expert workshop, which will contribute to a final report containing EU policy recommendations, national initiatives, and regulatory proposals.

The presentation underscored the EU's commitment to addressing health emergencies through innovation and preparedness.

Q&A with the audience

Michel Tyrene of the WHO praised the clarity of the presentations but expressed concern about the perceived inaccessibility of indoor air quality standards. He suggested that these standards often seem utopian. Michel Tyrene asked how to bridge the gap between desired standards and their practical implementation.

Pawel Wargocki responded by suggesting that fear of consequences could encourage decision-making. He emphasized that existing standards are not overly ambitious and can be implemented. He raised concerns about an ongoing debate within the European Commission regarding the Energy Performance Directive and the potential deletion of Article 11, which emphasizes monitoring indoor air quality in buildings.

David Vernez highlighted the complexity of the indoor air quality issue due to the involvement of various stakeholders and the diversity of building types. He emphasized the need for a collective effort to address the challenges posed.

Pawel Wargocki raised a crucial point regarding the invisibility of indoor air pollution. He noted that, unlike immediate threats such as COVID-19 or SARS-CoV-2, the consequences of exposure to air pollutants are often delayed, making risk perception difficult. He emphasized the importance of visualizing invisible pollution to raise awareness and foster better decision-making.

Kamran Abbasi of the BMJ posed a general question about methodological approaches across disciplines and the challenges of generating, interpreting, and reaching consensus on evidence.

A participant from CERN raised a thought-provoking question regarding the limitations of specifying flow rates in regulatory texts and suggested considering specifying concentrations instead. Corinne Mandin acknowledged the importance of guidelines for concentration and airflow, citing examples of existing guidelines for specific pollutants.

The discussion concluded with questions about the integration of indoor air quality into university curricula and its consideration in architecture and engineering training. The speakers agreed that, despite a high level of training, stricter regulatory frameworks are needed to guide practitioners in the effective implementation of this knowledge.

These presentations and discussions provided valuable insights into the challenges and opportunities in the field of indoor air quality. The need for interdisciplinary collaboration, regulatory improvements, and increased awareness of the invisible risks associated with indoor air pollution emerged as central themes. The panelists emphasized the importance of integrating indoor air quality considerations into broader sustainability and health initiatives to achieve more comprehensive and effective results.

Addressing Indoor Air Quality: A Comprehensive Approach for Public Health

Hans Kluge
World Health Organization Regional Director for Europe, Denmark

Dr. Hans Kluge, World Health Organization (WHO) Regional Director for Europe, emphasized the critical importance of clean indoor air for public health. He highlighted the considerable attention paid to this issue during the COVID-19 pandemic.

Dr. Kluge provided an in-depth look at the far-reaching consequences of poor indoor air quality, highlighting the alarming statistics in the WHO European Region, where nearly 150,000 deaths each year are attributed to household air pollution. He stated that the focus must be on reducing the effects of hazardous chemicals and substances, particularly on vulnerable populations such as children and people with chronic diseases. Health equity remained a central theme of WHO European policy.

He reiterated the need for evidence-based policymaking. He emphasized that the Budapest Declaration, which commits to setting stricter air quality standards and improving indoor air quality, is part of a broader environmental health priority. The intention to establish a new partnership for healthy indoor environments was highlighted, particularly in schools.

Hans Kluge congratulated the WHO office on the publication of revised global guidelines on air quality, currently under consideration by the European Parliament. These guidelines reinforce the commitments set out in the Parma and Ostrava Declarations on Environment and Health. He also highlighted the establishment of a WHO Collaborating Centre on Environmental Health Risk Management in Hungary, illustrating the growing global movement towards a comprehensive approach to indoor air quality.

Drawing on his extensive experience as a tuberculosis physician in challenging environments, including Siberian prisons, he addressed the practical challenges of indoor air quality and questioned the simplicity of recommending improved ventilation, particularly in regions with poor outdoor air quality.

The COVID-19 pandemic has highlighted the importance of good ventilation, not only for traditional air quality concerns, but also for infection prevention and transmission interruption. He emphasized the need for practical recommendations, particularly when outdoor air quality is compromised, drawing attention to the challenges encountered during extreme weather conditions.

Hans Kluge emphasized that "health is a political choice" and called for educating leaders and policymakers about the fundamental impact of indoor air quality on health. He emphasized the importance of storytelling to humanize the data and involve the public in the awareness-raising effort.

In conclusion, Dr. Kluge quoted a Native American saying from Chief Seattle, emphasizing the interdependence of all living things with the air they share. He thanked the conference organizers, WHO, and the Geneva Health Forum for their initiatives and called for collective efforts to achieve and maintain clean indoor air. The conference discussions, he asserted, will significantly contribute to ongoing global efforts to prioritize and improve indoor air quality, ultimately ensuring safer and healthier lives for all.

Collaborative Approaches for Health and Well-being

Nora Kronig Romero
Ambassador, Head of International Affairs Division, Vice Director, Member of Senior management Federal Office of Public Health , Switzerland

Ambassador Nora Kronig expressed her gratitude to Professor Antoine Flahault and his team, welcoming participants to the first WHO Europe conference on indoor air quality in Bern. The importance of indoor air quality, highlighted by the impact of the pandemic, was central to her speech.

She emphasized its crucial role in combating respiratory diseases, particularly in winter. Recognizing the inevitable influence of outdoor pollution on indoor environments, she emphasized the cross-cutting nature of this issue. The direct impact of environmental pollution on indoor air makes it a crucial factor for health, well-being, and productivity.

The Ambassador called for cross-sectoral collaboration at the national and international levels to address indoor air challenges. Referring to the Seventh Ministerial Conference on Environment and Health in Budapest, she emphasized its alignment with the common goal of tackling these issues.

She reaffirmed Switzerland's commitment to reducing environmental health risks, in line with the Federal Council's 2020-2030 Health Strategy. Indoor air quality, she emphasized, is closely linked to the broader objective of strengthening health competencies and reducing environmental threats to health.

She also underscored the joint responsibility of the Confederation, cantons, and municipalities, particularly as owners of public buildings, to ensure healthy indoor spaces. Public sector owners should set an example by promoting healthy, sustainable, and energy-efficient construction.

Underlining the transformation path towards healthier buildings, she stated that today's models must become tomorrow's standards, for the benefit of public health, the environment, and society.

Building on the rapid cooperation during COVID-19, she emphasized the need for sustained and in-depth multilateral collaboration to address environmental health.

In summary, Ambassador Nora Kronig's intervention highlighted the close links between indoor air quality, public health and sustainable development, and called for collective and coordinated action.

Advancing Global Health Through a Holistic Approach to Air Quality

Sir Jeremy Farrar
World Health Organization Chief Scientist, Switzerland

Looking back on the past three years marked by the COVID-19 pandemic, Sir Jeremy Farrar emphasized the missed opportunity if we fail to recognize the profound impact the air we breathe has on every aspect of our lives. Beyond the transmission of airborne pathogens, he highlighted the crucial role air quality plays in pollution, non-communicable disease risks, and the overall quality of indoor and outdoor environments.

Sir Jeremy Farrar emphasized the need to bring together diverse communities to address air quality holistically. He called for collaboration between engineers, architects, urban planners, experts in infectious and non-communicable diseases, and behavioral sciences. Breaking down research silos and fostering a common language and culture of collaboration are essential to advancing research in this field.

Addressing research funders, he called for support for empirical research that bridges different disciplines. Strengthening collaboration at the interfaces of various fields, particularly the empirical exploration of indoor air quality, is essential to accelerate progress.

Sir Jeremy Farrar delved into the ethical and social dimensions of air ownership. He prompted reflection on the shared nature of the air we breathe, emphasizing that what we exhale affects others, and vice versa. In a world marked by polarization and conflict, recognizing the collective ownership of air becomes crucial, influencing various aspects of health.

In closing, Sir Jeremy Farrar highlighted the timeliness of the conference and expressed hope that this work will continue into the future. He emphasized the imperative of collective efforts to understand and improve air quality, highlighting its profound implications for global health.

Advancing Indoor Air Quality: A Structural Approach for Belgium

Frank Vandenbroucke
Minister of Public Health, Belgium

Frank Vandenbroucke highlighted the crucial role indoor environments play in human health. Given that we spend a significant portion of our lives indoors, he emphasized the need for a structural approach to ensuring good indoor air quality, drawing attention to its implications for well-being and lessons learned from the COVID-19 pandemic.

The importance of understanding indoor air quality was highlighted, particularly in the context of combating airborne contagious diseases such as COVID-19. Anticipating the emergence of future airborne diseases, he emphasized the need to prepare for and adopt a more rigorous approach to the annual seasonal flu. He highlighted how poor indoor air quality can affect productivity, citing examples such as students falling asleep and colleagues being less productive in meetings.

Frank Vandenbroucke proposed a step-by-step strategy for Belgium to systematically improve indoor air quality. He informed the audience of the recent adoption of a law on indoor air quality in enclosed spaces accessible to the public. This legislation marked the first step towards a comprehensive understanding of indoor air quality in Belgium. Emphasis was placed on scientific and technical aspects, including monitoring, verification of measurements, and transparent communication through certification. It is essential to involve all stakeholders in this process.

The approved legislation defined two fundamental reference levels for air quality, thus setting the course for improvement and investment. These reference levels were the first steps in an ongoing air quality assessment process, which is expected to expand to other parameters. The legislation aimed to foster continuous improvement and address indoor air quality challenges through a multifaceted approach.

There is a real need to support scientific research to improve knowledge of outdoor and indoor pollutants. This knowledge base would, in turn, inform effective regulatory approaches and the adoption of best available technologies to mitigate the health impacts of air pollutants.

Certification has proven to be an essential tool for ensuring trust in monitoring the quality of living spaces. By promoting transparent, reliable, and comprehensive communication, certification aimed to provide the public with clear information on the expected air quality in different locations.

Frank Vandenbroucke emphasized the need for dynamic change, facilitated by systematic consultation with stakeholders, to achieve the seemingly ambitious goal of making good indoor air quality as commonplace as drinking tap water.

Frank Vandenbroucke acknowledged that the pursuit of good indoor air quality is essential for all members of society, from the youngest to the oldest. He advocated for a comprehensive, long-term approach to addressing the challenges of exposure to pollutants, airborne diseases, and the adoption of effective technologies to reduce energy consumption. It is essential for society to address this challenge collectively.

Recognizing the global nature of indoor air quality challenges, Frank Vandenbroucke emphasized the need for international collaboration on standardization. He welcomed both European and international initiatives in this regard as essential signals for raising awareness and driving change. This collaboration aimed to facilitate shared learning and the development of standardized approaches to indoor air quality.

Frank Vandenbroucke thanked the WHO and the Geneva Health Forum for organizing the conference and welcomed their initiatives to promote awareness and action on indoor air quality.

Challenge and opportunity for Indoor Air : Learning from the pandemic

Catherine Noakes
Professor of Environmental Engineering for Buildings, University of Leeds, United Kingdom

Catherine Noakes acknowledged the crucial role indoor air plays in health, productivity, and economic impact, drawing attention to the human dimension that often affects the most vulnerable members of society.

She highlighted the complex nature of indoor air quality, shaped by regulations, building materials, climate, and human behavior. The conflicting priorities and ongoing balance required for an optimal indoor environment were highlighted.

The presentation further explored the importance of ventilation, which is crucial to occupant health and building well-being. Historical trends in ventilation rates, dating back to 1895, illustrated the shift from disease-focused measures to considerations of comfort, energy efficiency, and odor control. Despite the existence of global ventilation standards, significant gaps were identified, requiring the urgent development of guidelines and standards.

The lack of specific air quality standards was highlighted, highlighting the challenges of their enforcement and awareness. The invisible nature of air posed challenges, unlike the tangible nature of energy bills. A survey conducted in the UK found that 66% of homes lacked adequate ventilation, indicating a widespread problem. Many buildings, including schools and workplaces, lack adequate ventilation systems.

Catherine Noakes proposed various strategies, ranging from individual actions to complex interventions. These included ventilation risk assessments, improved maintenance, and user guidance. Public health campaigns, and visualization tools, such as CO2 monitors, were recommended to raise public awareness.

Catherine Noakes discussed the effectiveness of air purification technologies, particularly those using filters. Innovative technologies and strategies, such as the use of high-efficiency particulate air (HEPA) filters and the implementation of continuous IAQ monitoring protocols, can be adopted. Key figures from a study conducted in primary schools demonstrated a significant reduction in fine particles and the absence of illness in classrooms equipped with air purifiers. The cost-effectiveness of these technologies was emphasized, given appropriate design and implementation.

To address financial concerns, data from studies was cited, including those from the UK's Royal Academy of Engineering Research, demonstrating the cost-effectiveness of improved ventilation in public and community buildings. While acknowledging the difficulty of making a similar case for domestic environments, she highlighted the economic benefits associated with improved indoor air quality in public spaces.

In conclusion, Catherine Noakes advocated for systemic change, emphasizing collaboration across disciplines and nations. She recommended :

- Incorporate stricter ventilation standards into building codes and public health regulations.
- Encourage research and development of more effective ventilation and air purification technologies.
- Educate building managers, employers, and the public about the importance of indoor air quality and the steps to take to improve it.
- Promote public health policies that include clear guidelines on ventilation and indoor air quality in public spaces and workplaces.

Improving ventilation in Swiss buildings : IAQ as part of sustainability

Roger Waeber
Head of Indoor Pollutants Unit, Health Protection Directorate, Federal Office of Public Health, Switzerland

Drawing on over 20 years of research, Roger Waeber highlighted the importance of indoor air quality, particularly with regard to pollutants and ventilation. Addressing the role of government, he presented the regulatory framework, emphasizing the need to disseminate information and formulate recommendations to raise public awareness.

The complexity of indoor air quality, characterized by a multitude of pollutants, was recognized, necessitating a preventative approach. Focusing on risk reduction, Roger Waeber highlighted the difficulty of conducting risk assessments for complex mixtures, hence the fundamental principle: "the less exposure, the better."

Since source reduction is not always achievable, particularly with regard to occupant emissions, air renewal remains a crucial strategy. Roger Waeber highlighted the adverse health consequences of insufficient ventilation, linking it to well-being, productivity, and the transmission of infections. In Switzerland, ventilation is still most often achieved by opening windows, particularly in schools. Increased awareness is therefore necessary.

Roger Waeber presented Switzerland's proactive approach, which has launched campaigns to address the underestimation of ventilation problems. Targeting schools, a typical example of densely populated areas, the campaign raised awareness among building owners and users of the importance of effective ventilation. Emphasizing sustainable building solutions, he presented examples of schools implementing effective ventilation measures, illustrating the dual approach of improving user practices and encouraging building retrofits.

The outbreak of the COVID-19 pandemic has reinforced the crucial role of ventilation in preventing the transmission of pathogens. Efforts to inform users about good ventilation practices were detailed, notably through the use of CO2 measuring devices. Roger Waeber presented a joint position paper, endorsed by renowned Swiss organizations in the building and building technology sector, emphasizing that well-ventilated buildings are better prepared for pandemics and seasonal infectious diseases.

The speaker acknowledged the urgent need to improve the energy efficiency of buildings in the face of climate change. However, he emphasized the importance of not compromising health in the name of energy savings. Examining the synergy between energy and health, the speaker advocated tailored ventilation solutions, incorporating features such as good supply air filtration, heat recovery, and demand-controlled ventilation, allowing each building to find its optimal balance.

The integration of health requirements into energy regulations was proposed, advocating a holistic approach from the early planning stages. He congratulated Swiss cantons and municipalities for setting stricter energy requirements, thus setting an example, and cited the example of two cantons that simultaneously imposed mandatory mechanical ventilation for densely populated areas, such as classrooms.

Highlighting additional measures, Roger Waeber mentioned radon protection and the use of low-emission materials. These and other health-related aspects are among the standards available for sustainable building

certification. Roger Waeber advocated for widespread implementation of these standards. He emphasized the importance of raising awareness at all levels, including urban planners, to ensure the systematic adoption of measures.

In conclusion, Roger Waeber affirmed the importance of building on existing experience and leveraging innovative solutions. He highlighted ongoing projects, supported by the Confederation, focused on indoor air filtration and real-time monitoring of biological particles. He expressed his gratitude to all contributors in this field and stressed the continued need to raise awareness and disseminate information to ensure better indoor air quality in Switzerland and beyond.

Compliance through information sharing in Belgium. Setting up a legal framework to structurally improve IAQ

Jelle Laverge
Associate Professor, Ghent University, Belgium

Jelle Laverge discussed innovative Belgian legislation aimed at addressing the challenges posed by an aging and insufficiently ventilated building stock. This legislative approach, presented by Minister Vandenbroucke, emphasizes public visibility of indoor air quality and its management. Jelle praised the collaborative efforts of scientists and officials, emphasizing the importance of transparency in ensuring healthy indoor environments.

Belgium is facing an aging building stock, particularly in European regions with temperate climates, where ventilation is often insufficient. Despite optimistic projections for future renovation rates, only marginal improvement is expected by 2050, as highlighted by the International Network for Information on Ventilation and Energy Performance (INIVE) on behalf of the European Commission. The inadequacy of this strategy to achieve substantial improvements in indoor air quality was highlighted.

To address these challenges, Belgium has adopted a strategy based on the principle of informed consent. This concept involves providing individuals with information about the indoor air quality to which they will be exposed, taking into account the limitations of ensuring universally adequate indoor air quality. Legislation requires visible monitoring in all public buildings, with a focus on measuring CO2 concentrations. Jelle presented the successful example of a local restaurant, illustrating how such monitoring can be made visible and easily accessible.

Despite a seemingly simple approach, implementation challenges were recognized. Non-specialists responsible for building operations encounter difficulties due to the lack of certified information. Jelle cited an unfortunate example where monitoring devices purchased by a city proved ineffective, highlighting the need for accurate and accessible information for non-specialists.

To improve the visibility of indoor air quality management, Belgium has supplemented monitoring with certification and labeling. Building owners must conduct a risk assessment for each public space, resulting in certification and reporting of this certification via a label. This label, displayed in public spaces, communicates the design capacity of the area and the measures taken to improve indoor air quality. Jelle Laverge acknowledged the difficulty of expressing the capacity of a space on the label, emphasizing the importance of technical information.

Aware of the complexity of indoor air quality and discussing ongoing research aimed at identifying the main pollutants impacting health, Jelle Laverge presented an indicator using an equivalent amount of fresh, unpolluted air per person, calculated from the impact of different air quality management strategies on the main pollutants. This indicator aims to simplify communication on the effectiveness of these measures on health.

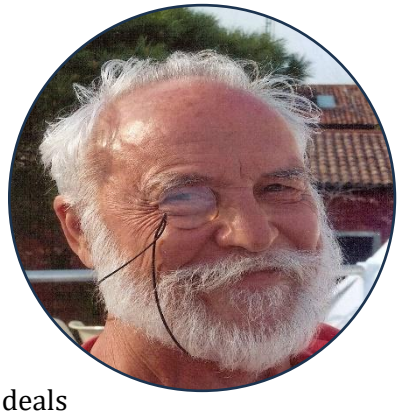
In conclusion, the importance of effective communication was emphasized. The success of the legislation depends not only on labeling, but also on individuals' understanding and implementation. Jelle Laverge emphasized the need to raise public awareness and demand measures to promote improvements in the

buildings where people live every day.

Belgium's comprehensive approach, as described by Jelle Laverge, aims to address the complexities of indoor air quality through a combination of visible monitoring, certification, and labeling. By prioritizing informed consent and transparency, Belgium seeks to improve indoor air quality in public buildings, thereby promoting a healthier environment for their occupants.

Priorities for improving indoor air in Switzerland

Claude-Alain Roulet
Professor Emeritus École Polytechnique Fédérale de Lausanne (EPFL), Switzerland



In Switzerland, the legal framework for indoor air quality is sufficient. The requirements for commercial premises are clear (OLT3, 2015). Reference concentrations and occupational exposure limit values are provided by the Federal Office of Public Health for indoor and outdoor pollutants (FOPH, 2019a, 2019b, Radon, 2000; Suva, 2013). Regarding indoor ventilation, the SIA 180 standard (SIA, 2014a) requires a ventilation concept for any major construction or renovation project; and the SIA 382/1 standard (SIA, 2014b) deals with mechanical ventilation systems.

The problem, according to Claude-Alain Roulet, is that these guidelines are often poorly implemented, if at all, and the public is poorly informed about the measures to be taken to ensure good indoor air quality. The first measure, namely preventing the diffusion of toxic compounds into the air, is nevertheless well known and applied. Smoking is virtually prohibited indoors, building materials and coatings are becoming less toxic, and information about the risk of radon infiltration, which is very real in Switzerland, is widely disseminated.

In the last century, however, ventilation of buildings without mechanical ventilation relied on air leaks from the envelope and the goodwill of occupants, who were generally poorly informed about the needs and effects of weather conditions on ventilation. Since the building envelope is relatively permeable to air, infiltration through wind leaks, and especially from temperature differences between indoors and outdoors, was sufficient to ensure acceptable air quality. However, this process ventilates too much in winter and too little in mid-season and summer. This is why the SIA 180 standard currently requires building envelopes that are sufficiently airtight when ventilation openings are closed, as well as a ventilation concept.

The removal of contaminants produced in the indoor atmosphere is all the better when the flow of fresh air is strong. However, the extracted air also carries the produced moisture, and winter fresh air is much drier than indoor air.

Excessive ventilation therefore dries out the air in winter, which promotes the transmission of viruses present in aerosols. The optimal relative humidity in occupied spaces is therefore around 50% and should under no circumstances be lower than 30% (SIA, 2014a).

Humidification is a possibility, but it can itself be a source of contamination (Müller et al., 2000).

As a result, indoor air is often too dry in winter, particularly in mechanically ventilated buildings (Figure 3).

However, to maintain a comfortable temperature during heatwaves, it is of course necessary to install sun protection (shutters, blinds), but also to ventilate as much as possible at night (wide-open windows are ideal for this) to cool the building's interior structure and to respect the strict minimum sanitary precautions during the day to reduce heat gain.

To ensure a good indoor climate, it is therefore important to adjust airflow to meet needs (particularly the outside temperature and the presence of people), and especially to avoid ventilation during unfavorable periods or periods when the building is unoccupied. To adjust these flow rates under all circumstances, it is necessary to be able to open windows, but also to have adjustable ventilation openings for low flow rates, or

to install mechanical ventilation. Unfortunately, mechanical ventilation systems are not always designed, built, and especially not commissioned according to best practices. As a result, many systems do not function properly and do not ensure sufficient airflow in the premises.

Finally, natural ventilation is currently confused with window ventilation, and controlled ventilation with mechanical ventilation. This leads to confusion. Indeed, any ventilation concept, whether mechanical, natural, or hybrid, must allow for proper control of airflows in order to adapt them to needs. However, a window left half-open in winter lets in too much air, which dries out the indoor air. Special ventilation openings, preferably automatic ones, would therefore be preferable. Such openings exist on the European market, but are almost never installed in Switzerland! Furthermore, we have observed that poorly commissioned or misused mechanical ventilation systems do not necessarily provide the desired flow rates.

The priority today is therefore good design, and above all, mastery of execution!

To improve mechanical ventilation systems, the QualiVentil association was created in French-speaking Switzerland. This association brings together professionals from all areas of ventilation: design, manufacturing, installation, and commissioning. Its main activities are:
- creating and organizing practical training courses for professionals in the field;
- publishing neutral, reliable, and up-to-date information on the topic of mechanical ventilation;
- providing neutral and professional consulting and expertise services;
- organizing thematic conferences.

More generally, it is necessary to document and assess the state of air quality in buildings, using a global approach.

Enhancing Indoor Air Quality: Perspectives and Challenges

Kamran Abbasi (Chairman)
Editor in Chief of the British Medical Journal, London, United Kingdom

Martin Bäumle
Member of National Council, Green'Liberal Group

Esther Friedli
Member of the Council of States, Democratic Union of the Center

Gabriela Suter
Member of National Council, Socialist Group

Catherine Noakes OBE
Professor of Environmental Engineering for Buildings, University of Leeds, United Kingdom

David Vernez
Professor, Head of Department, Center for Primary Care and Public Health (Unisanté), University of Lausanne, Switzerland

The panel discussion, moderated by Kamran Abbasi, Editor-in-Chief of the British Medical Journal, featured renowned experts and policymakers, including Esther Friedli, Gabriela Suter, Martin Bäumle, Catherine Noakes, and David Vernez.

The focus was on three key areas: balancing risks, managing change, and overcoming barriers to implementing effective measures to improve indoor air quality.

Esther Friedli, Member of the Council of States of the Canton of St. Gallen, highlighted the neglected importance of indoor air quality during the pandemic. She emphasized the need for increased awareness, individual accountability, and training for building owners. Esther Friedli highlighted the synergy between healthy buildings and energy efficiency, emphasizing that focusing on both is crucial to achieve optimal results.

National Council member Gabriela Suter challenged the notion that current legal provisions are sufficient to regulate indoor air quality. She advocated for national regulation, expressing concern about the lack of uniformity in cantonal regulations.

National Council member Martin Bäumle argued that climate protection and indoor air quality are not inherently contradictory. He emphasized the importance of trade-offs, particularly in addressing humidity concerns, and stressed the need for industry-led initiatives and benchmarks rather than strict national regulations.

Catherine Noakes, representing the University of Leeds, suggested that climate change mitigation efforts offer an opportunity to simultaneously improve indoor air quality. She emphasized the need for flexibility in approaches, recognizing that different buildings require different solutions.

David Vernez of Unisanté reinforced the idea of finding common health goals and flexible technical solutions, moving away from rigid regulations. He also suggested that occupants, particularly in rental spaces, can play a role in influencing indoor air quality.

The discussion on regulations and standards generated divergent views. Suter reiterated the need for a national law regulating indoor air quality or, failing that, air filters for all classrooms. Bäumle spoke out against strict regulations, favoring industry initiatives and benchmarks. The importance of data emerged as a central theme. Vernez emphasized the need to redistribute responsibilities and raise public awareness, making indoor air quality a community issue.

The debate concluded with a consensus on the importance of awareness, individual responsibility, and effective data management to address indoor air quality challenges. The diversity of perspectives presented by the speakers highlighted the multidimensional nature of this issue, which requires a collaborative and multidisciplinary approach to achieve meaningful change.

This debate provides valuable insights into the complexity of balancing indoor air quality, climate change concerns and the challenges of implementing effective measures.

Key Messages

1. Indoor air is a major public health issue, since we spend more than 80% of our time in enclosed spaces.
2. Air quality must be as high a priority as drinking water, and become a universal standard to protect public health.
3. Poor indoor air quality increases the risk of respiratory, cardiovascular and infectious diseases, as demonstrated during the COVID-19 pandemic.
4. Sources of indoor pollution are multiple: building materials, human activities, infiltrated outdoor pollution.
5. Schools, medical facilities and homes for the elderly are places where fragile people live, and which therefore require good indoor air quality.
6. Improving indoor air quality is cost-effective, with measurable benefits in terms of productivity, absenteeism and healthcare costs.
7. Simple solutions such as CO_2 sensors or fragrance-free cleaning products can have a significant impact, without requiring heavy investment.
8. The fight against indoor pollutants, the fight against infectious agents and the fight against heat waste or heat waves must be addressed in a coordinated way.
9. Four types of measures can be identified to improve indoor air quality: reduction of pollutants at source, air quality measurement, regular ventilation, air purification.
10. Clear standards and certification systems are needed to guide users.
11. Coordinated political action and regulation on a global scale are essential.

List of speakers

In alphabetical order

- Kamran Abbasi, Editor in Chief of the British Medical Journal, London, United Kingdom
- Martin Bäumle, Member of National Council, Green'Liberal Group, Switzerland
- Sir Jeremy Farrar, World Health Organization Chief Scientist, Switzerland
- Esther Friedli, Member of the Council of States, Democratic Union of the Center, Switzerland
- Hossein Gorji, Scientist, Laboratory of multi-scale studies in building physics, Empa, Switzerland
- Hans Kluge, World Health Organization Regional Director for Europe, Denmark
- Nora Kronig Romero, Ambassador, Head of International Affairs Division, Vice Director, Member of Senior management Federal Office of Public Health, Switzerland
- Jelle Laverge, Associate Professor, Ghent University, Belgium
- Corinne Mandin, Head of the Laboratory of Epidemiology, Institute for Radiation Protection and Nuclear Safety, France
- Catherine Noakes, Professor of Environmental Engineering for Buildings, University of Leeds, United Kingdom
- Andreas Prenner, Policy Officer at European Health Emergency Preparedness and Response Authority (HERA), Switzerland
- Claude-Alain Roulet, Professor Emeritus École Polytechnique Fédérale de Lausanne (EPFL), Switzerland
- Gabriela Suter, Member of National Council, Socialist Group, Switzerland
- Frank Vandebroucke, Minister of Public Health, Belgium
- David Vernez, Head of Department of Occupational and Environmental Health, Center for Primary Care and Public Health (Unisanté), University of Lausanne, Switzerland
- Roger Waeber, Head of Indoor Pollutants Unit, Health Protection Directorate, Federal Office of Public Health, Switzerland
- Pawel Wargocki, Associate Professor, International Center for Indoor Environment and Energy, Technical University of Denmark, Denmark

Acronyms and abbreviations

BMJ	British Medical Journal
CEPI	Coalition for Epidemic Preparedness Innovations
CERN	European Organization for Nuclear Research
CO2	Carbon Dioxide
COVID-19	Coronavirus Disease 2019
EMPA	Swiss Federal Laboratories for Materials Science and Technology
EPFL	École Polytechnique Fédérale de Lausanne In English : Swiss Federal Institute of Technology in Lausanne
EU	European Union
FOPH	Federal Office of Public Health
HERA	Health Emergency Preparedness and Response Authority
IAQ	Indoor Air Quality
INIVE	International Network for Information on Ventilation and Energy Performance
OFEV	Office Fédéral de l'Environnement
OFSP	Office Fédéral de la Santé publique In English : Federal Office of Public Health
OLT	Ordonnance on the Labour Act
ORTQAI	Observatoire Romand et Tessinois de la Qualité de l'Air Intérieur
PCB	Polychlorobiphenyls
PCR tests	Polymerase Chain Reaction tests
Ppm	Parties per million
QualiVentil	Association romande pour une ventilation de qualité
SARS-CoV-2	Severe Acute Respiratory Syndrome Coronavirus 2

SIA	Schweizerische Ingenieur- und Architektenverein In English : Swiss Society of Engineers and Architects
SINPHONIE	Schools Indoor Pollution and Health Observatory Network in Europe
Suva	Schweizerische Unfallversicherungsanstalt In English :Swiss Institute for Accident Insurance
UK	United Kingdom
Unisanté	Center for Primary Care and Public Health
WHO	World Health Organization

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